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Assessing variation in personal health service delivery and workplace smoking ban enforcement by local health departments

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Abstract

Assessing variation in personal health service delivery and workplace smoking ban enforcement
by local health departments

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Local Health Department (LHD) services play a crucial role in driving community health outcomes. However, LHDs face critical decisions, in times of budget and staffing shortfalls, around how essential public health services should be delivered. This dissertation describes variation in how LHDs are delivering services, and how other safety net providers, such as Federally-Qualified Health Centers (FQHCs), may be allowing LHDs to move their service portfolio away from clinical services and towards population-focused activities that they are uniquely suited to provide in their communities.

This dissertation examines: 1) if higher volume of services provided by FQHCs was associated with discontinuation or absence of LHD clinical services; 2) if variation in FQHC and LHD service delivery was associated with differences in individual health access outcomes; and

3) whether variation in LHD enforcement of the Washington State Clean Indoor Air Act was associated with conditions which could be attributable to workplace smoking exposure.

In the first paper of this dissertation, I found that LHDs are less likely to provide certain clinical services where FQHCs provide a greater volume of services, suggesting a substitution effect. However, there are clinical services, such as prenatal care, where the effect was not seen, that may complement a public health mission – and LHDs may be strategically placed to continue delivering these services.

In the second paper, I observed a significantly higher likelihood of individuals reporting more positive health access outcomes where FQHC primary care service volumes were high, which suggests that intensive allocation of FQHC resources in a community is associated with improved health care access.

In the third paper, I found that half of Washington State LHDs, mainly in rural jurisdictions, are not conducting state-mandated enforcement efforts. The presence of enforcement activities shows directional, but not statistically significant associations with lower WEA prevalence among individuals in a jurisdiction. As both inspection and violations exhibit similar effect magnitude, this suggests that responding to violations may be a cost-effective enforcement strategy.

This dissertation examines how LHD service provision decisions are linked to partners in their community, and drive health and health care access. It offers guidance for LHDs in transforming their portfolio of activities so they can provide effective, population-focused services.

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Chapter 1. INTRODUCTION

1.1 BACKGROUND

Local Health Departments (LHDs) are agencies that provide critical public health services to communities.¹ Generally organized at the county or multi-county level, LHDs play a crucial role in maintaining and improving a community's health. They are among the few institutions dedicated to promoting population health, and, often, the sole institution with a mandate to broadly assess and respond to public health service needs at the local level.² However, LHD leaders are at a crossroad in determining the public health roles they will play in the 21st century.

In times of budget and staffing shortfalls, LHD leaders have been forced to make difficult decisions around the services offered to their communities.³ Between 2008 and 2013, LHDs reduced staffing by over 48,300 workers.⁴ In the heat of the financial crisis (2009-2011), almost half (45%) of LHDs reported reductions in their budgets. In recent years (2013-2014), a smaller but still sizable proportion (27-28%) of LHDs continued to report reductions in funding for public health services.⁴

These shocks to the public health system have catalyzed the debate over the minimum and optimal set of services an LHD should provide, and what functions might be more effectively served by others in the community. In times of dwindling resources, LHD leaders need evidence about the value of taking on new assurance or enforcement activities, and whether it is responsible for them to discontinue direct provision of expensive services – such as provision of safety net medical care – that may distract from their core public health mission.

In 1988, the Institute of Medicine (IOM) defined three core functions of the LHD – Assessment, Policy Development, and Assurance.⁵ In 1994, the IOM further enumerated these

functions into the 10 essential public health services (EPHS) (Table 1.1); responsibilities shared by federal, state, and local public health agencies.

Table 1.1. The 10 Essential Public Health Services

- | |
|--|
| <ul style="list-style-type: none"> (1) Monitor health status to identify and solve community health problems; (2) Diagnose and investigate health problems and health hazards in the community; (3) Inform, educate, and empower people about health issues; (4) Mobilize community partnerships and action to identify and solve health problems; (5) Develop policies and plans that support individual and community health efforts; (6) Enforce laws and regulations that protect health and ensure safety; (7) Link people to needed personal health services and assure the provision of healthcare when otherwise unavailable; (8) Assure competent public and personal health care workforce; (9) Evaluate effectiveness, accessibility, and quality of personal- and population-based health services; (10) Research for new insights and innovative solutions to health problems |
|--|

Taken from IOM report, For the Public's Health: Investing in a Healthier Future. 2012.²

This dissertation examined how these essential public health services weave into two critical LHD activities. The first activity, which was a focus of Aims 1 and 2, centered on assuring access to clinical services for vulnerable populations and ensuring the integrity of the health care safety net. This activity most directly related to EPHS no. 7, and also touched on several of the other essential services--most directly, nos. 1 and 9. Continued assessment (EPHS no. 1) and assurance (EPHS no. 9) of the effectiveness of the health care safety net through use of strategic information is essential for assuring that safety net services continue to evolve to meet community needs.

The second LHD activity, addressed in Aim 3, related to enforcing state-mandated workplace health and safety laws – a facet of EPHS no. 6. This enforcement role may include new, evolving, and seemingly arbitrary mandates, which might be more closely aligned with the existing responsibilities of other regulatory and oversight bodies, such as state departments of labor. The specific enforcement role examined in this research was how LHDs were involved

with enforcing workplace smoking bans in Washington State in 2012 and their impact on worker health.

As detailed in the EPHS framework, LHDs are broadly responsible for driving assessment, planning, and population-based primary prevention in their communities.⁷ However, the framework does not prescribe the exact activities or volumes of service an LHD should provide – these factors are generally shaped by community need, as well as the funding and staff available to provide these services. This raises important questions for LHD leaders: as their capacity to provide services is reduced through cuts to their budget, can they still devote significant resources to important, but resource-intensive clinical service delivery services, while having to maintain or increase their role in providing population-focused services? And in times of budgetary uncertainty, can they devote resources to support unfunded state mandates, such as smoke free law enforcement, which may fall outside of their traditional purview or areas of expertise, and where little evidence may exist to support additional investments?

1.2 OBJECTIVES

This dissertation addressed these questions in several significant ways. Aim 1 identified whether, in jurisdictions where an increase in the volume of services provided by Federally-Qualified Health Centers (FQHCs) occurred between 2010 and 2013, LHDs were more likely to discontinue or not provide certain clinical services. This analysis helps to highlight the broad changes which have taken place in the safety net, and describe whether community partners might be substituting for discontinued LHD services and effectively meeting safety net clinical service needs in communities.

Aim 2 examined whether changes and variation in provision of these services was associated with improvements in individual health care access outcomes. The study sought to identify differences in individual health access outcomes in jurisdictions where LHDs and FQHCs provide services. The paper delivered crucial information to LHD leaders on whether maintaining clinical services, once FQHCs are well-established in their jurisdiction, may be a worthwhile investment.

Aim 3 examined the substantial variation in LHD enforcement of the Washington State Clean Indoor Air Act, and whether this variation was associated with health outcomes related to workplace exposures. The study provides evidence to state and local health officials, as well as regulatory agencies (such as the Washington State Department of Labor and Industries (L&I)), on whether enforcement efforts are differentially implemented throughout the state, and how they can move forward to identify best practices and standardize enforcement efforts to improve worker health.

The dissertation produced evidence around how the presence of LHD services and services of other providers drive health and health care access outcomes, and how LHDs can reshape their service portfolios and collaboration models in times of limited resources and changing roles. This research examined the substantial variation in LHD clinical service and enforcement activities, and examined how this variation may have significant implications for the public's health.

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Chapter 2. AIM 1: SUBSTITUTION BY FEDERALLY-QUALIFIED HEALTH CENTERS OF LOCAL HEALTH DEPARTMENT CLINICAL SERVICES

2.1 ABSTRACT

Introduction: Strategic and budgetary considerations have shifted Local Health Departments (LHDs) away from safety-net clinical services and towards population-focused services. FQHCs play an increasing role in the safety-net, and may complement with or substitute for LHD clinical services. We examined the association between FQHC service levels in communities and the presence of specific LHD clinical services in 2010 and 2013.

Methods: We integrated data from LHD surveys and FQHC service data for 2010 and 2013. We used multivariate regression and instrumental variable methods to examine FQHC service levels that might predict related LHD service presence or discontinuation from 2010 to 2013.

Results: There were modest reductions in LHD service presence and increases in FQHC service volume over the time period. LHD primary care and dental service presence were inversely associated with higher related FQHC service volume. LHD prenatal care service presence, as well as a measure of change in general service approach, were not significantly associated with FQHC service volume.

Conclusions: LHDs are less likely to provide certain clinical services where FQHCs provide a greater volume of services, suggesting a substitution effect. However, certain clinical services, such as prenatal care, may complement a public health mission – and LHDs may be strategically placed to continue to deliver these services.

2.2 BACKGROUND

Local Health Departments (LHDs) play a crucial role in maintaining and improving a community's health. However, political and budgetary conditions, as well as a nation-wide shift to an emphasis on providing population-focused services, have led to a recent decline in the range of clinical services that a typical LHD provides.^{1,2} Studies have not fully examined how these changes within LHDs interplay with those of other safety-net providers, such as Federally-Qualified Health Centers (FQHCs). First launched in 1965, FQHCs have increased their role in providing care for uninsured and Medicaid-eligible populations dramatically in the past decade.³ It is possible that FQHC service increases are allowing LHDs to reduce their clinical service portfolio and focus instead on essential community-wide population health assurance responsibilities, more closely related to their public health mission – an approach recommended by the Institute of Medicine.^{1,4,5}

FQHCs are awarded significant federal grants to support non-reimbursed care, as well as general infrastructure and staffing improvements.⁶ As a result, FQHC services were largely resilient to state and local budget cuts resulting from the 2008 recession, which had a substantial effect on LHD activities.^{7,8} In fact, FQHCs received substantial federal investment from the American Recovery and Reinvestment Act of 2009, which committed over \$2 billion in federal money to meet rising service demand and to address needed capital improvements at FQHCs.⁹ This led to a public health and safety-net care network with a larger FQHC contribution than seen prior to the recession.¹⁰ Increased federal funding for FQHCs and from state Medicaid programs during the scale-up of the Affordable Care Act (ACA) from 2013 further increased the stability of funding for FQHC service delivery.³

LHD-FQHC collaboration can reduce unnecessary duplication of services, lower the cost of care, and minimize safety net service gaps in the community – all crucial steps for meeting Affordable Care Act (ACA) goals that focus on improving equity, efficiency, and effectiveness of health care delivery.¹¹ Substantial variation in the range of clinical and assurance services that LHDs pursue persists – this variation may be partially driven by the presence and quality of LHD-FQHC interactions.^{2,12}

One factor driving both LHD and FQHC clinical service delivery may be entrepreneurial interest in providing Medicaid-reimbursable care.¹ In 2010, for example, LHDs receiving more than 50% of their revenue from Medicaid sources had per capita expenditures that were almost twice as high as those that had less than 50% Medicaid revenue.¹³ However, LHDs that discontinued clinical services between 1997 and 2008 interacted with a larger number of community partners and were located in states with larger increases in Medicaid spending than those that continued providing clinical services.¹ This supports the notion that higher Medicaid outlays in jurisdictions, while potentially incentivizing LHDs to engage in more clinical services, instead may be driving the growth of other safety net providers, and allowing LHDs to focus on their core public health mission. Following this reasoning, LHDs may also feel “crowded out” in their ability or need to provide services, and this may drive decisions around service approaches.¹⁴ Figure 2.1 offers a model for how LHDs and FQHCs may interact to provide safety-net services, through continual reassessment of community need, funding, and internal factors.

