UNIVERSITY OF CALIFORNIA, MERCED

# Cost and geographic variations in service delivery by Local Health Departments: An analysis of Immunization, Tuberculosis, and Sexually-Transmitted Disease clinics

A dissertation submitted in partial satisfaction of the requirements
for the degree Doctor of Philosophy

in

Social Sciences

by

Van Do-Reynoso

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The Dissertation of Van Do-Reynoso is approved, and it is acceptable

in quality and form for publication on microfilm and electronically.

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This dissertation is dedicated to my husband and best friend Gabriel, and our three beautiful daughters Rebecca, Bethany, and Sarah. Thank you for your unconditional love and patience. I want to thank my colleagues in Madera County for your support and encouragement. I am grateful for my advisor and mentor Paul Brown for his advice and guidance. Lastly, many thanks go to my extended family, friends, fellow public health colleagues, and professors, for being my companions on this journey. You have all made this accomplishment possible.

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- Mendiola J, Do-Reynoso V, Gonzalez M., Generation status as a determinant of influenza vaccination among Mexican-identified adults in California, 2011–12. Preventive Medicine Reports. 2016; 3:25-29
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**Abstract of the Dissertation**

Local Health Departments (LHDs) perform a critical role in providing essential public health services to prevent the spread of disease. National surveys of LHDs from 2008 to 2016 indicate a consistent commitment to providing preventive clinical services such as childhood immunizations, screening and treatment of tuberculosis, and screening and treatment of sexually transmitted disease (STDs). Due to the implementation of the Affordable Care Act in 2010, more people have access to health insurance and preventive services. As more resources are re-directed to community health centers and medical homes, LHDs need to reconsider whether to maintain these preventive clinical services. The challenge for LHDs is the uncertainty about the cost to delivering these services. This dissertation estimates the cost for LHDs to deliver childhood immunizations, screening and treatment of tuberculosis and STDs using resource based costing methods, as well as a community engagement framework to explore barriers in achieving optimal childhood immunization rates. Evidence suggests that while the estimated costs to deliver these preventive clinical services varied widely among LHDs, these costs are comparatively lower than published rates. Evidence also suggests that LHDs in rural counties may experience more barriers in delivering childhood immunization services than their non-rural counterparts. These geographic variations include more rural LHDs reporting lower immunization coverage rates, and experiencing barriers such as lack of timely appointments, high cost to provide immunizations, anti-vaccination concerns, and lack of reimbursement for services from both public and private health insurance providers.

**Cost and geographic variations in service delivery by Local Health Departments: An analysis of Immunization, Tuberculosis, and Sexually-Transmitted Disease clinics**

## 1. Introduction

Local Health Departments protect the health of their communities by preventing disease and promoting policies and systems to ensure that the populations they serve can achieve optimal health. Local Health Departments (LHDs) typically provide clinical programs and services such as immunization services, screening for diseases and conditions, treatment of communicable diseases, and maternal and child health services. Most local health departments also provide population-based programs and services such as epidemiology and surveillance, health education, and environmental health services (NACCHO, 2016).

LHDs are guided by the Ten Essential Public Health Services (Figure 1A) in the implementation of their mission, core functions, programs, and services. These ten essential services are: (1) monitor health status to identify 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 to identify and solve health problems; (5) develop policies and plans that support individual and com-munity health efforts; (6) enforce laws and regulations that protect health and ensure safety; (7) link people to needed personal health services and ensure the provision of health care when otherwise unavailable; (8) ensure a competent public health and personal health care work-force; (9) evaluate effectiveness, accessibility, and quality of personal and population-based health services; and (10) research for new insights and innovative solutions to health problems


*Figure 1.1.* The 10 Essentials of Public Health Services.
(Source: https://www.cdc.gov/nphpsp/essentialservices.html)

Several factors are forcing LHDs in California to redefine their roles and responsibilities for improving population health. These factors are the implementation of the Patient Protection and Affordable Care Act (hereinafter referred to as the Affordable Care Act or ACA) in 2010, the expansion of Medi-Cal eligibility to 138% Federal Poverty Level in 2014, and the redirection of indigent medical care funding from counties to the state with the enactment of Assembly Bill 85 in 2013. In alignment with the Ten Essentials of Public Health Services, LHDs perceive themselves as the primary institutions responsible for identifying and addressing their community's health concerns including linking or providing care to medically underserved populations. The residual number of uninsured people will challenge LHDs and force them to identify which of the safety net services will be needed to maintain amidst decreasing funding and increasing restrictions.

Since Local Health Departments are the entities charged with identifying unmet needs, addressing gaps in service delivery, and reducing health disparities in their jurisdiction, LHDs need information to understand their role and options in the delivery of clinical services in the era of healthcare reform. However, LHDs may lack the capacity to gather the data. Rural LHDs in particular may lack the resources to obtain data on the impact of the ACA and their provision of preventive services to the safety net population in their region. California has 58 LHDs operated by counties, and 3 additional city LHDs operated by Berkeley, Long Beach, and Pasadena. Of the 58 counties, 35 are considered rural as indicated by their participation in the Counties Medical Services Program, which provides limited-term health coverage for uninsured low-income, indigent adults that are not otherwise eligible for other publicly funded health programs. Of these 31 small counties, 48% of them has populations less than 50,000 and the remaining 52% has populations less than 200,000.

Like all other LHDs, these small LHDs need to understand their role in the new public health system where more people are covered by health insurance, more people have access to preventive health services, and where there may be a decreasing need of a 'safety net' for medically underserved populations. However, small LHDs may lack the capacity to gather the information about the effectiveness of services offered by other safety net providers, such as Federally Qualified Health Centers, Rural Health Centers, private sector primary care providers, and medical facilities in their jurisdiction. In a comparison of the workforce and training needs of rural public health departments to those in suburban and metropolitan areas, Hajat et al. (2003) concluded that collaborative approaches and regionalization are needed in rural jurisdictions to address the staffing shortage and program; and administrative training are crucial to promote effective and efficient delivery of public health services in rural areas. Since then, the ACA has transformed the existing health care system by providing unprecedented investments in the expansion of access to health insurance, community health centers, public health workforce, health information exchange infrastructure, patient-centered medical home, accountable care organizations, electronic health records, and prevention services. The passage and implementation of the ACA is a driving force for change in the current public health system (Bovbjerg et al., 2011). The recommendations of ACA for successful navigation of the changing landscape included evidence-base practice,

defining value to foundational activities, and forming partnerships with diverse organizations.