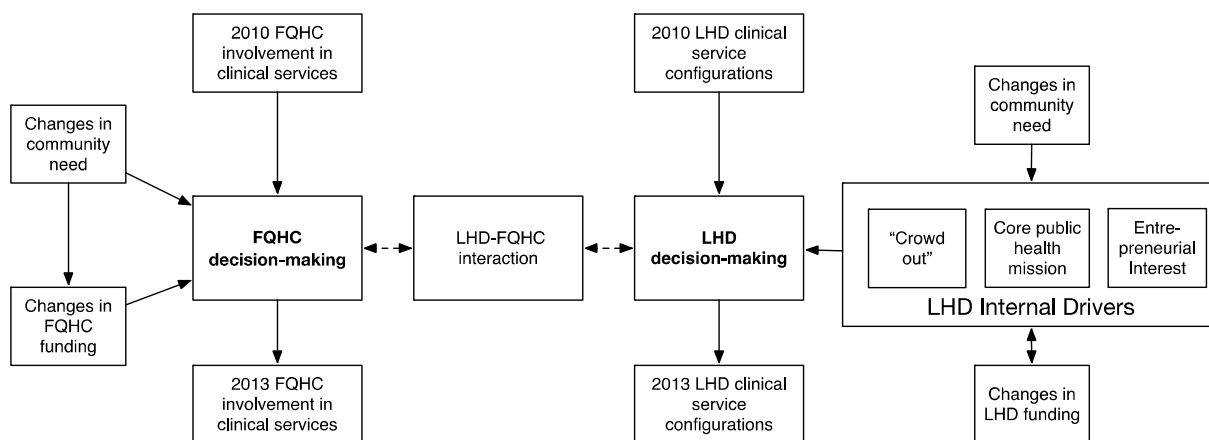


Figure 2.1. Conceptual Model of LHD-FQHC Collaboration in Safety-net Service Provision

Our research focused on three strategically important services – primary, prenatal, and dental care – where we also have comparable data for both LHDs and FQHCs. LHD primary care service patterns are different from specialized services (prenatal and dental), and allows us to understand interaction patterns from several important perspectives.^{15,16}

Primary Care refers to integrated, comprehensive, and accessible clinical services which address a large majority of personal health care needs.¹⁷ These services were offered by only a small proportion of the nation’s LHDs (11%) in 2013.¹⁸ Primary care services are a resource-intensive activity, and are offered more frequently in larger, metropolitan jurisdictions with stronger financial resources and provider capacity compared to smaller jurisdictions with less well-resourced LHDs. A national study, using post-recession data from 2010, has shown an inverse relationship between the presence of LHD primary care services and the presence of FQHC services in a jurisdiction.²

Prenatal care was provided by 27% of LHDs in 2013.¹⁸ While it can be categorized as a specialized clinical service, prenatal care is often linked to enabling and social services (such as

the Special Supplemental Nutrition Program for Women, Infants, and Children [WIC]) that fall under the broader public health assurance role of an LHD.¹⁵ As a result, even in the face of reductions in other clinical service areas, there is evidence LHDs may maintain prenatal care services.

Dental care was provided by 24% of LHDs in 2013, most frequently in more populated jurisdictions.¹⁸ While safety-net dental care represents a very small (less than 5%) proportion of overall dental care in the United States, safety-net facilities provide care for a large number of patients who might otherwise have unmet dental need.¹⁹ While over 70% of FQHC sites provide dental care, there is often insufficient capacity at these sites to meet demand for services.^{16,20}

Our study sought to explore relationships between LHD and FQHC service delivery around clinical services and in a rapidly changing safety-net landscape. Our aims were to assess whether changes in LHD service presence or discontinuation were driven by increases in FQHC services, and what levels of FQHC services might best predict whether an LHD continued or discontinued offering a service between 2010 and 2013.

2.3 METHODS

Study Design

We identified four dependent variables, representing the absence or presence of three LHD services (primary care, prenatal care, and dental care), as well as the change in a three-level latent class measure of LHD service approach. In a separate logistic regression model for each of the three services, we examined the presence of LHD services in 2010 and 2013; and compared these with county-level, logged FQHC patient per-capita levels for identical services in respective years. Then, in another set of three logistic regression models, we compared logged

FQHC patient per capita service levels in jurisdictions where LHDs, which offered service in 2010, discontinued or maintained the service in 2013. Finally, we examined whether an LHD may have discontinued enough services to lower their latent class measure, and compared that to the FQHC service variable. In total, we ran seven models, with three examining service presence, and four examining service discontinuation or reduction in latent class.

This study did not meet the IRB definition of human subjects research that would require IRB approval.

Measures and Data Sources

Dependent variables. The dependent variables were drawn from the 2010 and 2013 National Association of County and City Health Officials (NACCHO) National Profile of Local Health Departments (Profile) surveys, and identified whether each service was offered directly by the LHD, or not.¹⁸ The latent class measure was created using LHD responses to 42 NACCHO service activity questions that relate to personal and population health activities from both years. We used these activities to create three latent “classes” which quantitatively group LHD personal and population health service approaches, based on whether they provide a majority of pre-defined basic, expanded, or specialized individual- and population-focused services.²¹ The three groups, per previously published research, were designated as limited (broad basic population services), core (broad basic population and individual services) and core plus (expanded population and individual services).²¹ Bekemeier et al. describes the rationale and methods for construction of the latent classes in a separate paper. Using these latent class groupings allowed us to examine changes in general LHD service approach from 2010 to 2013.

Independent Variables. FQHC data for 2010 and 2013 were drawn from the Uniform Data System (UDS), a public reporting tool for FQHC grantees who receive federal funding from the Health Resources and Services Administration (HRSA).²² We calculated per capita FQHC service utilization, defined by the number of FQHC services delivered in a jurisdiction for each of the three services per 1000 residents. These were merged with LHD data, using the inclusion criteria of whether an FQHC grantee with available service data was present in a LHD county-level jurisdiction that had a NACCHO Profile survey response for both years (Appendix A).

Covariates. Finally, we included county-level sociodemographic and health access indicators drawn from the HRSA Area Health Resource File (AHRF) for years that matched reporting years in the corresponding LHD jurisdiction for each observation. These variables included the jurisdiction's Health Professional Shortage Area (HPSA)/ Dental Professional Shortage Area (DPSA) status, median household income, metropolitan/rural status, percentage of population greater than age 65, and uninsurance rate.

Data Analysis

We implemented an instrument variable (IV) approach using a two-stage residual inclusion (2SRI) technique. 2SRI methods have been shown to be more consistent in non-linear estimates when compared to a traditional two-stage least squares (2SLS) modeling approach.²³ Our 2SRI approach involved an initial ordinary least squares regression which regressed the proposed IVs on the FQHC utilization variables.

Both logged FQHC federal budget level and the state's decision whether to accept the ACA Medicaid expansion were determined to be strong potential IVs: They were strong

predictors of FQHC service levels in a community, and were theorized to not be associated with unmeasured characteristics of communities that may be associated with LHD service presence outcomes. Thus, for each of the seven models, we constructed a first stage OLS regression model using two IVs – FQHC federal budget (log \$ per capita) and state ACA Medicaid expansion acceptance (yes/no) – to address potential endogeneity which could be present in jurisdiction-level FQHC and LHD service changes. Then, the residual from this first-stage regression was used as a control variable in the final second-stage model, where FQHC utilization was a predictor of LHD service presence or discontinuance.

We ran the 2SRI IV models with bootstrapped standard errors to produce odds ratio estimates and confidence intervals for the effect of a 1 log change in FQHC per capita service effect on the LHD service outcome. We examined performance of the IVs by assessing the identification of the FQHC predictor, and confirming homoscedasticity of the first-stage residuals, to assess model fit (Appendix 2).

Our second stage IV model produced coefficients of the effect of FQHC service levels on the LHD outcomes. From these models, we calculated marginal predictions of LHD service presence or discontinuation at commonly-observed levels of each FQHC service to facilitate interpretation of the predictors. Predictive margins were used to present generalized, adjusted treatment means which represent an average response at specified levels of a predictor.²⁴ Analyses were conducted using R 3.2.3 and Stata 14 statistical software.

2.4 RESULTS

In our sample of LHDs (n=371), 16 (4.5%) had primary care services and discontinued them between 2010 and 2013, 34 (9.5%) were providing prenatal services and discontinued

them, and 34 (9.6%) had dental services and discontinued them (Table 2.1). There was minimal overlap of LHDs in each of the groups, suggesting that LHD leaders appeared to eliminate specific services over the period. Only 28 LHDs discontinued two of the three services, and none eliminated all three. FQHCs in our sample showed modest, but statistically insignificant growth in services provided over the period 2010 to 2013, with a mean increase of 20 medical care and 12 dental care visits for each 1000 residents in a jurisdiction (Table 2.2).

Table 2.1. Descriptive Statistics for 371 LHDs Included in Sample

		Included LHD jurisdictions (n= 371) , %		
% Metropolitan (Rural Urban Continuum Code (RUCC) 1-3)		246 (66%)		
% Designated Health Professional Shortage Areas (HPSA)		143 (39%)		
% Designated Dental Professional Shortage Area (DPSA)		76 (21%)		
		2010	2013	Discontinued Service (when present in 2010)
LHD Primary Care Services		75 (20%)	60 (17%)	16 (23%)
LHD Prenatal Care		145 (40%)	134 (37%)	34 (24%)
LHD Dental Care		167 (46%)	147 (41%)	34 (21%)
LHD Latent (Service Approach) Classification	Limited	213 (57%)	210 (57%)	Lowered Latent Classification: 43 (12%)
	Core	61 (16%)	52 (14%)	
	Core Plus	97 (26%)	109 (30%)	

Table 2.2. Descriptive Statistics for FQHCs included in Study Sample of 371 LHD Jurisdictions

	Included FQHC Grantees	
	2010	2013
Number of FQHC grantees	n=742	n=687
Number of FQHC grantees/ Jurisdiction	Mean = 2.00 Median = 1 SD = 2.54 Min=1, Max=32	Mean = 1.85 Median = 1 SD= 2.18 Min=1, Max=27
County level: Per Capita-Medical Care Services/1000 population	Mean= 410.6 Median=116.7 SD=1363.7	Mean=432.4 Median=117.3 SD=1348.5
Per Capita Prenatal Care Services /1000 population	Mean=7.42 Median=1.03 SD= 33.16	Mean=5.98 Median=1.28 SD=19.22
Per Capita Dental Care Services/1000 population	Mean=107.1 Median=20.2 SD=441.6	Mean= 119.2 Median=24.6 SD=594.97

In Table 2.3, the seven regression models are presented in columns, with the odds ratio indicating, depending on the model, whether higher FQHC service levels in a year was associated with a higher likelihood of presence of the related LHD service, or with discontinuation of the related LHD service. Higher FQHC medical and dental service levels were significantly and inversely associated with LHD service presence. A 1 log increase in per capita FQHC medical services in a jurisdiction was associated with a 33% reduction in the likelihood we observed the presence of primary care services at an LHD (OR=0.670, p=0.009).

Table 2.3. 2SRI IV Adjusted Logistic Regressions of FQHC Service Change on LHD Service

Predictor of LHD Service	LHD Primary Care		LHD Prenatal Care		LHD Dental Care		Reduction in LHD Latent Class from 2010-2013
	Presence in either year	Discontinued in 2013	Presence in either year	Discontinued in 2013	Presence in either year	Discontinued in 2013	
Odds ratio (95%CI)							
Difference in FQHC per capita service (1 log increase)	0.670** (0.496, 0.905)	1.176 (0.613, 2.256)	0.879 (0.693, 1.115)	1.125 (0.535, 2.369)	0.663*** (0.523, 0.840)	1.627 (0.945, 2.802)	1.348 (0.882, 2.066)
N	701	134	701	171	611	266	200

*p<0.05, **p<0.01, ***p<0.001

In order to portray the data in more practical terms, we examined marginal predictions for a range of commonly-observed FQHC service levels for each service presence/discontinuation outcome (Figure 2 and appendices 3-5). We found that in jurisdictions where FQHCs offered general medical services at a rate of five visits per 1000 residents in either year, LHDs had a 42% likelihood of offering the service, and a 16% likelihood of discontinuing the service by 2013 if the LHD had offered the service in 2010. However, if the FQHC services were provided at a rate of 200 per 1000 residents, the LHD would only have a 14% likelihood of offering the service, and a 26.6% likelihood of discontinuing the service if they offered it in 2010. Likewise, if FQHC dental care was provided at rate of 5 services per 1000 residents in either year, there was a 60% likelihood of an LHD providing the service; while if FQHC services were at the rate of 100 of 1000 residents in a jurisdiction, we would only see a 36% likelihood of LHD dental service presence. A full table of these marginal predictions is included in Appendix A.

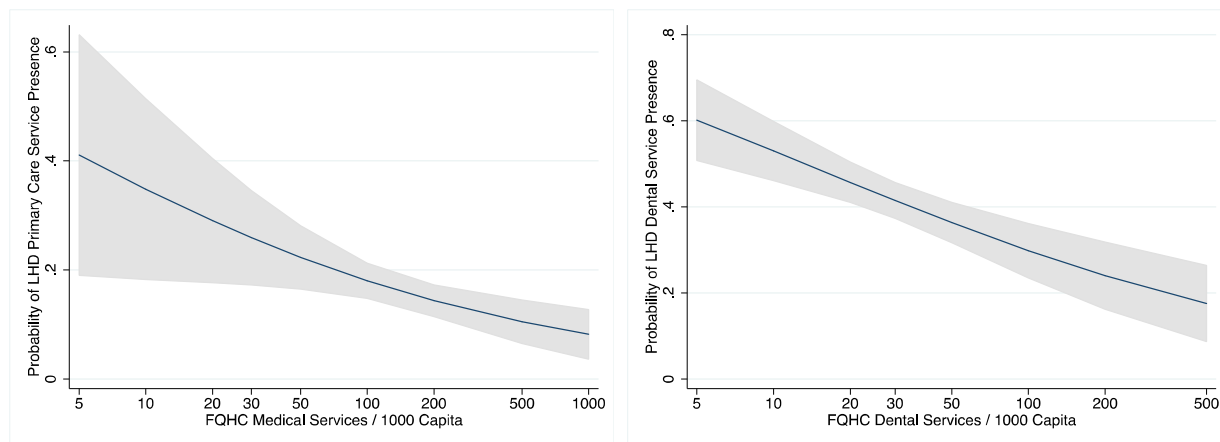


Figure 2.2. Marginal Predictions of LHD Medical and Dental Service Presence Based on Variation in FQHC Service Levels (95% Confidence Intervals Shaded)

We noted directional effects for discontinuation of each of the services and the latent class grouping. This may indicate a higher likelihood of LHDs discontinuing services in the presence of higher FQHC service volume; however, none were significant at the $p=0.05$ level. This may be related to the small sample of LHDs who offered the services in the baseline year, and the reduction in power that stems from the use of IV methods. We did observe significant effects of the service discontinuation outcome in naïve logistic regression models, which did not include the IV-derived first-stage residual.

2.5 DISCUSSION

Higher FQHC service volume in a jurisdiction appears to be inversely associated with the presence of primary care and dental services at LHDs. However, LHDs appear to be more likely to maintain prenatal care services, even when FQHCs in their jurisdiction also provide prenatal services at higher volumes. While FQHCs are required to offer many non-clinical and enabling prenatal services, such as outreach, transportation, and identification of additional health services

available, LHDs may be able to provide supplementary non-clinical prenatal-related social services to a community in a manner more responsive to community need.⁶ For example, many LHDs provide other services related to Maternal and Child Health, such as WIC (65%) and Maternal Child Health Home Visits (60%); and other interventions that may be more closely suited to the LHD mission of population wellness, early intervention, and prevention.¹⁸ Additionally, prenatal care services are often funded by a federal funding formula, and LHDs may have less discretion about how those funds are spent, and be ‘obligated’ to continue providing these services.²⁵ “Crowd-out” might explain the more direct substitutive effects seen around dental care, as there may be a limited number of providers and infrastructure available to provide dental care to low-income populations in jurisdictions.

Studies suggest that there are standard community characteristics that may assist LHDs in deciding whether they should provide clinical services.²⁶ However, service decisions are based on a number of contextual factors including assessed need, available community partners, care reimbursement mechanisms, and local provider constraints.^{1,12,27} More research is needed into factors that might drive local variation in FQHC service arrangements. Staff training, provider capacity, and state funding restrictions may all affect services offered by FQHCs.^{28,29}

Our findings also offer implications for the changing role of LHDs around the assurance of community health provision. The ACA promotes local assessment of health needs and a community-level responsibility for population health outcomes.³⁰ While FQHCs are specifically tasked with delivering personal health services, and, as federally-funded entities, have a consistent national mission to underserved populations; LHDs are responsible for assuring broad community health needs are met, and exhibit wide variation in the activities they carry out to meet these needs.¹² LHDs, therefore, are well-placed to lead community-wide work with FQHCs

and other providers to ensure clinical services respond to community needs. The National Association of Community Health Centers has identified certain approaches an LHD could take: connecting FQHCs with communities and stakeholders; providing a population-based perspective to FQHC activities and communications; using shared data to identify populations, geographic areas, and partners for collaboration; and working with FQHCs to provide referrals, co-location, or purchasing of population health services.¹¹

Further research is needed to examine how variation in LHD-FQHC service provision might drive differential health care access and utilization, particularly among the vulnerable populations they both serve. A related paper by our study team will examine whether the collaboration around these services are related to variations in outcomes that may be affecting access to safety-net health care.

2.6 CONCLUSION

LHDs with scarce resources may be in positions to discontinue clinical services which may be adequately provided by other organizations in the community, and instead invest in core public health assurance activities. The explosive growth in Medicaid coverage and the reach of FQHCs since ACA enactment presents opportunities for recasting the role of safety net care providers. Examining interactions in safety net coverage, and how changes in providers affect access to care and care outcomes, will be critical for determining if communities are meeting ACA goals for adequate service coverage and improved population health outcomes.

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Chapter 3. AIM 2: FEDERALLY-QUALIFIED HEALTH CENTER AND LOCAL HEALTH DEPARTMENT CLINICAL SERVICES: RELATIONSHIPS WITH INDIVIDUAL HEALTH CARE ACCESS OUTCOMES

3.1 ABSTRACT

Objective: We examined the association between the Federally-Qualified Health Center (FQHC) and Local Health Departments (LHD) clinical services in LHD jurisdictions and individual health access outcomes in 2010 and 2012.

Methods: Using logistic regression, we examined LHD and FQHC clinical service presence and volume data to determine whether variation in safety net service delivery was associated with individual BRFSS-derived health care access outcomes (unmet medical need and having a routine health provider).

Results: Many medically underserved jurisdictions do not yet have adequate safety-net services. LHD presence was associated with higher unmet need in a jurisdiction, but presence of both LHD and FQHC services was associated with lower unmet medical need. Higher FQHC service volume was also associated with higher likelihood of an individual having a routine health provider and lower unmet medical need.

Conclusions: In some jurisdictions, the public health system may be starting to address unmet health needs through the establishment of FQHCs, but service levels may still be

inadequate to meet demand. Public health leaders should monitor and advocate for expansion of the FQHC services in jurisdictions which are medically underserved.

3.2 BACKGROUND

The Institute of Medicine (IOM) defines the health care safety net as a network of providers that offers care to patients regardless of their ability to pay for services, and that serves a substantial proportion of patients that are uninsured, covered by Medicaid, or are from vulnerable population groups.^{1,2} In the United States, it consists of a patchwork system of clinical care delivered through Federally-Qualified Health Centers (FQHC), Local Health Departments (LHD), hospital charity care, and some private practices. The financing, organization, and service volume of the safety net has changed dramatically in the wake of the Great Recession and the implementation of the Affordable Care Act (ACA).¹ The ability of many LHDs to provide safety net services has decreased over the past decade, due in part to cuts in state and local budgets which fund many services.³ However, over the past six years, federal funding for FQHCs has increased dramatically, leading to the expansion and further establishment of centers throughout the country.⁴

FQHCs, with federal funding from the Health Resources and Services Administration (HRSA), have a national mission to provide primary care in areas where other health care providers may be unwilling or unable to locate.⁴ Increases in FQHC services and utilization have been shown to improve primary care access in Medically Underserved Areas (MUAs).^{5,6} The MUA, along with the Health Professional Shortage Area (HPSA), are designations which assist HRSA in federal FQHC funding and policy decisions, and aim to improve access to health care in communities that lack adequate provider capacity.

Studies have identified the expansion of the FQHC network as an effective strategy for reducing disparities in primary care access and related health outcomes.⁷ However, FQHCs are just now reaching many underserved communities – in 2009, 43% of counties with MUA designations still lacked FQHC availability.⁴ Substantial new funding in the American Recovery and Reinvestment Act of 2009 and the ACA aimed to address this gap.^{4,8} In 2012, as FQHC services expanded, the IOM made the case that LHD collaboration with new clinical service partners was essential to ensure comprehensive service coverage, and that LHDs might use FQHC expansion as an opportunity to reduce their clinical service portfolio and expand the population-focused services that they are uniquely suited to deliver.⁹

Accordingly, studies have noted substitutive effects – for example, in communities where FQHCs offer higher volumes of primary care or dental services, LHDs are less likely to offer the same services.¹⁰⁻¹² However, it is unclear whether these shifts have improved access to health care for individuals in these communities, and whether LHD leaders are using evidence of community need in choosing to discontinue these services. To our knowledge, there has been no published research examining how variation in FQHC and LHD safety net care arrangements have affected individual-level health access outcomes in communities. Assessing the nature of these organizational approaches can help gauge the effect of recent heavy investment in FQHC services, and of LHD retreat in funding safety-net services. Thus, the motivation of this study was to assess how individual-level health access outcomes may have been affected by the presence and per capita volume of FQHC services, and the presence of LHD services, in 2012.

3.3 METHODS

Study Design

We gathered national FQHC service presence and jurisdictional covariates from the HRSA Area Health Resource File (AHRF).¹³ We merged national LHD service presence data from the National Association of County and City Health Officials (NACCHO) Profile Survey of LHDs with AHRF data.¹⁴ Finally, using county identifiers, we linked LHD and FQHC data with individual-level data from the 2012 Behavioral Risk Factor Surveillance Survey (BRFSS), a large, nationally-representative, cross-sectional telephone survey of health behaviors among adults.

For each set of models, we looked at BRFSS outcomes that would represent both potential access to care (having a usual source of care) and realized access outcomes (unmet need due to cost).¹⁵ We used survey-weighted cross-sectional logistic regression to examine how safety net service presence is associated with individual health access outcomes. We first examined FQHC/LHD service presence and the interaction of both FQHC and LHD services being present in a jurisdiction, then, we examined FQHC service volume, LHD service presence, and an interaction between FQHC service volume and LHD service presence.

Measures and Data Sources

Dependent Variables. From the BRFSS, we identified outcomes that were considered proximal to variation in access to safety net care. We set out to examine whether BRFSS respondents (1) had a routine health provider (“Do you have one [or more] person you think of as your personal doctor or health care provider?”) or (2) identified having unmet medical need in

the past year due to cost (“Was there a time in the past 12 months when you needed to see a doctor but could not because of cost?”)

Independent Variables. Our primary independent variable was the presence of FQHC services in each local health jurisdiction in 2012. We drew 2012 FQHC presence information for all U.S. counties from the AHRF.¹³ We obtained 2012 data on per capita FQHC patients from the HRSA Uniform Data System (UDS), an FQHC reporting system.¹⁶ FQHC services were defined in the models as logged patient volume per capita. We also examined LHD primary care service presence or absence in 2012 from questions drawn from the NACCHO Profile Survey.¹⁴ We defined LHD service arrangements as the presence of medical or dental services offered directly by the LHD. We also created a variable to represent the interaction of LHD service presence with differing FQHC service volumes.

Covariates. We drew jurisdiction-level control variables from the AHRF which, based on our review of the literature, as community-level factors that may be associated with individual health care access outcomes.¹⁵ Models controlled for jurisdiction-level rurality, uninsurance rate, median household income, proportion of population over age 65, and HPSA designation. Models also controlled for individual BRFSS respondent age, sex, racial group, marital status, education level, employment status, and income level.