The implementation of the Affordable Care Act resulted in approximately 19.2 million nonelderly people gaining health insurance coverage from 2010 to 2015 (Garrett et al., 2016). In California, the ACA had expanded health coverage to millions of residents and improved coverage for millions more; but between 2.7 and 3.4 million people under age 65 were predicted to remain uninsured by 2019, after the ACA is fully implemented. Of those predicted to remain uninsured, approximately 50% remained ineligible for federal coverage options due to their immigration status (Lucia et al., 2015). Proposed modifications to the ACA is expected to increase the number of uninsured due to more restrictive Medicaid eligibility. The California Department of Health Care Services noted that the proposed American Health Care Act represents a massive shift in costs to states, which will increase the burden on the state safety net providers, and potentially increase uncompensated care costs in the populations of hundreds of millions and potentially billions annually (Kent, 2017).

Under the current ACA, the Prevention and Public Health Fund expanded its access to primary care services via increased its funding to primary care service providers such as Rural Health Centers, Federally Qualified Health Centers, and school-based health centers. Various blogs, briefings, and journal articles advocate reconsideration by public health departments to provide clinical services. However, if the ACA is repealed or replaced in the future, the number of uninsured will again increase and uncompensated costs will impact Local Health Departments. While networking with their state health department, key federal agencies, and nearby county health jurisdictions, Local Health Departments (LHDs) have the autonomy to form local collaborations and determine which health issues of particular concern and relevance to target within their communities. Local Health Departments are aware of the need for evidence-based strategic planning, especially as it pertains to identifying the effectiveness of their existing operations and developing partnerships with regional healthcare providers.

## Current Situations in LHDs

Many LHDs lack the time and resources to identify efficient and cost-effective services that can positively impact vulnerable populations. A 2012 national survey undertaken by the National Association of County and City Health Officials (NACCHO) found that, in 14 states including California, 41% of LHDs had made significant cuts to staffing resulting in a reduction of population-based health services, such as population-based primary prevention and surveillance (NACCHO, 2014). LHDs in rural areas may face additional constraints including shortages of primary care providers, isolated communities, and lack of integration in existing healthcare providers. These constraints challenge underfunded and under-staffed the ability of rural LHDs to find new ways to ensure that core public health services are delivered and effective.

In addition to the shifting landscape with the implementation of the ACA, LHDs continued to face funding and staffing challenges. A 2012 national survey undertaken by the National Association of County and City Health Officials (NACCHO) found that 62% of California local health departments (LHDs) reduced or eliminated services in at

least one program area; 20% of LHDs reported continued cuts in immunization services; and more than one-third (36%) of California LHDs lost at least one staff person due to layoffs or attrition in the previous year. The same study reported that California public health staff operated at a diminished capacity at 22% of all LHDs, either because their hours were reduced or because they were furloughed. Additionally, 24% of California LHDs expected their budget to be lower in 2013, continuing the trend of substantial percentages of LHDs experiencing budget cuts over the past five years (NACCHO, 2013). Using 1997 and 2008 data, Hsuan and Rodriguez (2014) found that LHDs are discontinuing clinical services over time. Those covering a wide range of core public health functions are less likely to discontinue services when residents lack care access. They concluded that future research is needed to examine the impact of ACA on the provision of clinical services by LHDs, especially in jurisdictions with residents still uninsured.

While the ACA offers expanded access to healthcare for vulnerable populations, particularly preventive services, the impact in rural regions was unknown. One uncertainty is the number of people who may continue to be uninsured by choice or by current eligibility restrictions. Similar to the study by Lucia et al., the California Health Care Almanac, published by the California Healthcare Foundation (2013) projects, indicates that one in five Californians will remain uninsured. However, the data projections are limited to only socioeconomic factors, and do not include county size or location. Likewise, the report of California's Uneven Safety Net by the Health Access Foundation in 2013 cites the CalSIMS projection of 3-4 million Californians remaining uninsured in 2019 and does not include projections of the uninsured in the 34 small counties.

The Affordable Care Act established the Community Health Center Fund to provide $11 billion over a five year period for the operation, expansion, and construction of health centers throughout the country (HRSA, 2012). In addition to the $1.5 billion set aside for capital improvements, funds are also provided to support primary care residency programs and the goal of providing high-quality and low-cost primary care. The additional investment is expected to reduce some of the challenges previously faced by safety net providers in caring for the uninsured, enhancing compensation for primary care providers, and expanding the community health center infrastructure. However, due to its size and location, small rural counties may not have community health centers nearby; and thus, another uncertainty is the access to available services due to limited capacity of Federally Qualified Health Centers, Rural Health Centers, and private primary care providers to accommodate the increased demand. In addition, as more citizens acquire health coverage, more health professionals will be needed, especially in primary care. Rural locations may face increased competition for these professionals (Allen et al., 2013). A review of the impact of national health insurance on childhood vaccination in Taiwan shows that the increase in utilization of services is dependent on socio-demographics of the region and accessibility to services (Liu et al., 2002).

The implementation of ACA is forcing local health departments to define the value of public health services and document gaps in the availability and accessibility of services due to the changing landscape in funding. Because of these uncertainties, it is even more vital that all LHDs, but particularly small LHDs, develop a clear sense of their

role within the changed healthcare environment and formulate innovative approaches that make the best use of existing resources in the provision of clinical services such as childhood immunization. Historically, LHDs primary role in this arena is to ensure the timely and effective delivery of immunizations services to children in their jurisdiction and direct delivery of immunizations to vulnerable populations (Ransom et al, 2012). Some of these activities are mandated by law, while others, such as providing vaccinations through public health clinics, are the result of local decision making. The estimated 94% of the population who will have insurance coverage beginning in 2014 may have immunization coverage as part of their package of care (Stewart et al., 2010). Although the impact of the ACA on LHDs vaccination and immunization activities remains unclear (Tan, 2011), LHDs will still need to consider how to extend coverage to those sectors of the population who will not be covered by the ACA, i.e., the undocumented workers and people who refused to buy private insurance.