Sampling Frame

Our initial descriptive data were drawn from 576,539 BRFSS observations from 2010 and 2012, representing 1,180 LHD jurisdictions. Our sample for our regression models, examining FQHC and LHD service presence in 2012, consisted of 1,308 LHD jurisdictions, with 289,218 nested BRFSS respondents. Of the 755 jurisdictions with an FQHC presence, the UDS had specific service volume data for 349 jurisdictions, with 156,855 BRFSS respondents. Other

FQHCs did not have available service volume data in their UDS submissions. Analysis revealed that jurisdictions with service volume data were more likely to be rural and designated as whole HPSA regions than those with missing service volume data.

Data Analysis

We conducted descriptive analysis of county and individual-level demographic and health status variables, by LHD and FQHC service presence, and compared changes between 2010 and 2012. Finally, we constructed survey-weighted logistic regression models to examine the effect of the LHD and FQHC predictors on the individual health access outcomes, incorporating a Taylor linearized variance estimator to account for the clustered nature of the BRFSS observations. For the above regression models, we also ran stratified analysis for subgroups of BRFSS respondents who reported household incomes of less than \$20,000. Analyses were conducted using R 3.2.3 and Stata 14 statistical software.

3.4 RESULTS

In 2012, jurisdictions with FQHCs were more urban and more likely to be designated as HPSAs than jurisdictions without FQHC presence (Table 3.1). BRFSS respondents in jurisdictions with an FQHC presence generally reported higher unmet medical need than respondents in jurisdictions without an FQHC. Jurisdictions without LHD primary care services in 2012 were more rural than those jurisdictions with primary care services. While 70.2% of the jurisdictions with both FQHC and LHD services were urban, more than half of jurisdictions that lacked both LHD primary care and FQHC presence were rural. The highest levels of unmet medical need (18.1%) were observed in jurisdictions without an FQHC, but with LHD primary care presence.

Table 3.1. Jurisdiction Sociodemographic and Individual Health Care Access Outcomes Characteristics by FQHC/LHD Service Presence in 2010 and 2012

1,180 Jurisdictions w/ 2013 and 2010 PROFILE Data	FQHC Not Present in 2010		FQHC Present in 2010		FQHC Not Present in 2012		FQHC Present in 2012	
	LHD Primary Care Not Present	LHD Primary Care Present	LHD Primary Care Not Present	LHD Primary Care Present	LHD Primary Care Not Present	LHD Primary Care Present	LHD Primary Care Not Present	LHD Primary Care Present
N (jurisdictions, %)	533 (44.8%)		656 (55.2%)		492 (41.7%)		688 (58.3%)	
N (jurisdictions, %)	449 (84.2%)	84 (15.8%)	538 (82.0%)	118 (18.0%)	423 (86.0%)	69 (14.0%)	577 (83.9%)	111 (16.1%)
% Urban (SE)	39.6 (2.3)	45.2 (5.4)	57.5 (2.1)	70.3 (4.2)	39.5 (2.3)	43.5 (6.0)	56.7 (2.1)	70.2 (4.4)
% Whole Health Professional Shortage Area (HPSA) Designation (SE)	31.8 (2.2)	19.0 (4.3)	42.1 (2.1)	26.3 (4.1)	31.4 (2.2)	21.7 (5.0)	40.9 (2.0)	26.1 (4.2)
% Part HPSA Designation (SE)	35.9 (2.3)	41.7 (5.4)	50.0 (2.2)	61.0 (4.5)	36.6 (2.3)	40.6 (6.0)	49.6 (2.1)	57.7 (4.7)
% of population older than 65 (SE)	16.1 (0.17)	16.2 (0.46)	15.4 (1.7)	16.6 (4.9)	16.1 (0.17)	12.1 (0.42)	15.5 (0.16)	16.3 (0.51)
Median HH income (\$) (SE)	46,902 (545)	44,324 (1087)	44,370 (522)	43,799 (963)	47,305 (563)	42,261 (1031)	44,357 (508)	44,194 (965)
N (BRFSS, %)	69,075 (24.0%)		218,246 (76.0%)		63,685 (22.0%)		225,533 (78.0%)	
N (BRFSS, %)	56,176 (81.3%)	12,899 (18.7%)	175,023 (80.2%)	43,223 (19.8%)	58,419 (91.7%)	5,266 (8.3%)	196,131 (87.0%)	29,402 (13.0%)
% Low Income (>\$20,000 HH income)	14.1 (0.30)	14.4 (0.70)	18.1 (0.21)	18.2 (0.37)	18.3 (0.32)	19.7 (1.03)	21.7 (2.4)	21.8 (5.3)
% Population without Health Insurance Coverage	12.8 (0.31)	16.3 (0.82)	16.1 (0.20)	14.8 (0.36)	15.0 (0.32)	17.4 (1.00)	18.6 (0.24)	19.2 (0.47)
% Population without Routine Health Provider	15.5 (0.40)	16.5 (0.88)	19.4 (0.22)	19.3 (0.41)	17.8 (0.31)	18.9 (1.10)	21.7 (0.25)	22.9 (0.51)
% Population with Unmet Medical Need	12.6 (0.33)	16.0 (0.84)	15.2 (0.19)	14.8 (0.34)	14.9 (0.32)	18.1 (1.00)	16.7 (0.20)	17.7 (0.42)

In the first set of logistic regression models, we saw contrasting associations between FQHC/LHD presence and individual-level health care access outcomes (Table 3.2). FQHC presence did not appear to be associated with unmet need in the entire BRFSS sample, but was marginally associated with a 9.6% likelihood of lower unmet need in a low-income subsample (OR=0.906). FQHC presence was associated with a lower likelihood of an individual reporting a routine health provider in both samples, but only significantly in the entire BRFSS sample. BRFSS respondents who lived in a jurisdiction with LHD presence were 27% more likely to report having unmet medical need (OR=1.274), and 15% less likely to report having a routine health care provider (OR=0.846). When both LHD and FQHC services were present in a county, we saw a lower level of unmet need than when only LHD services was present (OR = 0.842).

Table 3.2. Adjusted Logistic Regression of Effect of 2012 FQHC and LHD Service Arrangements in a Jurisdiction on Individual Health Care Access Outcomes

2012 BRFSS Responses nested within LHD jurisdictions	Model 1: Had Unmet Medical Need in Past Year		Model 2: Has a Routine Health Provider	
	Entire Sample	Low-Income	Entire Sample	Low-Income
Presence of an FQHC	1.016 (0.956 - 1.079)	0.906* (0.817 - 1.006)	0.916*** (0.867 - 0.969)	0.893* (0.783 - 1.019)
Presence of LHD Primary Care	1.274*** (1.104 - 1.470)	1.247* (0.988 - 1.573)	0.864* (0.746 - 1.002)	0.817 (0.612 - 1.089)
Presence of both LHD and FQHC Service	0.842** (0.719 - 0.986)	0.852 (0.661 - 1.100)	1.066 (0.905 - 1.256)	1.267 (0.919 - 1.745)
BRFSS Observations	312,586	54,675	312,466	54,706

*** p<0.01, ** p<0.05, * p<0.1, "low income" is defined as <\$20,000 HH income

Our final models limited the analysis to jurisdictions with FQHC presence and available data on FQHC primary care service volume. In jurisdictions with FQHC service presence in 2012, there was high variation in per capita service volume. There was a mean service volume of 97.8 visits per 1000 population for medical services, with a median patient volume of 57.3 per 1000 population in a jurisdiction, and a standard deviation of 151 patients per 1000 population.

Higher FQHC service levels were strongly associated with BRFSS respondents reporting lower unmet need (Table 3.3). Regression models showed that, among the entire BRFSS sample, a 1 log increase in FQHC service levels in jurisdictions with FQHC presence was associated with a 4.0% decrease in reported unmet medical need (OR=0.960), and a 4.5% increase in the likelihood the respondent had a routine health provider (OR=1.045). Among a low-income sample of respondents reporting lower than \$20,000 household income, we noted a marginally significant increase in having a routine health provider (OR=1.058), but not statistically

significant lower unmet medical need. We also found that neither presence of LHD primary care services, nor the interaction of presence of LHD services with higher FQHC service was associated with better health care access outcomes.

Table 3.3. Adjusted Logistic Regression of Effect of 2012 FQHC Service Volume and LHD Service Presence in a Jurisdiction on Individual Health Care Access Outcomes

2012 BRFSS Responses nested within LHD jurisdictions	Model 1: Had Unmet Medical Need in Past Year		Model 2: Has a Routine Health Provider	
	Entire Sample	Low-Income	Entire Sample	Low-Income
Odds Ratio, (95%CI)				
FQHC service volume (1 log increase)	0.960** (0.931 - 0.990)	0.969 (0.917 - 1.024)	1.045*** (1.016 - 1.074)	1.058* (0.997 - 1.122)
Presence of LHD Primary Care	1.006 (0.769 - 1.316)	0.931 (0.605 - 1.434)	0.809 (0.613 - 1.067)	1.221 (0.656 - 2.271)
Presence of both LHD and FQHC Service volume increase	0.990 (0.908 - 1.078)	0.968 (0.847 - 1.108)	0.944 (0.865 - 1.030)	1.012 (0.835 - 1.226)
BRFSS Observations	156,855	27,557	156,758	27,564

*** p<0.01, ** p<0.05, * p<0.1, "low income" is defined as <\$20,000 HH income

3.5 DISCUSSION

We first examined changes in safety net services over a critical period – 2010 to 2012 – when more Americans lived in jurisdictions with FQHC service presence, and a number (n=22) of LHDs in the sample made decisions to discontinue primary care services. Descriptive analysis revealed substantial changes in how safety net care was being delivered, and the communities they were serving, over this time period.

In our cross-sectional regression modeling of jurisdictions from 2012, we found that presence of FQHCs in jurisdictions was associated with lower likelihood of having a routine health provider. This was an anticipated finding, as federal law and regulations require that such

facilities be built in areas which are medically underserved. When we examined only jurisdictions which have FQHC service volume data, we observed significantly higher likelihood of BRFSS respondents having better health access outcomes where FQHC primary care service volumes were higher. This finding suggests that intensive allocation of FQHC resources in a community may drive improvements in health care access.

LHD service presence, after controlling for community and individual demographic factors, was not associated with lower unmet medical need. Additionally, an interaction term in the second set of models, which represented the presence of LHD services in combination with higher FQHC service volume, was not significant, suggesting that LHD services may not be offering additional gains toward improving health care access in jurisdictions where FQHCs are already offering a high volume of service in a community.

Our findings suggest that in some jurisdictions, the broader public health system may be starting to address unmet health needs through the establishment of FQHCs, but service levels may still be inadequate to meet demand. FQHCs, as federally-funded entities, have a consistent national focus to provide clinical services to vulnerable populations. LHDs, by contrast, employ a wide variation of population-focused and clinical service strategies to meet the health needs of their communities.^{11,17} As LHDs consider discontinuation of clinical services, public health leaders should continue to guide expansion of FQHC networks which ensure strong safety net coverage, particularly in areas with high unmet need that do not have high FQHC service volumes. If FQHC services are then provided at adequate volumes to meet demand in jurisdictions, an LHD's leadership might be well-placed to fully transfer safety-net clinical service roles to an FQHC network, which might free public health resources for more population-focused, rather than individual-level, activities.

This analysis contributes evidence to public health systems around what kind of improvements in health access outcomes would be expected if there were strong FQHC investments in a jurisdiction. LHDs, by their nature, are well-positioned to play a population-focused assurance role that monitors a community's health status, identifies issues, mobilizes community partnerships of providers, and links individuals to care, thus, addressing health issues in a local context.¹⁸ LHD leaders can work with their FQHC counterparts to improve connections with communities and other stakeholders; provide a population-based perspective to FQHC activities and communications; use shared data to identify populations, geographic areas, and partners for collaboration; work together to provide referrals, co-location, or purchasing of health services; or transform their clinical practices into FQHCs directly.¹⁹ These collaborative concepts, which were beyond the scope of this study, should be explored in future research.

3.6 LIMITATIONS

We were unable to merge data for a substantial proportion of BRFSS respondents, due to state-level suppression of county identifiers for observations in some smaller counties, or missing county identifiers at the state level altogether (in six states). From the initial 475,687 BRFSS respondents, we were able to establish county identifiers for 319,448 (67.2%). The study was more likely to include observations from larger, more urban counties due to small cell size suppression policies of state health departments which might remove county identifiers for very small counties with a low number of observations. Additionally, BRFSS data that were successfully drawn from smaller counties included a correspondingly smaller number of respondents, which may have limited our ability to detect statistical significance. As rural counties generally face serious health access disparities, future research should focus on gathering data and assessing health system performance in these areas.

We also faced limitations in assessing LHD service provision. The NACCHO Profile survey is the strongest available national data source on LHD activities, but lacks the ability to identify variation within LHD service categories beyond its presence or absence. LHD jurisdictions are large, often heterogeneous, units of analysis, and it is possible that residents in different parts of a jurisdiction face different access barriers.

Finally, as this was a cross-sectional analysis, it is important to note that we are unable to infer that certain safety net service approaches are causally linked to the examined health care access outcomes. It is possible that reverse causation was present in some of the relationships we examined – for example, unmet need may be driving LHD service presence in some jurisdictions. As LHD and FQHC service models continue to change, and data that can be used to assess these changes improves, researchers should use methods which allow strong causal inference in how variation in the safety net may be driving health care access outcomes.

3.7 CONCLUSION

FQHCs already provide primary care services to a substantial portion of the U.S. population, particularly those who are Medicaid-eligible or uninsured, and their role as a key safety net care provider in the U.S. is likely to continue to grow. However, LHDs still provide crucial clinical services in underserved communities where FQHC services are not present or offered broadly enough to meet demand.²⁰ Public health leaders should monitor and advocate for expansion of the FQHC services in jurisdictions which are medically underserved, and FQHCs should collaborate with LHDs in monitoring the need for services in their communities.

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Chapter 4. AIM 3: EFFECT OF LHD JURISDICTIONAL-LEVEL ENFORCEMENT OF SMOKE-FREE LAWS ON WORK-RELATED ASTHMA IN WASHINGTON STATE

4.1 ABSTRACT

In 2006, Washington State began enforcement of a state-level smoke-free law which banned smoking in most public buildings and places of employment. It aimed to reduce public and occupational Secondhand Smoke (SHS) exposure, and charged Washington's 35 Local Health Departments (LHDs) with upholding the statute – however, it offered minimal guidance, and no funding, for enforcement efforts.¹ This led to substantial variation across jurisdictions in how inspections and responses to violations were administered, as measured by a recent survey of LHD activities.² This research examines whether presence of LHD inspection activities or LHD response to violations of the smoke-free workplace law was associated with lower prevalence of Work-Exacerbated Asthma (WEA) among population groups where WEA could reasonably be attributed to SHS exposure – a measure that might serve as a proxy for business compliance.

4.2 BACKGROUND

While occupational health and safety issues are typically regulated by federal or state-level labor agencies, legislation in many states has enlisted local health departments (LHDs) to monitor and enforce smoking bans - similar to how food and environmental inspections are implemented.¹ In Washington State, a successful 2005 ballot initiative amended the existing 1985 Clean Indoor Air Act such that, in 2006, smoking was banned inside and within 25 feet of

all public buildings and public and private businesses.³ The measure charged LHDs to enforce the ban through inspection, fines, and license restrictions on offending businesses. Local law enforcement personnel were responsible for enforcing the ban on individual smokers. The measure, however, was not accompanied by clear guidance on specific enforcement measures, and was not paired with a funding mechanism to support enforcement.

Some states have experienced problems with implementation resulting from lack of administrative or funding support for enforcement. Ohio implemented a similar state-wide ban in 2006, and found, soon after implementation, a large majority of LHDs were spending significant resources on smoking ban enforcement (after accounting for unpaid fines and high costs of enforcement).⁴ This resulted in many LHDs deciding to reduce or end enforcement efforts. In the face of an unfunded mandate, LHD leaders may determine that business-by-business enforcement is impractical and financially unsustainable.⁵ LHDs instead might focus on responding to specific complaints from community members, or on conducting education and awareness campaigns around the ban to improve self-compliance. It is also possible that LHDs may choose not to implement any efforts to improve compliance. Thus, there is a need to understand whether LHDs are implementing smoke-free enforcement models, whether they may be effective in reducing Secondhand Smoke (SHS) exposure, and more generally, whether LHDs can implement enforcement programs as an effective and sustainable public health service.

In order to assess the potential effects that variation in enforcement might have on worker health, it is useful to identify health effects which are associated with SHS that could serve as a measure of business compliance. Two potential markers of SHS exposure are Work-Exacerbated Asthma (WEA) and Work-Related Asthma (WRA) among at-risk industry groups.⁶ The Council

for State and Territorial Epidemiologists (CSTE) acknowledges the importance of these indicators in monitoring worker health, and identifies them as key Occupational Health Indicators (OHI #21) that are critical in surveillance and research.⁶ A 1993 study, using 20 years of follow-up with a large adult cohort, initially supported the notion that indoor air pollutants, such as SHS, are common preventable asthmagenic exposures in non-smoking populations, and are significantly associated with the development and exacerbation of asthma.⁷

Individual-level self-reported data from the Behavioral Risk Factor and Surveillance Survey (BRFSS)-dependent Asthma Callback Survey (ACBS) show that 10% of current asthma cases were caused, and upwards of 20% were aggravated, by a person's current occupation.⁸ Studies have also shown associations between asthma occurrence and exposure to SHS through examination of direct biological pathways,⁹⁻¹¹ variation in strength of smoke-free laws,^{12,13} and of direct exposures in workplaces.^{14,15} Studies have also measured the pre/post effects of indoor smoking ban implementation, finding significant improvements in biological markers of SHS exposure and in related health outcomes.^{10,11,16-19} We found no published studies, however, that have assessed whether variation in smoking ban enforcement by LHDs or other agencies is associated with reduced SHS exposure or related health outcomes.

LHD enforcement of smoke free workplace laws may reduce SHS exposure that contributes to WEA by several mechanisms. First, the knowledge that LHDs are vigorously enforcing laws could encourage businesses to ensure compliance. Second, standardized implementation and enforcement of smoke free policies may reduce smoking prevalence.¹⁵ By 2011, almost 80% of U.S. residents were covered by smoke-free legislation in workplaces, restaurants, and bars.²⁰ Therefore, there is a strong need for research to examine current

enforcement mechanisms, and determine if there are better approaches to improving worker and population health.

Our study examined the high degree of variation in approaches to LHD enforcement of the clean indoor air law in Washington State, and assessed whether stronger LHD enforcement practices were associated with lower WEA rates that might be attributable to occupational SHS exposure - which may be indicative of compliance with the legislation.

4.3 METHODS

Study Design

This study was a cross-sectional analysis using data from the 6-state 2013 Multi-Network Practice and Outcome Variation Examination Study (MPROVE) to examine specific LHD approaches to clean indoor air law enforcement in Washington State, and to use logistic regression methods to examine associations with WEA outcomes in BRFSS/ACBS data from a period during and immediately before LHDS completed the MPROVE survey (2011-2013).^{2,21} Washington BRFSS/ACBS data contain county identifiers for all respondents, so we first merged ACBS data with county and occupation-identified state BRFSS data, and then merged the combined data with LHD jurisdictional-level MPROVE data. This study did not meet the IRB definition of human subjects research so no IRB approval was needed.

Measures and Data Sources

Dependent variable. Our study examined outcomes from 41,243 BRFSS and 2,080 ACBS respondents (survey years 2011-2013) residing in 29 Washington LHD jurisdictions. The BRFSS is a large, nationally-representative, cross-sectional telephone survey of adult health

behaviors, and ACBS is a follow-up telephone survey given to BRFSS respondents who respond affirmatively to the question “Have you ever been told by a doctor, nurse, or other health professional that you have asthma?” We examined the prevalence of previous or current (ever) WEA, drawn from individual-level BRFSS/ACBS respondent data. This was defined from positive responses to either of two questions on the ACBS that ask about the current or previous work-relatedness of the respondent’s asthma: “Are your asthma symptoms MADE WORSE by things like chemicals, smoke, dust or mold in your [CURRENT/PREVIOUS] job?”²²

Washington BRFSS fields questions on respondent industry and occupation, which are categorized for all employed respondents – these data have been successfully used in previous research to examine WEA prevalence.²² Workers in office/administrative support and food preparation and service industries are more likely to be in positions where occupational SHS levels have a direct causal link with smoke-free policy enforcement. Therefore, we conducted additional analysis on the subset of BRFSS respondents who work in these industries.

Independent variables. The MPROVE study included two indicators related to the smoke-free workplace enforcement activities of an LHD – these were the number of business inspections made, and the number of business violations to which the LHD responded. The indicators were based on data from a one-year period, starting at the beginning or middle of 2012, dependent on the LHD’s reporting abilities.

Covariates. We included metropolitan status, based on Rural-Urban Commuting Area Coding (RUCA), as well as jurisdiction-level median household income, both drawn from the Area Health Resource File (AHRF), as an LHD jurisdiction-level covariate.²³ We also included

age, sex, marital status, education (high school and college completion), and year of BRFSS/ACBS observation as individual-level covariates.

Sample Frame

Washington State has 35 LHD jurisdictions, with 32 serving county-level jurisdictions, while 3 LHDs incorporate 2 or 3 lower-population counties. Six jurisdictions in the state did not respond to the MPROVE study; and 2 LHDs did not respond alternatively to one of the enforcement questions. Therefore, 29 jurisdictions have data, and 28 were included in the final analysis. BRFSS respondents who were not employed or reported being current smokers were excluded from the analysis.

Data Analysis

We first conducted descriptive analysis on the LHD program data. We then constructed survey-weighted logistic regression models, using the presence of either any LHD inspection or any LHD response to violation in the reporting year as a jurisdictional-level predictor. Individual BRFSS respondents served as the unit of analysis, with individual WEA as the outcome of interest. Models adjusted for individual sex, age, marital status, education, income, individual smoking status, and employment status, as well as county rural-urban designation. We used R version 3.2.3 and Stata 14 statistical packages to conduct the analysis.

4.4 RESULTS

In order to explore the distribution of enforcement practices across the state, we examined both presence and per capita levels of inspection and violation practices in LHD jurisdictions. Table 4.1 and Figure 4.1 describe the variation seen in LHD enforcement practices.

In 2012, 14 of the 28 responding LHDs (50%) reported conducting inspections of business establishments (mean number of inspections = 60.9). Sixteen LHDs (57.1%) indicated that they had responded to violations of the ban in their jurisdiction. Two LHDs responded to violations without conducting inspections, while four LHDs conducted inspections but reported no violation responses in their jurisdiction. Twelve LHDs conducted no inspections and responded to no violations. In bivariate analysis, we found a strong correlation between inspection and violation response levels ($R^2=0.248$, $p<0.001$).