## An Urgent Need Identified in LHDs

Part of the calculation regarding the most effective and cost-effective way to provide services is the extent of cooperation that the LHD will have with healthcare providers in their jurisdiction. These providers, such as community health centers and school-based health centers, have received additional ACA funding, and expected to gain prominence in delivering primary care services to vulnerable populations. This creates new opportunities for LHDs to collaborate with health care providers to deliver core public health functions (Mays, G. P. et al., 2010), and perhaps provide transition to their monitoring role to ensure a competent and sufficient public health workforce with equitable access to health services, in which patients received coordinated and integrated care.

However, forging new roles and relationships may result in conflict. For instance, while health care providers will continue to receive reimbursement from payers as well as funding from the Vaccines for Children (VFC) program, the demand for LHDs to provide immunization services may increase. Patients may continue to seek immunizations from LHDs because of the convenience and low or free services. Conversely, private providers may continue to refer patients to LHDs for immunizations because of inadequate reimbursement rates and complicated vaccine administration requirements. As indicated by a recent newspaper article, a crisis exists in the delivery of immunization services in Arizona due to the low reimbursement rate and the lengthy lag time for payments. Many private providers are not offering routine childhood immunizations; instead, these privately insured patients are referred to county public health clinics (Arizona Central, 2014).

A new state advisory committee was generated to make recommendations to address the situation including how to increase the number of private physicians who will resume full vaccination services. California’s small counties are facing similar issues. Data from a recent informal survey of small counties indicate that private providers are reluctant to offer childhood immunizations because of the low reimbursement rates and high administrative costs. A new state workgroup, which was sponsored by the California County Local Health Officers and comprised of state and county public health officials,

private providers, and pharmaceutical companies, convened in early 2014 to improve access to childhood immunization in rural counties. In order to maintain high immunization coverage rates, the health care system in rural areas must perpetuate positive immunization related beliefs and attitudes (Gore et al., 1999); and be affordable, accessible, and friendly (Wilson, 2000).

The LHDs must consider the cost when deciding whether to deliver immunizations to undocumented children through a clinic, refer them to a community health center, or to school-based health center. The LHDs need to decide whether the children will receive timely and appropriate access, and the effectiveness of other providers in tracking and following up children. Many small, rural LHDs do not have a history of close collaborations with the healthcare providers and entities upon which to build new partnerships; and, in some cases, viewing them as competitors in the delivery of services.

Successful relationships built between healthcare providers to coordinate immunization coverage depend upon several organizational and environmental factors. In examining successful partnerships built to deliver the influenza vaccines in various counties, Rubin et al. (2014) recommended public health departments to cultivate relationships with pharmacists and pharmacies in order to build trust and credibility prior to the outbreak. Chen et al. (2012) reviewed regional public health partnerships in Nebraska and concluded that issues such as geographic distance and access to informational technology may be barriers for some rural communities. The authors recommend allocating additional resources to improve the effectiveness of regional partnerships. Rosenfeld et al. (2011) surveyed retail pharmacies in Florida and concluded that the partnership between public health and pharmacists were invaluable for distributing, transferring, and administering the H1N1 influenza vaccine, managing access to antivirals, and serving as a vital link to hospitals and other healthcare providers. Overall, these authors suggest that public health organization with partnership of pharmacies are the better solution in handling and coordinating immunization coverage.

Extensive literature search of cost estimations of health serviced yielded few studies that specifically address childhood immunization in rural public health jurisdictions or post-ACA implementation. Nonetheless, these cost estimation studies provided the framework for similar analysis of services in rural counties. For example, Cho et al. (2011) establish a structured approach for cost analysis of mass prophylaxis clinic operations and report results from pilot tests of a mass vaccination clinic budgeting tool. Cho et al. (2011) confirm that mass vaccination clinics by public health departments can be effective to quickly vaccinate a community. The results highlighted the need for clinic managers to estimate costs under scenarios where operational assumptions differed from expectations. The cost estimation tool outlined in Cho's study may prove useful for small health departments as they considered mass vaccination clinics for school-aged children. Zhou et al. (2014) determine that routine childhood immunization programs remain one of the most cost-effective prevention programs in public health. Their analysis demonstrates that because of vaccination, children born in the U. S. in 2009 will suffer fewer cases of vaccine-preventable diseases and fewer early deaths related to those diseases during their lifetimes. They conclude that for every dollar spent on childhood immunization ultimately saves at least 10 dollars in societal costs. Singh (2013) describes

two techniques that LHDs can use to assess their efficiency at providing public health services: process costing as a technique used by management accountants; and stochastic frontier analysis as a technique used by economists. Using these two techniques, Singh estimates the efficiency of the Florida LHDs in providing adult, child with dental health services; and concludes that the LHDs' efficiency varies both within and across agencies.

In addition to serving the residual populations not covered by any type of insurance, LHDs have the responsibility of maintaining the overall health of people residing in their jurisdiction. Yet, the net result of ACA on health status in different regions is still unknown, partly due to the uncertainty regarding the number of people who will have access to services, and partly due to the uncertainties regarding the capacity of Federally Qualified Health Centers, Rural Health Centers, and private providers to accommodate the increased demand. Uncertainties regarding the capacity of primary care providers to serve the existing and new members can be exacerbated by other changes in the health system, including the restrictions in Medicaid reimbursements and reduction in funding for public health clinical services (NACCHO, 2016). LHDs receive approximately 14 % of their revenues from federal sources, 21% from state sources, and 30% from local sources, and 15% from payments for clinical services (Figure 1.2). In recent years, LHDs in California received major changes in the allocation methodology. In 2013, Assembly Bill 85 provided a mechanism for the State to redirect 60 to 80% of county health realignment funding to fund social service programs (CSAC, 2013), primarily the cost to expand eligibility for Medi-Cal to 138% Federal Poverty Level. A more recent proposal likely to pass will eliminate future growth in the health realignment growth account to fund $623 million for the In-Home Support Services program (CSAC, 2017).