Table 4.1. Variation in Inspection and Violation Response by LHD (n = 28)

	Total Inspections	Inspections Per 10,000 Capita	Total Violations	Violations Per 10,000 Capita
Median	2	0.4	3	1
Mean	60.88	8.4	16.96	0.8
Standard Deviation	202.9	46.1	52	0.5
Maximum	1000	335	253	1.7

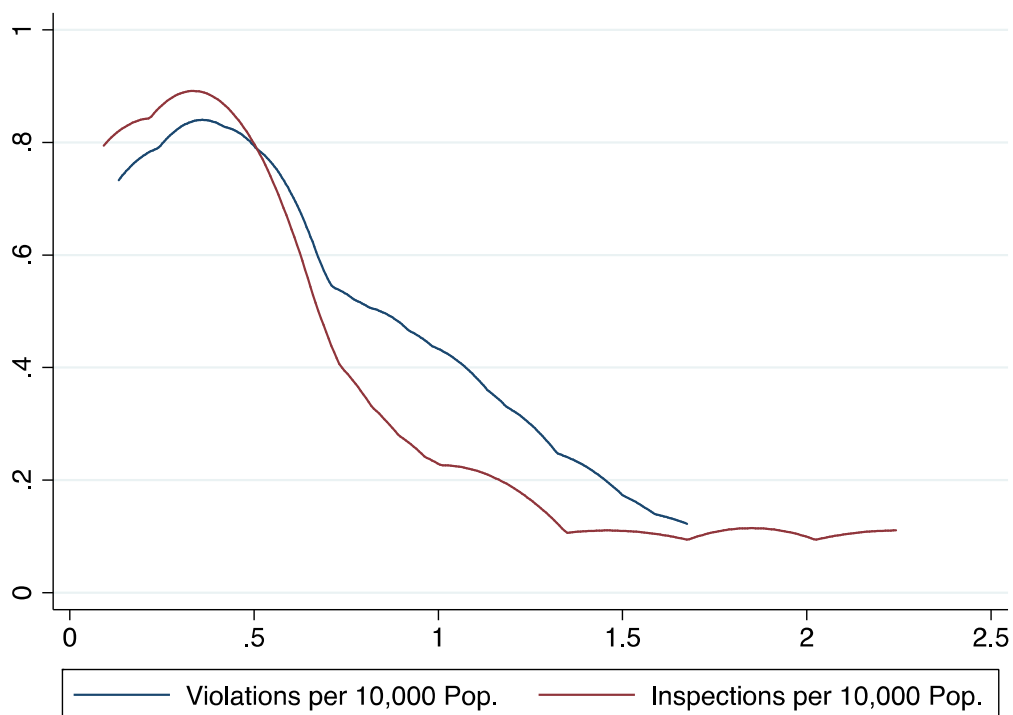


Figure 4.1. Kernel density plot of Inspection and Violation Data for LHDs who Conducted either Enforcement Practice (n=28)

*Two LHDs which conducted inspections at much higher rates (126 and 335 inspections / 10,000 population) were excluded from the above plot for clarity

In descriptive analysis of the BRFSS data, we noted very similar levels of smoking among the entire Washington State adult population and the employed population (both 16.6%), and a slightly higher prevalence of smoking among the Office/Service Industry Employed Population (17.7%) Asthma prevalence rates were 13.29% among the employed population and 14.91% among the office/service industry population.

As seen in Table 4.2, BRFSS/ACBS data show that the state-level prevalence of employed individuals ever (current or previous) having WEA among non-smokers was 1.04%. Among office and service industry-employed individuals, we observed an overall WEA

prevalence of 1.02%. These prevalence rates are similar to other studies which have examined WEA.^{8,22} There were notable differences in the prevalence rates between LHD jurisdictions that had enforcement activities and those that did not. For example, jurisdictions where no inspections took place had a WEA prevalence rate of 1.34%, while jurisdictions where inspections did take place had a WEA prevalence rate of 0.95%. None of these differences were significant at $p=0.05$ in bivariate statistical tests, however.

Table 4.2. BRFSS Respondents and WEA Prevalence Rates by Enforcement Practices of LHD

	# LHDs	2011-2013 BRFSS Observations of Non-Smokers, Ever WEA Prevalence % (Standard Error %)	
		Currently/ Recently Employed Population	Office/Service Industry Employed Population*
No Inspections Conducted	14	3,469 1.34 (0.24)	611 1.61 (0.71)
Inspections Conducted	14	10,907 0.95 (0.17)	2,348 0.87 (0.26)
Total	28	12,985 1.04 (0.14)	2,959 1.02 (0.27)
No Violations Reported	12	2,648 1.37 (0.27)	611 1.70 (0.88)
Violations Reported	16	10,299 0.97 (0.16)	2,808 0.88 (0.25)
Total	28	12,947 1.04 (0.14)	2,941 1.02 (0.27)

* Office/Service Industry includes industry groupings of Accommodation and Food; other services; and Professional, Scientific, Management; Admin Support, and Waste Management Services.

Table 4.3 shows logistic regression models comparing respondents in jurisdictions where LHDs conducted no inspections or responded to no violations, to those in jurisdictions where

they did report conducting inspections or responding to violations. Columns 1 and 3 include the overall employed BRFSS sample (excluding current smokers), while columns 2 and 4 limit the sample to those employed only in office/service industries (also excluding current smokers). The first row of each column represents the effect of presence of the respective enforcement practice. For example, among the employed population, an LHD having conducted an inspection would be related to a 26% reduction in the prevalence rate of current or previous WEA (OR=0.732) – however, these associations were not significant at standard significance thresholds ($p=0.05$). Directional but non-significant effects were seen in both conducting any inspections and responding to any violations in association with lower WEA rates in both respondent samples. Older individuals and women were more likely to have reported current or previous WEA.

Table 4.3. Survey-Adjusted Logistic Regression Models of Presence of LHD Inspection and Violation Response on WEA
Prevalence (95% Confidence Intervals)

Odds Ratio (OR), 95% Confidence Intervals	Any Inspections Conducted		Any Violations Reported	
	(1) Ever WEA, Currently/Recently Employed	(2) Ever WEA, Office/Service Industry Employed	(3) Ever WEA, Currently/Recently Employed	(4) Ever WEA, Office/Service Industry Employed
Any Inspections conducted/ Violations reported in LHD jurisdiction	0.733 (0.445 - 1.205)	0.593 (0.178 - 1.972)	0.736 (0.448 - 1.209)	0.514 (0.179 - 1.478)
Metropolitan Status (Rural=ref)	1.544 (0.702 - 3.396)	4.290* (0.908 - 20.26)	1.468 (0.692 - 3.111)	3.840* (0.932 - 15.82)
Median Jurisdiction Household Income (continuous, \$1000 change)	0.975 (0.944 - 1.008)	0.911*** (0.859 - 0.965)	0.973 (0.942 - 1.006)	0.908*** (0.859 - 0.961)
Age of respondent (continuous)	1.028*** (1.017 - 1.039)	1.030** (1.005 - 1.055)	1.028*** (1.016 - 1.039)	1.031** (1.005 - 1.057)
Sex of respondent (Male=ref)	2.961*** (1.935 - 4.532)	1.537 (0.666 - 3.548)	2.914*** (1.899 - 4.472)	1.504 (0.649 - 3.489)
Marital Status (Single=ref)	1.298 (0.856 - 1.968)	1.184 (0.532 - 2.631)	1.330 (0.873 - 2.027)	1.202 (0.536 - 2.693)
Completed College (no=Ref)	1.015 (0.679 - 1.517)	1.053 (0.449 - 2.469)	1.039 (0.692 - 1.561)	1.067 (0.453 - 2.516)
Year of BRFSS observation	0.766** (0.603 - 0.973)	1.038 (0.657 - 1.643)	0.761** (0.597 - 0.970)	1.052 (0.664 - 1.667)
Observations	12,985	2,853	12,947	2,837

*** p<0.01, ** p<0.05, * p<0.1

4.5 DISCUSSION

Conducting any inspections or responding to violations appears to show potential directional effects that might be associated with lower WEA prevalence, but not at a statistically significant level. As both inspection and violations exhibit a similar magnitude of effects, it could suggest that vigorous response to violations may be an effective strategy to ensure smoke-free working conditions when conducting inspections are not possible, or if compliance concerns are minimal in a community. Twelve of the 28 LHDs who provided MPROVE survey data did not respond to any reports of violations or conduct any inspections in their jurisdiction, despite a mandate in state law to do so. While this could mean that there were no explicit violations of the law in the jurisdiction in the given year, the volume of violation reports from other jurisdictions suggest this is unlikely. It also may mean that there is a lack of understanding in the community around how to report violations, that community norms do not lend themselves to reporting violations, or the LHD may not have the infrastructure to receive, register, and respond to violations. LHDs which are not engaging in any enforcement mechanism may want to consider strategies for supporting violation responsiveness in their jurisdictions.

Studies have consistently shown that smoke-free policies are effective in improving population health outcomes in communities.²⁴⁻²⁶ Research on the drivers of effective public health action show that education and engagement are crucial in guiding social norms and policy awareness around tobacco cessation and smoke-free workforce laws, and may support compliance efforts.⁵ Therefore, a comprehensive tobacco policy at the LHD-level which consists of efforts to engage and educate the community around the laws and hazards of occupational

smoking is likely a strong strategy to ensure smoking ban compliance, reduced workplace SHS exposure, and lower rates of WEA outcomes.

Smoke-free law enforcement, like many LHD practice issues, brings up policy questions around public health service capacity. Compared with urban jurisdictions, rural jurisdictions pass fewer public health policies, and have lower per-capita resources for addressing public health needs.²⁷ Adult (age 18+) smoking rates have generally declined over the past decade (from 20.9% in 2005 to 16.8% in 2014).²⁸ However, significantly higher rates of smoking are seen among lower-education, lower-income, and rural populations. Rural residents are generally exposed to more second-hand smoke than urban residents, and have also been shown to more strongly support smoke-free laws in their communities.²⁹ The majority of Washington LHDs are located in rural areas, and the fact that 38% (8/21) of rural LHDs surveyed, compared to only 14% (1/7) urban LHDs in our sample did not conduct any inspections or respond to any violations represents a potential neglected LHD service area that may be exacerbating tobacco-related health disparities. LHD enforcement of smoke free laws might be a key factor in promoting worker and population health in these communities, and increased funding and attention to these efforts are warranted.

A likely trend in the coming decades is the expansion of smoke-free laws to larger spheres of influence – for example, public areas and multi-unit housing.²⁰ As smoking loses social acceptance, there is a potential for the number of violations, in the face of new bans, to increase as well. New and recently-legalized products, such as electronic cigarettes and marijuana, also pose new enforcement challenges for communities and their public agencies, and present areas for further research and monitoring.²⁰

4.6 LIMITATIONS

We limited the scope of this research to Washington State LHDs, as we were interested in examining the variation in implementation of a state law where clearly defined responsibilities were given to LHDs, and where we were presented with the opportunity to use unique industry-linked BRFSS/ACBS data. However, restricting the analysis to Washington State data may have limited the generalizability of our findings to other areas, and also may have impeded our statistical power to draw significant findings from the data.

The cross-sectional nature of the study design was another limitation, and did not allow us to infer causality in the relationship between enforcement and worker asthma outcomes. Also, the lack of attribution of WEA to specific exposures in the data was a weakness. We attempted to address this by limiting the employment sites to those where we would expect SHS to be the major asthmagenic agent present, but there are other exposures that could be reasonably expected to also exacerbate asthma – for example, cleaning products in bars/restaurants. There are also other enforcement mechanisms in Washington State – for example, by law enforcement for individual violations of the smoke-free law – but we would not expect this mechanism to directly affect worker health. As the law has been in place for seven years, it is also possible that LHDs may have implemented advocacy or enforcement programs at an earlier time, which might not be reflected in the more recent data.

There may be community-level factors that we did not control for – such as acceptance of smoking, presence of industries that have more asthmagenic exposures, etc. – that might be associated with the enforcement practices of an LHD, and lead to us finding a spurious

association. Many of these limitations highlight the need for the increased availability and use of longitudinal data in public health systems research.

4.7 CONCLUSION

Examining the associations between LHD jurisdiction-level enforcement and individual-level outcomes highlights the potential impact of LHD smoking ban enforcement efforts on worker health, and can help justify public health funding for these endeavors. We determined that there are potential benefits to workers in improving the implementation of these laws, but were unable to draw statistically significant conclusions around the effect of improved enforcement. Further research should examine the effects of the changing scope of smoke-free legislation, the evolving nature of the LHD enforcement role, as well as differences in rural vs. urban enforcement.

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Chapter 5. CONCLUSION

5.1 SUMMARY

LHDs have suffered from severe budget cuts over the past decade that may be compromising LHD service capacity and the nation's health. At the same time, they face pressure to provide an increasing number of public health services. This trend has raised two important questions for LHD leaders:

- As LHD capacity to provide services is affected by budget cuts and community-level changes, can they, and is there a need to, devote significant resources to important, but resource-intensive clinical service delivery activities, while maintaining or increasing their role in providing population-focused activities?
- In times of budgetary uncertainty, can they devote resources to support unfunded state mandates, such a smoke-free law enforcement, which may fall outside of their traditional purview or areas of expertise, and where little evidence may exist to support additional investments?

Answers to these questions have significant policy implications for local health departments and other agencies responsible for safety-net services to low-income, vulnerable populations.