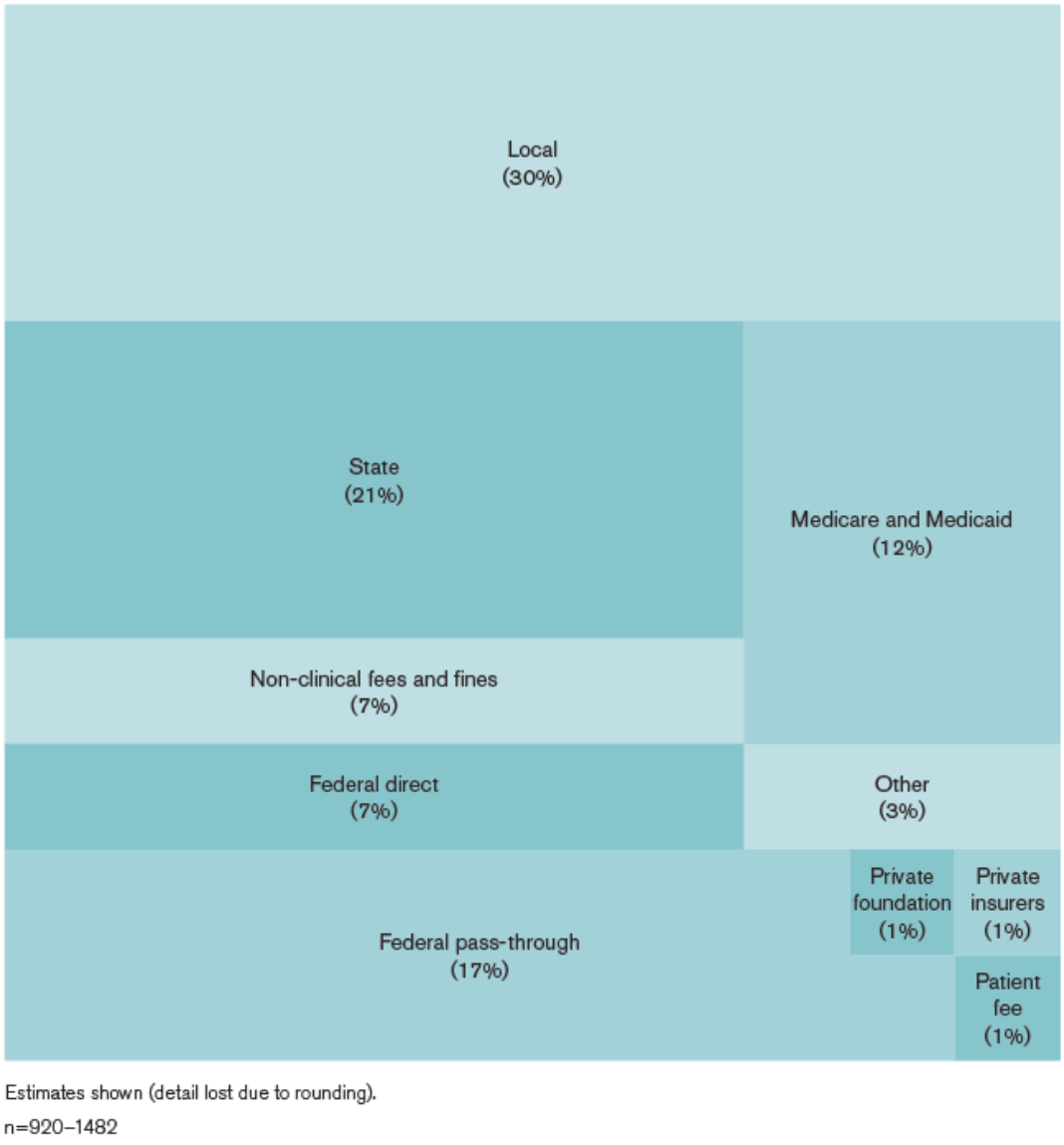


*Figure 1.2.* Sources of revenues to Local Health Departments
(Source: 2016 National Profile of Local Health Departments, NACCHO)

## Research Aims and Studies

Given the uncertainties regarding the impact of the ACA and the continuous diminishing funding, Local Health Departments, especially those in rural counties, expressed the need for critical information in order to understand the current and future provision of care in their region. LHDs also need to understand the options of service delivery especially to vulnerable populations, and the costs and outcomes that can be expected from each option. LHDs are likely to differ in their internal capacity to compile this type of information. In this case, larger LHDs are likely to have the resources in

house to develop policy options and provide decision makers with the information needed to make informed decisions; but smaller LHDs may lack the same range of expertise and resources.

To fulfill the urgent need from LHDs, this dissertation sought to understand the options for the delivery of clinical prevention services in different LHDs, using on community-based participatory research framework. The research aims of the three studies were to provide information to assist local health departments in their decision to maintain traditional preventive clinical services. LHDs can either continue to directly perform these clinical services or contract out or delegate them to community providers. One of the primary issues that LHDs need to consider in making this decision is the cost to provide these clinical services. The other primary issue for consideration is the corresponding effects to population health of either option. In partnership with LHDs throughout California, this research explored the costs for delivering childhood immunization, tuberculosis control, and sexually-transmitted disease clinical services; and documented the differences between rural and non-rural LHDs in the delivery of childhood immunization.

This dissertation is a combination of three different studies. Study One is a variation identification study between rural and non-rural child immunization services provided by LDHs. Study Two is a cost estimation of child immunization and TB services in LDHs. Lastly, Study Three is a cost estimation of sexually transmitted disease services in selected local health departments. While many LHDs offer an array of clinical services, childhood immunization, TB services, and STDs services were selected for the studies because these services are typically being delivered by most LHDs to all members of their community. However, since the ACA has expanded access to health insurance, community health centers and providers are also offering these preventive clinical services to the newly insured. Given the constraints from limited resources, LHDs need cost information in their decision to continue offering these core preventive clinical services while maintaining their mission to maintain local population health.