Aims 1 and 2 examined the first question posed above. The Aim 1 paper found that LHDs are less likely to provide certain clinical services where FQHCs provide a high volume of those services, suggesting a substitution effect. Thus, as FQHC utilization increases in the coming years in many jurisdictions, LHDs may be able to discontinue many clinical services, and focus on monitoring and assurance of the health care safety net. However, we also identified additional contextual factors that LHDs might consider before making these decisions. For

example, prenatal care was a service that was likely to be maintained by LHDs, even if provided at high levels by FQHCs in their jurisdiction. We concluded that some clinical services, such as prenatal care, may complement a public health mission well – and LHDs may be strategically placed to continue delivering these services.

Our Aim 1 study found that between 4.5% and 9.6% of LHDs discontinued one of three examined services (primary care, prenatal or dental services) over the period of examination (from 2010 to 2013). This change has important implications for communities. Increases in service volume from local FQHC partners may explain part of the decrease in LHD clinical service presence, but other factors that may be driving these changes are not yet clear. A limitation of Aim 1 was that comprehensive data around direct FQHC/LHD coordination of services was not available. This area of research could benefit from further study on the communication and collaboration patterns between LHDs and FQHC clinical operations.

Our Aim 2 study showed that individuals who lived in jurisdictions with a higher volume of FQHC services had lower unmet medical need, and suggested that FQHCs served as effective safety net providers, and adequately substituted for LHD clinical services in jurisdictions where LHDs do not provide clinical services (or have chosen to discontinue them). However, an FQHC solely being present was not associated with improved individual health care access outcomes. This pointed to a pressing need for LHDs to be engaged in population-level assessment and assurance of the availability of safety-net care in their jurisdiction – a role that many LHDs are not currently engaged in. In 2010, for example, only two-thirds of LHDs reported conducting any activities which assured access to medical services in their jurisdiction.¹ Our Aim 2 study found that, in 2012, 36% (423/1180) of local health jurisdictions did not have either an LHD or

FQHC which provided primary care services in their community. This further provides evidence that LHDs may not be adequately assessing need for services in their community.

Our Aim 3 study examined the second question posed above, which posited whether or not LHDs were devoting resources to a state enforcement mandate. The study found that half (14/28) of surveyed Washington State LHDs did not conduct any inspections related to the Clean Indoor Air Act in 2012, and only slightly more (16/28) responded to violations of the ordinance. These findings demonstrated how public health policies and management practices are inadequately disseminated and implemented, and pointed to the need for public health systems to coordinate, harmonize, and share best practices and research evidence around the delivery of essential public health services.

The analysis was conducted on data collected near the end of the recession (2012), and the LHD practices which we observed might reflect recession-induced service cuts. Unfunded mandates, such as the enforcement mechanism studied in Aim 3, are often viewed by LHD leaders as impractical and financially unsustainable, and may be among the first services to be eliminated in times of budgetary uncertainty.² As this was a cross-sectional analysis, further research is warranted to examine how these services may change over time. The Aim 3 paper also suggests that LHD leaders who are taking action to enforce state mandates may be having a positive impact on worker health – however, our findings were not statistically significant, and further studies, on broader populations, or examining specific industry exposures, are needed.

5.2 POLICY IMPLICATIONS

There are several conclusions which unite the three papers. First, there was substantial variation in the presence and service levels of LHD activities that were studied in this dissertation, including apparent inadequacies in service delivery or responsiveness. Second,

LHDs have modified services in recent years due to budgetary and programmatic decisions at the local, state, and federal level.^{3,4}

These conclusions led us to identify some policy implications for this research. A consistent theme in the three papers is that there was room for improvement in partnership and sharing of best practices among public health agencies and local clinical partners. Improvements in this partnership and communication may increase the effectiveness of public health activities and of the overall health care safety net.

An important mechanism to identify opportunities and barriers for effective partnerships comes from research conducted by Rodriguez, which examined what drives the capability of LHDs to effectively collaborate – a concept termed Partnership Collaborative Capacity (PCC).⁵ This measure has been defined as the ability of public health agencies to collaborate with relevant public and private entities to increase the efficiency of delivery of evidence-based public health interventions.⁶ Using data derived from the NACCHO Profile Survey, Rodriguez observed stronger collaborative capacity in large and well-funded health departments, or where LHDs provided or contracted a relatively higher number of clinical services compared to smaller or less well-resourced LHDs.⁵ Rodriguez’s research suggests that LHDs may choose to turn away from collaborative activities as they discontinue clinical services. Shifting away from clinical service delivery alternatively presents an opportunity for LHDs to focus on core population-focused community assessment, policy development, and assurance goals, where they can leverage collaborative capacity toward engagement with a wide range of partners to improve population health outcomes, separate from the “distraction” of providing intensive clinical services.⁷

As part of improved information sharing, and to ensure appropriate dissemination of best practices, it will be important to identify and standardize a “minimum package” of public health services, to which every LHD should commit to implement itself, and which might be enforced by state health agencies.⁸ Accrediting bodies have designed public health performance standards which can be used for evaluating and improving both state and local public health systems, and many of the recommendations around LHD best practices that have been noted in this dissertation can feed into this process.⁹ State health agencies, large and well-established LHDs, and public health systems and services research institutions are well-placed to drive the promotion of these best practices, and ensure that public health activities which are delivered to communities are having the most beneficial impact. These improvements can help remake LHDs to become effective institutions for assuring strong population health outcomes in the 21st century.

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APPENDIX A. ADDITIONAL AIM 1 ANALYSIS

The following flowchart describes how LHD jurisdictions were selected for inclusion in the study. The basic criteria were the presence of an FQHC grantee and available UDS data for each year, as well as completed PROFILE surveys for each year. Also, LHDs were only included that matched county boundaries. This resulted in a final sample of 371 LHDs.

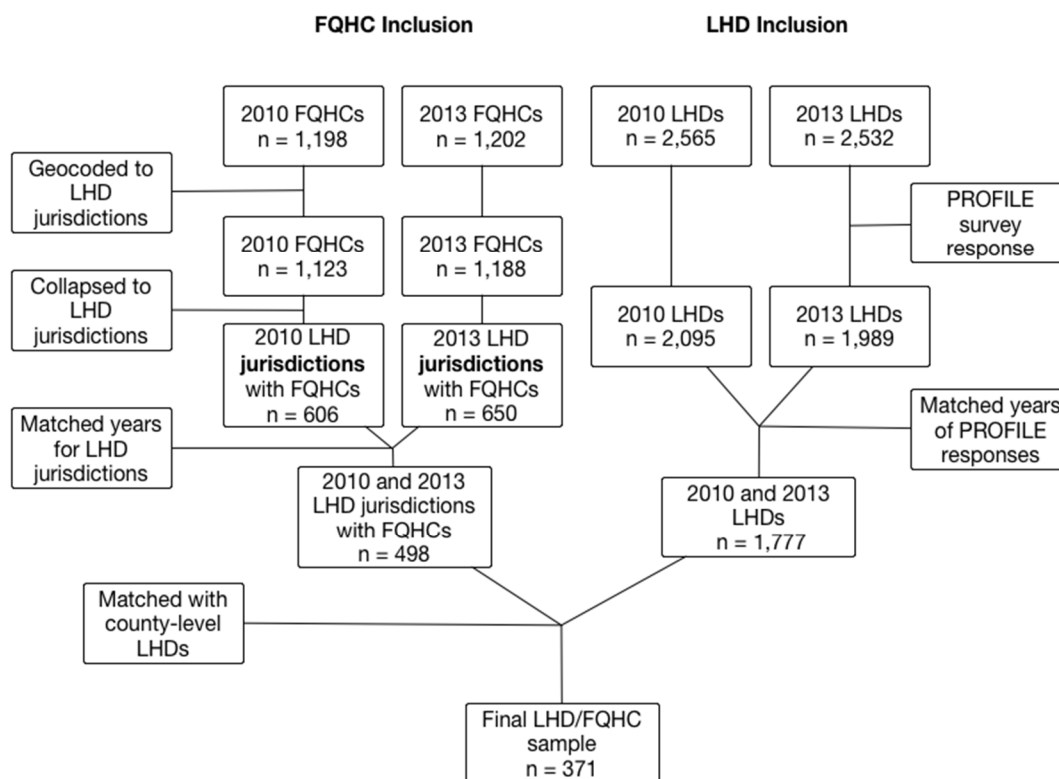


Figure 5.1. Inclusion of FQHC and LHD Jurisdictions in the Analysis

IV Regressions – Identification and Model Fit Testing

Tests of the instrumental variables showed strong identification with the FQHC predictor. Residual versus fitted value plots for each first stage equation were examined to investigate heteroscedasticity, which might indicate a violation of the least squares assumptions. No patterns in the residuals were observed, suggesting homoscedasticity. Additionally, residuals from the first stage models were compared using equations that included and excluded control variables that represented county need, to assess any correlation between the proposed IVs and the control variables that would be undesirable. Residuals were statistically similar when run both with and without the control variables, providing evidence that the IVs perform well in excluding the effects of county-level need in the second stage models.

To examine model fit in the second stage, we compared naïve and instrumented models Hosmer-Lemeshow goodness of fit tests and Akaike Information Criterion (AIC) scores (Table 5.1 and Figure 5.1). All instrumented models demonstrated either equivalent, or in the case of dental, prenatal, and latent class service reduction, better, goodness of fit when compared to naïve regression models (Table 5.2).

Table 5.1. Weak Identification and Need Control Variable Independence Testing

First-Stage Model Tests	F-Test (Weak Identification), Chi-Squared (2), p-value	Need control variable model vs. reduced model residual correlation (shown in Figure 5.1 below)
FQHC Medical Services	199.73, p<0.0001	R ² =0.9302, p<0.0001
FQHC Prenatal Services	68.30, p<0.0001	R ² =0.9808, p<0.0001
FQHC Dental Services	127.28, p<0.0001	R ² =0.8705, p<0.0001

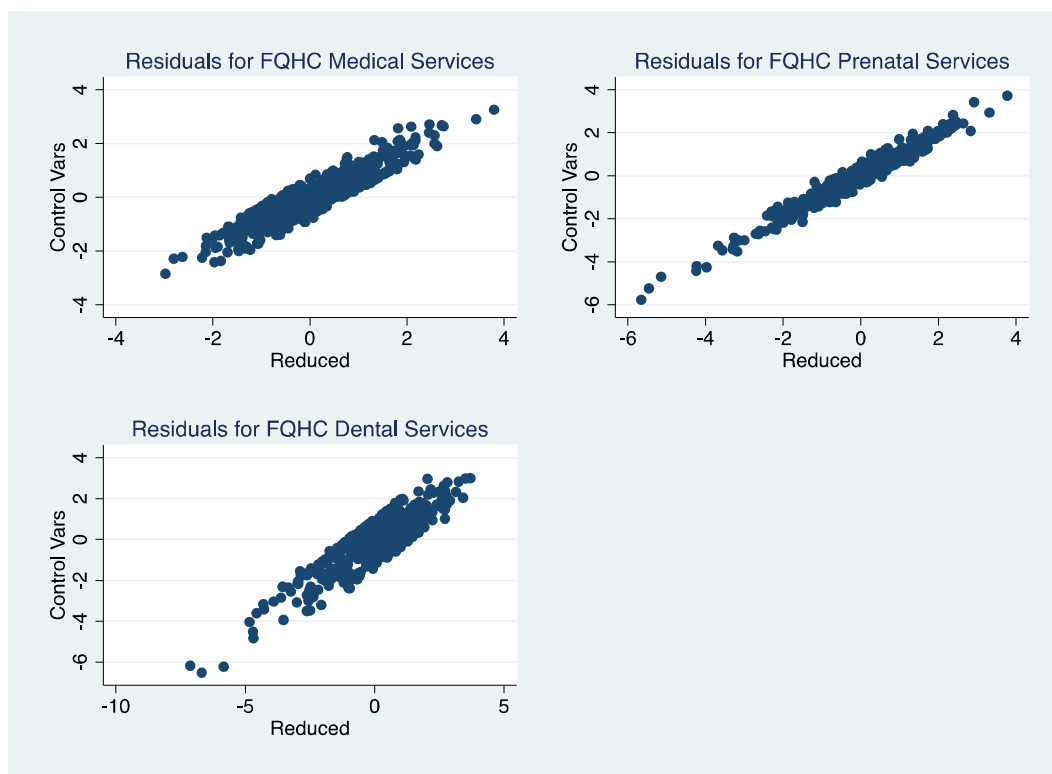


Figure 5.2. Comparison of Residuals for each First Stage Model Containing Need Control Variables (HPSA, HH income, Uninsurance Rate, SNAP, infant mortality rate, rural-urban continuum score, % population greater than 65), Compared to Reduced Model

Table 5.2. Model Fit Comparisons for Naïve and Second-Stage Instrumented Regression

Second Stage Model Fit	Instrumented Model		Naïve Model	
	Hosmer-Lemeshow Goodness of Fit	Akaike Information Criterion (AIC)	Hosmer-Lemeshow Goodness of Fit	Akaike Information Criterion (AIC)
Primary Care Presence	P=0.8785	626.0471	P=0.8874	659.2124
Primary Care Discontinuation	P=0.0956	152.0353	P=0.1807	150.6362
Prenatal Care Presence	P=0.2811	650.3276	P=0.3109	653.9473
Prenatal Care Discontinuation	P=0.8201	237.1544	P=0.1687	239.8142
Dental Care Presence	P=0.1327	818.6347	P=0.5699	830.3564
Dental Care Discontinuation	P=0.8281	302.1011	P=0.1708	317.2739
Latent Class Reduction	P=0.3736	309.0818	P=0.5774	312.1402

Table 5.3 shows predicted value tables that correspond to the plotted values in Figure 2.2. Figure 5.2 shows additional plots for service discontinuation and for lowering of latent class, in which no significant associations were seen in logistic regression modeling.