## Study 1: Variations between Rural and Non-Rural Child Immunization Services in Local Health Departments

The first study is a variation identification study between rural and non-rural child immunization services. Childhood immunization was chosen as the primary research target of this dissertation because of its high importance to local health departments in preventing communicable diseases. National surveys of LHDs in 2013 report 90% of respondents offer childhood immunizations. Since the implementation of the Affordable Care Act expanded access to preventive clinical care such as childhood immunizations and LHDs have decreasing resources to offer vaccines to all children, LHDs need information on costs to deliver service and the impact to local immunization rates if changes were made. Studies have documented three primary obstacles to childhood immunization services: health system barriers, provider barriers, and parental barriers (Esposito, Principi, & Cornaglia, 2014; Kimmel, Burns, Wolfe, & Zimmerman, 2007). Among these barriers, health system barriers include cost of providing the service, vaccine storage regulations, lack of a unified immunization registry, and provider

contractual issues. Provider barriers include challenges with timely appointment, missed opportunities, lack of clinical information, registry access, and communication with parents. Parental barriers include fear of vaccination, lack of information about vaccination schedules, available time, transportation to appointments, and cost for vaccinations. The ACA increased its access to health care services and removed copayments for prevention services such as childhood immunizations (Koh & Sebelius 2010). Early observations from a recent study on the impact of the ACA suggested more adults utilizing preventive services, such as flu vaccination after the elimination of cost-sharing for such services (Shen et al., 2014). However, childhood immunization was not included in the study. Little information is available regarding the costs associated with childhood immunizations in a public health setting. Although numerous studies investigated the implementation of the Affordable Care Act (ACA), little was known about its impact on the delivery of childhood immunization by local health departments or the associated costs to deliver the service. This study sought to identify barriers in the perceptions of LHDs about their roles in service delivery of childhood immunization and the reported costs to provide these services.

## Study 2: Cost Estimation of Child Immunization and Tuberculosis Clinics in Local Health Departments

The second study is a cost estimation study of childhood immunization and tuberculosis treatment services delivered by three Local Health Departments in the San Joaquin Valley. A survey conducted before the advent of the Affordable Care Act found that immunizations and tuberculosis screening/treatment services were provided by more than three-quarters of all Local Health Departments nationwide. However, the role of LHDs in providing the services was unclear given the expansion in Medicaid and private insurance. Specifically, LHDs need to decide whether to continue offering the same level of services as before, reduce their service delivery to target groups left out by the ACA (e.g., undocumented workers), or rely upon Federally Qualified Health Centers (FQHCs), Rural Health Clinics (RHC), and private medical providers to be the sole providers of these services.

In making this decision, LHDs must weigh the expected change in immunization rates and/or tuberculosis (TB) screening/treatment likely to result from a reduction in their service provision against the potential for cost savings. This shift in practice requires accurate estimates of the costs incurred by these LHD clinics. TB control is a service that LHDs are currently *mandated* to perform, but treatment in theory could be shared with the private sector (Ehman et al., 2014). Childhood immunizations are provided mainly by FQHCs, RHCs, and PMPs, with LHDs playing a more limited role (Groom et al., 2007). Based on the need of LHDs, this study attempted to provide cost estimation of immunization and TB services. Building on the results of the first study where cost estimation for childhood immunizations were based on revenues reported by LHDs, Study Two used a Resource Based Cost (RBC) approach estimate the costs of providing childhood immunization and TB services. These estimates were then compared to the revenues and expenses reported by the LHDs, referred to as Reported Cost (RC) estimates.

**Study 3: Cost Estimation of Sexually Transmitted Disease Services**

The third study is a cost estimation study of sexually transmitted disease services in selected local health departments. Estimates showed that nearly 20 million new sexually transmitted infections occur every year in this country, which accounted for almost $16 billion in health care costs (CDC, 2015). The annual national STD incidence rates in the United States did not declined in recent decades despite the identification of effective surveillance and prevention methods (Ozer et al., 2005). Local Health Departments and their system partners played a critical role in controlling the spread of STDs (Chesson, H. W., 2006; Hogben et al., 2010; Kimball et al., 1997). Moreover, recent evidence also indicates that increases in STD prevention funding are associated with reductions in gonorrhea (Chesson, H. W. et al., 2005) and syphilis (Chesson, H. et al., 2008) incidence rates.

Preventing sexually transmitted diseases (STDs) continues to be one of the core responsibilities of public health systems. The 2013 survey by the National Association of County and City Health Officials showed wide variation in screening and treatment services, with 55-92% of LHDs providing STD screening and 50-87% treatment services (NACCHO, 2014). However, little is known about the cost for LHDs to continue providing these services given the decreasing state and federal allocations, the limited capacity for billing, and the potential decrease in clients due to the availability of services under the Affordable Care Act.

Previous research has examined variation in the local organization of STD screening and treatment services in local public health systems to understand how organization of STD care at the local level affects service provision (Rodriguez et al., 2012). Rodriguez et al. (2012) estimated the cost variation in STD treatment efforts across five jurisdictions in California. Study Two examined the cost of STD services specifically because cost is a determining factor for how programs are initiated and maintained, especially in LHDs with extreme budgetary constraints or recent rises in STD morbidity. A Resource Based Cost (RBC) approach is used to estimate the costs of providing STD services, and compared to the Reported Cost (RC) estimates provided by the LHDs.

## Summary

In summary, the ACA and the ensuing decrease in funding to LHDs for direct preventive clinical services have changed the operating landscape for LHDs. These three studies are expected to contribute information to LHDs on whether to maintain their childhood immunization, TB, or STD clinics given that the ACA has expanded access to preventive health care, and that there are community providers offering similar services. These studies offer cost information and identify options for LHDs in maintaining services in their local communities. As challenges to the ACA continue, the current expanded access to health insurance or guaranteed free prevention services may be in jeopardy. The findings from these three studies offer LHDs the mechanism to conduct cost estimation of their services, as well as suggestions on identifying barriers to achieving optimal community health, such as meeting the Healthy People 2020 immunization coverage rates.

## References


Allen, S. M., Ballweg, R. A., Cosgrove, E. M., Engle, K. A., Robinson, L. R., Rosenblatt, R. A., Wenrich, M. D. (2013). Challenges and opportunities in building a sustainable rural primary care workforce in alignment with the Affordable Care Act: the WWAMI program as a case study. *Acad Med, 88*(12), 1862-1869.

CDC. (2015). *Sexually Transmitted Disease Surveillance 2014*.

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

Chesson, H. W. (2006). Estimated effectiveness and cost-effectiveness of federally funded prevention efforts on gonorrhea rates in the United States, 1971-2003, under various assumptions about the impact of prevention funding. *Sex Transm Dis, 33*(10 Suppl), S140-144.

Chesson, H. W., Harrison, P., Scotton, C. R., & Varghese, B. (2005). Does funding for HIV and sexually transmitted disease prevention matter? Evidence from panel data. *Eval Rev, 29*(1), 3-23.

CSAC. (2013). *California State Association of Counties Reader's Guide to AB 85*.

CSAC (2017). [Dismantling the CCI, the County IHSS MOE, and Shifting IHSS Collective Bargaining to Counties].

Ehman, M., Flood, J., & Barry, P. M. (2014). Tuberculosis Treatment Managed by Providers outside the Public Health Department: Lessons for the Affordable Care Act.

Garrett, B., & Gangopadhyaya, A. (2016). *ACA Implementation—Monitoring and Tracking: Who Gained Health Insurance Coverage Under the ACA, and Where Do They Live?* Retrieved from http://www.urban.org/sites/default/files/publication/86761/2001041-who-gained-health-insurance-coverage-under-the-aca-and-where-do-they-live.pdf

Gore, P., Madhavan, S., Curry, D., McClung, G., Castiglia, M., Rosenbluth, S. A., & Smego, R. A. (1999). Predictors of childhood immunization completion in a rural population. *Soc Sci Med, 48*(8), 1011-1027.

Groom, H., Kolasa, M., Wooten, K., Ching, P., & Shefer, A. (2007). Childhood immunization coverage by provider type. *J Public Health Manag Pract, 13*(6), 584-589.

Hogben, M., Chesson, H., & Aral, S. O. (2010). Sexuality education policies and sexually transmitted disease rates in the United States of America. *Int J STD AIDS, 21*(4), 293-297.

HRSA. (2012). *The Affordable Care Act and Health Centers*.

Kent, J. (2017). *Summary and Preliminary Fiscal Analysis of the Medicaid Provisions in the Federal American Health Care Act*. Sacramento.

Kimball, A. M., Lafferty, W. E., Kassler, W. J., Hundt, A., MacCornack, R., & Bolan, G. (1997). The impact of health care market changes on local decision making and STD care: experience in three counties. *Am J Prev Med, 13*(6 Suppl), 75-84.

Liu, T. C., Chen, C. S., & Chen, L. M. (2002). The impact of National Health Insurance on neonatal care use and childhood vaccination in Taiwan. *Health Policy Plan, 17*(4), 384-392.

Lucia, L., Jacobs, K., Graham-Squire, D., Watson, G., Roby, D., Pourat, N., & Kominski, G. (2015). *A Little Investment Goes a Long Way: Modest Cost to Expand Preventive and Routine Health Services to All Low-Income Californians*.

Mays, G. P., Scutchfield, F. D., Bhandari, M. W., & Smith, S. A. (2010). Understanding the organization of public health delivery systems: an empirical typology. *Milbank Q, 88*(1), 81-111.

NACCHO. (2013). *Local health department job losses and program cuts: findings from the 2013 Profile Study*. Retrieved from www.naccho.org/topics/infrastructure/lhdbudget/upload/Survey-Findings-Brief-8-13-13-3.pdf

NACCHO. (2014). *2013 National Profile of Local Health Departments*. Retrieved from http://www.naccho.org/topics/infrastructure/profile/upload/2013-National-Profile-of-Local-Health-Departments-report.pdf

NACCHO. (2016). *2016 National Profile of Local Health Departments*.

Ozer, E. M., Adams, S. H., Lustig, J. L., Gee, S., Garber, A. K., Gardner, L. R., Irwin, C. E., Jr. (2005). Increasing the screening and counseling of adolescents for risky health behaviors: a primary care intervention. *Pediatrics, 115*(4), 960-968.

Rodriguez, H. P., Chen, J., Owusu-Edusei, K., Suh, A., & Bekemeier, B. (2012). Local public health systems and the incidence of sexually transmitted diseases. *Am J Public Health, 102*(9), 1773-1781.

Stewart, A. M., Richardson, O. L., Cox, M. A., Hayes, K. J., & Rosenbaum, S. J. (2010). The Affordable Care Act: US vaccine policy and practice.

Tan, L. (Producer). (2011, December 15, 2012). *Impact of the Affordable Care Act on immunization*. Retrieved from http://www.ama-assn.org/resources/doc/public-health/immunization101-tan2.pdf

Wilson, T. (2000). Factors influencing the immunization status of children in a rural setting. *J Pediatr Health Care, 14*(3), 117-121.

**2. Variations between Rural and Non-Rural Child Immunization Services of LDHs**

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## Abstract

***Background*:** The Affordable Care Act (ACA) has resulted in more people gaining access to preventive services such as immunizations. However, little is known about the variations between rural and non-rural Local Health Departments (LHDs) in providing childhood immunizations in the era of post-health care reform and their associated costs to provide this service.

***Purpose:*** This study compares the delivery of childhood immunizations by LHDs in California and explores the variations between rural and non-rural jurisdictions.

***Method****:* A mixed method approach was used to collect and analyze information from LHDs about immunization clinic structure and operations, barriers to services, and perceived roles for immunization services.