Table 5.3. Marginal Predictions of LHD Service Presence at Common FQHC Service Levels

FQHC Medical Service Level / 1000 Capita	Primary Care Service Presence	Primary Care Service Discontinuation	Latent Class Reduction	FQHC Prenatal Service Level / 1000 Capita	Prenatal Service Presence	Prenatal Service Discontinuation	FQHC Dental Service Level / 1000 Capita	Dental Service Presence	Dental Service Discontinuation
5	0.411 (0.190, 0.631) p<0.001	0.168 (-0.031, 0.367) p=0.097	0.221 (-0.002, 0.444) p=0.053	5	0.391 (0.281, 0.502) p<0.001	0.236 (0.051, 0.421) p=0.012	5	0.601 (0.508, 0.695) p<0.001	0.136 (0.069, 0.204) p<0.001
10	0.348 (0.183, 0.514) p<0.001	0.183 (0.025, 0.342) p=0.023	0.258 (0.062, 0.454) p=0.010	1	0.371 (0.296, 0.445) p<0.001	0.251 (0.137, 0.365) p<0.001	10	0.530 (0.461, 0.598) p<0.001	0.170 (0.116, 0.224) p<0.001
20	0.290 (0.177, 0.404) p<0.001	0.200 (0.082, 0.317) p=0.001	0.299 (0.140, 0.458) p<0.001	5	0.325 (0.271, 0.378) p<0.001	0.287 (0.133, 0.440) p<0.001	20	0.457 (0.410, 0.504) p<0.001	0.210 (0.156, 0.264) p<0.001
30	0.259 (0.172, 0.346) p<0.001	0.210 (0.113, 0.306) p<0.001	0.324 (0.191, 0.458) p<0.001	10	0.306 (0.227, 0.384) p<0.001	0.303 (0.053, 0.554) p=0.018	30	0.415 (0.373, 0.457) p<0.001	0.236 (0.169, 0.304) p<0.001
50	0.223 (0.165, 0.281) p<0.001	0.223 (0.139, 0.307) p<0.001	0.358 (0.256, 0.460) p<0.001	20	0.287 (0.181, 0.394) p<0.001	0.320 (-0.038, 0.679) p=0.080	50	0.363 (0.317, 0.410) p<0.001	0.273 (0.173, 0.372) p<0.001
100	0.180 (0.148, 0.212) p<0.001	0.241 (0.132, 0.350) p<0.001	0.406 (0.333, 0.479) p<0.001	30	0.277 (0.154, 0.399) p<0.001	0.330 (-0.094, 0.755) p=0.127	100	0.298 (0.235, 0.361) p<0.001	0.327 (0.170, 0.484) p<0.001
200	0.144 (0.115, 0.173) p<0.001	0.261 (0.092, 0.429) p=0.002	0.456 (0.362, 0.549) p<0.001	50	0.264 (0.122, 0.406) p<0.001	0.343 (-0.167, 0.854) p=0.187	200	0.240 (0.162, 0.318) p<0.001	0.386 (0.161, 0.610) p=0.001

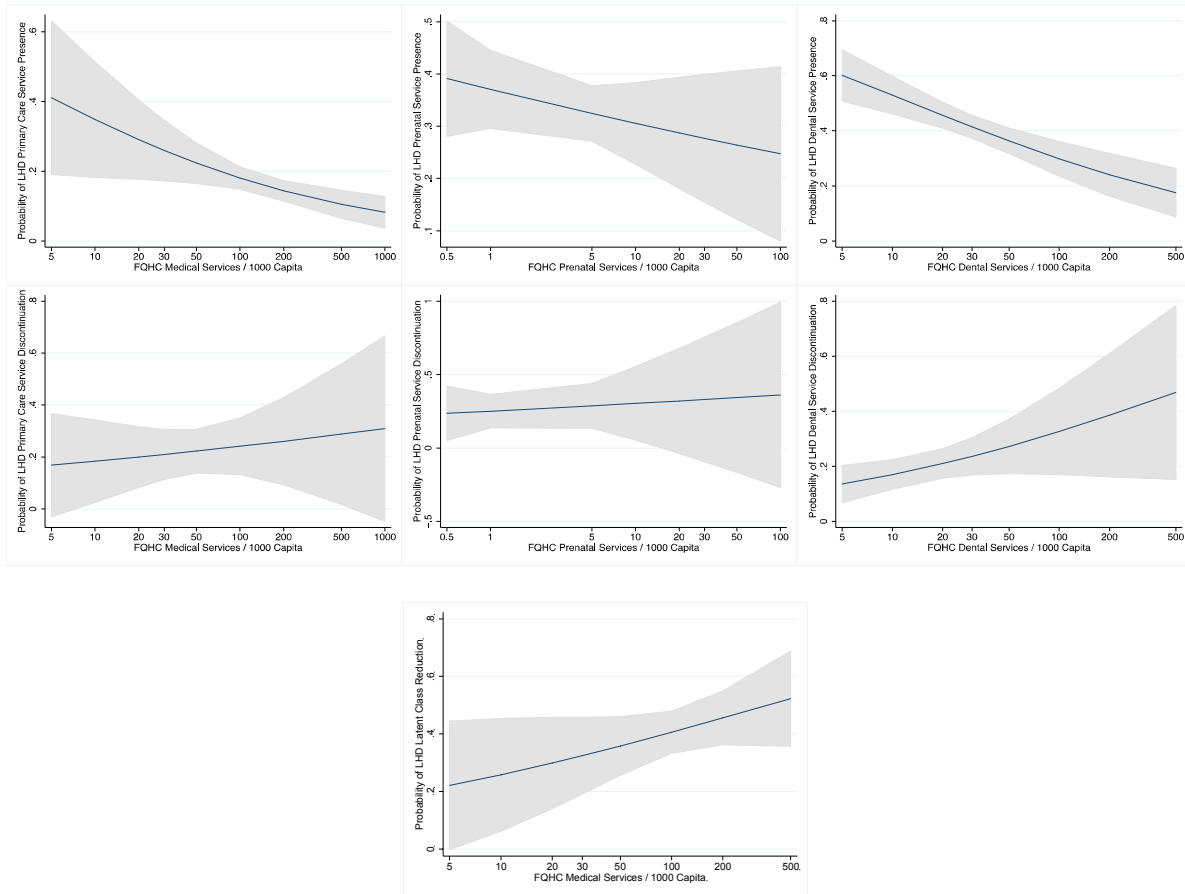


Figure 5.3. Marginal Predictions of Outcome at Specified FQHC Service Level in 2SRI IV
 Logistic Regression of FQHC Service Change on LHD Service Presence (Top Row),
 Discontinuation (Middle Row), and Change in Latent Class (Bottom Row) with 95% Confidence
 Intervals

APPENDIX B. ADDITIONAL AIM 2 FIXED EFFECTS ANALYSIS

Methods

The motivation of this extension of the Aim 2 study was to assess how individual-level health access outcomes may have been affected by changes in LHD and FQHC primary care presence in LHD jurisdictions from 2010 to 2012. Using county identifiers, similar to the cross-sectional analysis we linked LHD and FQHC data with individual-level data from the 2010 and 2012 Behavioral Risk Factor Surveillance Survey (BRFSS). We then constructed survey-weighted fixed effects logistic regression models which examined whether changes in FQHC and LHD service presence from 2010 until 2012 may have resulted in differences in individual health care access outcomes.

Dependent Variables. From BRFSS, we identified outcomes in each year that were considered proximal to variation in access to safety net care. We set out to examine whether BRFSS respondents (1) had a routine health provider (“Do you have one [or more] person you think of as your personal doctor or health care provider?”) or (2) identified having unmet medical need in the past year due to cost (“Was there a time in the past 12 months when you needed to see a doctor but could not because of cost?”)

Independent Variables. Our primary independent variable was the presence of FQHC services in each local health jurisdiction in 2010 and 2012. We drew 2010 and 2012 FQHC presence information for all U.S. counties from the AHRF.¹³ We obtained 2012 data on per capita FQHC patients from the HRSA Uniform Data System (UDS), an FQHC reporting system.¹⁶ FQHC services were defined in the models as logged patient volume per capita. We

also examined LHD primary care service presence or absence in 2009 and 2012 from questions drawn from the NACCHO Profile Survey.¹⁴ We defined LHD service arrangements as the presence of medical or dental services offered directly by the LHD. We also created a variable to represent the interaction of LHD service presence with differing FQHC service volumes.

Covariates. We drew jurisdiction-level control variables from the AHRF which, based on our review of the literature, as community-level factors that may be associated with individual health care access outcomes.¹⁵ Models controlled for jurisdiction-level rurality, uninsurance rate, median household income, proportion of population over age 65, and HPSA designation. Models also controlled for individual BRFSS respondent age, sex, racial group, marital status, education level, employment status, and income.

Our initial fixed effect logistic regression was drawn from 576,539 BRFSS observations from 2010 and 2012, representing 1,180 LHD jurisdictions. We constructed a logistical regression model, using LHD jurisdictional fixed effects, to examine how change in FQHC/LHD service presence from 2010 to 2012 (i.e. addition of FQHC service, or discontinuation of LHD service) was associated with variation in BRFSS respondent health access outcomes in the respective year.

Results

In a set of fixed effects models, we examined whether changes in FQHC and LHD services between 2010 and 2012 predicted health access outcome changes for individuals in these jurisdictions (Table 5.4). We did not find significant differences in health access outcomes in any of the comparisons.

Table 5.4. Fixed Effects Logistic Regression of Effect of 2010 to 2012 Change in FQHC and LHD Service Arrangements in a Jurisdiction on Change in Prevalence of Cross-Sectional Individual Health Care Access Outcomes

2010/2012 BRFSS Responses nested within LHD jurisdictions (Odds ratio, 95% confidence intervals)	Model 1: Has a Routine Health Provider	Model 2: Had Unmet Medical Need in Past Year
Change in Presence of an FQHC from 2010 to 2012	0.948 (0.866 - 1.037)	0.990 (0.901 - 1.087)
Change in Presence of LHD Primary Care Service from 2010 to 2012	0.955 (0.722 - 1.263)	1.167 (0.871 - 1.563)
Positive Change in Presence of both LHD and FQHC Service	0.994 (0.744 - 1.327)	0.835 (0.618 - 1.129)
BRFSS Observations	102,267	576,539
LHD Jurisdictions Included	1,180	1,180

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VITA

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