***Results***: Forty-two LHDs participated in the survey (response rate 69%); 24 were from rural counties (response rate of 71% of total rural counties). Sixty-eight (68%) of rural and 84% of non-rural LHDs planned to maintain current level of immunization services; 41% of rural respondents and 72% non-rural respondents billed Medi-Cal; and 41% of rural respondents provided cost information related to their immunization clinics compared to 50% response for non-rural counties.

The mean annual cost to immunize a child is $256 for rural jurisdictions compared to $151 for their non-rural counterparts. Both rural and non-rural LHDs identified lack of timely appointments as the key barrier to immunizations. LHDs in rural areas are more likely to make referrals to other safety net providers. However, non-rural LHDs respondents were more likely to convene immunization coalitions and conduct health education and outreach services about childhood immunization. Regression analysis showed that several factors have a positive impact on kindergarten immunization rates. These factors included referring to private providers, contracting with private insurance, engaging in collaborative relationships with external agencies, and offering immunizations to privately insured children.

***Implication:*** Rural LHDs may need additional resources to maintain or achieve acceptable immunization rates. Strategies should include offering immunizations to privately insured children and securing reimbursement from private insurance for the service, better coordination with rural providers, and participation in community coalition and health education efforts.

## Background

Immunization has been proclaimed as one of the greatest achievements in public health because it prevents illness and premature death, and results in billions of dollars saved in direct and societal costs (Zhou, 2014). Immunization coverage is an estimate of the percentage of populations who received the recommended vaccines. Immunization coverage can be used as a gauge to predict how well communities are protected from vaccine-preventable diseases. As of 2015, both California and the United States as a whole have not met the Healthy People 2010 goal of on-time vaccination for 95% of school-age children (Smith, 2015). The Affordable Care Act (ACA) has resulted in more people gaining access to free or low-cost preventive services such as immunization. In California, the ACA has expanded health coverage to millions of residents and has improved coverage for millions more. However, estimated as between 2.7 and 3.4 million, people under age 65 are predicted to still remain uninsured by 2019 post the fully implementation of the ACA (Fronstin, 2016; Lucia et al., 2015).

As of January 2017, the implementation of the Affordable Care Act has facilitated 32 states including the District of Columbia, to adopt Medicaid expansion ("Current Status of State Medicaid Expansion Decisions," 2017), which extended eligibility to people with annual incomes below 138 percent of the federal poverty level. In California, the expansion of Medicaid resulted in a redirection of indigent medical care funding from counties to the state, which is based on the estimates that counties would have lower costs for health care services for the indigent population. Since many have become eligible for coverage through Medicaid or the health insurance exchange, the amount redirected from counties to the state is 60% of health realignment funding or 80% of savings using a formula-based approach that takes into account a county's cost and revenue experience (CSAC, 2013; Rodriguez et al., 2012). The expanded health coverage and corresponding reduction of direct funding for indigent care is forcing LHDs to redefine their roles and responsibilities for improving population health (Leider et al., 2015).

LHDs are charged with identifying unmet needs, addressing gaps in service delivery, and reducing health disparities. Several studies have noted that despite the increase in health coverage, residents in rural areas still have limited access to health care services, primarily due to inadequate network coverage and unfamiliarity with the health care system (Allen et al., 2013; Bolin et al., 2011; Collins, 2015; Douthit et al., 2015; Ortiz et al., 2013; Talbot et al., 2013; Wright, Damiano, et al., 2015). In California, there are 61 LHDs, of which 34 are in rural counties. These counties participate in the Counties Medical Services Program (CMSP), which provides limited-term health coverage for uninsured, low-income, and indigent adults that are not otherwise eligible for other publicly funded health programs. These rural LHDs are the primary institutions responsible for identifying and addressing their community's health concerns including management of preventive care, and the 'safety net' for medically underserved populations.

The ACA increases access to health care services and removes copayments for prevention services such as childhood immunizations. However, little is known about how the ACA has impact the delivery of childhood immunization by local health

departments. Previous studies have documented three primary obstacles to childhood immunization services: health system barriers, provider barriers, and parental barriers (Esposito et al., 2014; Kimmel et al., 2007). Health system barriers include the cost of service provision, vaccine storage regulations, lack of a unified immunization registry, and provider contractual issues. Provider barriers include challenges with timely appointment, missed opportunities, lack of clinical information, registry access, and communication with parents. Parental barriers include fear of vaccination, lack of information about vaccination schedules, available time, transportation to appointments, and cost for vaccinations.

Early observations from a recent study on the impact of the ACA suggest more adults utilizing preventive services, such as flu vaccination, after the elimination of cost sharing for such services (Shen et al., 2014). However, childhood immunization was not included in the study. Although not specifically addressing immunization rates, various studies have demonstrated general health disparities due to geographic barriers. These studies generalize that people living in rural communities are more likely to have poor health outcomes due to challenges in accessing health services (DeVoe et al., 2009; Hale et al., 2016; Hartley, 2004; Thomas et al., 2014). To understand the impact of the ACA on the delivery of childhood immunization services by local health departments, this study surveyed rural and non-rural jurisdictions in California to identify health system barriers, provider barriers, parental barriers, and geographic barriers that may influence their local immunizations rates.

## Method

California Health and Safety Codes require all schools and childcare facilities to report the immunization status of their enrollees each fall season. The California Department of Public Health Immunization Branch publishes annual reports that measure compliance with the school immunization law at licensed childcare facilities and all schools with kindergartens and/or 7th grades with ten or more students. Data from the 2014-2015 California Department of Public Health Kindergarten Summary Report were used to determine the immunization rate in each county. Furthermore, membership in the Counties Medical Services Program (CMSP) was used as a proxy to categorize a jurisdiction as rural. The CMSP was established by statute in January 1983 as an administrative mechanism for small rural California counties with a population of 300,000 or less to provide health care services to uninsured indigent adults. In 2015, there were 34 counties in CMSP.

Firstly, key informant interviews on childhood immunizations were conducted with public health leaders and community providers in four counties between October 2014 and April 2015. Participants included ten Local Health Department staff, two Federally Qualified Health Center staff, and two Rural Health Center staff. Interviews were conducted in person or via teleconference using semi-structured questions about the availability of childhood immunization services in the jurisdiction, the role of the local public health department in the delivery of immunization services, the insurance coverage of families seeking immunization services at the public health department, and the barriers to immunization services. The interviews were transcribed and qualitative

analysis was performed to find common and unique themes in the data obtained from the interviews.

Secondly, a draft survey containing 37 questions was piloted in June and July 2015 with six public health administrators from small, medium, large LHDs in different geographic areas to test the validity and reliability. The final survey contained 55 questions to allow data collection on the organizational structure of the LHD, immunization clinic operations, efforts to ensure immunization services, efforts to collaborate with external health care providers, local barriers to childhood immunization, and changes in the role of LHD. To understand immunization clinic operations and changes experienced by LHD since the implementation of the ACA, the survey asked questions about changes in volume of clients seeking services, the types of health insurance coverage of the families seeking immunizations, the level of staffing in the clinic, the revenue sources, and the costs to provide services. To understand efforts to ensure that children are being immunized, the survey contained questions about referrals to various health care providers and efforts to collaborate with safety net providers and community agencies. The survey also asked LHDs about barriers in immunization services and to rate the importance of various activities that LHDs can do to ensure appropriate level of immunization coverage. All questions used Likert-type responses or simple binary yes/no responses making the resulting data amenable to quantitative analysis.

Post the pilot trial, the formal survey was emailed to 61 local health jurisdictions in California by the County Health Executives Association of California in September 2015. The invitation and survey was sent to Public Health Directors or their designees and contained a link to a 55-question on-line Qualtrics survey. An attachment containing the survey was also included in the email request. Reminder and outreach emails were sent to the Public Health Directors or their designees in October; and additional emails were sent to the local Immunization Coordinators in November to increase the response rate. Follow-up calls were conducted to make clear if the LHDs preferred phone interviews to complete the survey.

The survey was closed in January 2016, and results were cleaned and coded for analysis using SPSS v23. Duplicate entries and incomplete entries were not used in the analysis. Regression analyses were conducted using the 2014-2015 Kindergarten Immunization rates as the dependent variable. Stepwise linear regression was performed for each set of barrier measures. The sets in Table 2.1 include Health System Barriers (B1); Provider Barriers (B2); Parental Barriers (B3); and Local Health Department (LHD) Barriers (B4). The rural versus non-rural indicator CMSP was included as a predictor for all the analyses. Descriptive analysis was also used to compare immunization rates between rural and non-rural jurisdictions. Additional analysis was performed to probe whether the variances in immunization rates in rural and non-rural counties can be attributable to differences between clinic operations, costs to provide childhood immunization services, local barriers, and roles of the LHD in providing immunizations and related immunization services.

Table 2.1. Identified barriers in childhood immunization.

| **Health System Barriers (B1)** |
|---|
| Lack of timely access to appointments |
| Limited number of community clinics or provider offices that provide immunization |
| Inadequate number of providers willing to provide immunization services due to costs |
| Increase in Medi-Cal coverage |
| Inadequate number of providers offering services to children who do not have private insurance |
| **Provider Barriers (B2)** |
| Inadequate clinician knowledge about vaccines and contraindications |
| Lack of timely access to appointments |
| Impact of waiting time for appointments at community clinics or provider offices |
| **Parental Barriers (B3)** |
| Raising influence of anti-vaccination movement |
| Patient's cost for immunization |
| Impact of the anti-vaccination movement |
| Impact of parental lack of knowledge about immunization schedules or fears about immunization |
| **Local Health Department Barriers (B4)** |
| Offers childhood immunization services |
| Refers to Rural Health Centers |
| Refers to School Based Clinics |
| Refers to private providers |
| Receives referrals for immunization services |
| Is a contracted provider for Medi-Cal Managed Care |
| Is a contracted provider for private health insurance |
| Bills Medi-Cal |
| Bills Private insurance |
| Convenes coalitions to improve childhood immunization services |
| Has an effective and collaborative partnership with external providers |
| Believes in offering immunization services to privately insured |
| Believes in offering immunization services to publicly insured |
| Believes in offering immunization services to uninsured |
| Believes in referring all children seeking immunizations to external providers |
| Believes in contracting for immunization services |
| Believes in ensuring activities rather than providing immunization services |
| Believes in purchasing, storing and supplying vaccines to external providers as needed |
| Believes in maintaining capacity to respond to outbreaks via immunization service |
| Believes that ACA has improved access to immunization |
| Has assessed current state of local immunization services |
| Has identified internal barriers to immunization services |
| Uses innovations to reduce LHD barriers |

## Results

Survey tracking records indicated 58 LHDs initiated the survey, but only 48 submitted responses. Of the submitted surveys, six were excluded from this study, because they were incomplete or duplicate entries from the same LHD resulting in 42 surveys meeting criteria for analysis. Since there are 61 LHDs in California, 42 surveys equate to a 69% response rate. Of the 42 responses, 24 were from CMSP counties equating to a 57% response rate from rural jurisdictions (Table 2.2).

### Immunization Rates

Analysis of the data from the 2014-2015 California Department of Public Health Kindergarten Summary Report Kindergarten rates indicated that more rural LHDs have rates below 95% as set by Healthy People 2020. Of the counties with rates below 95% goal, 88% was rural and 78% was non-rural. A Chi-square test revealed that this difference is not statistically significant. Of the counties with rates at 95% or above, 13% was rural and 22% was non-rural counties.

Regression models did not produce any significant predictors of kindergarten immunization rates in three of the four sets of barriers. The p-value was greater than .05 for all measures in Health System Barriers (B1), Providers Barriers (B2), and Parental Barriers (B3). For LHD Barriers (B4), the final model selected included six predictors in addition to CMSP, which were referring to private medical, receiving referrals from external agencies, contracted with private medical, billing Medi-Cal, having effective collaborations, and offering IZ services to private insurance. The chosen model gives the most parsimonious results when looking at all the regression diagnostics combined.

The model explains 62% of the variance in IZ rate across LHDs (Table 2.3). The intercept (constant) of 87% is reasonably close to the sample average of 89% (Table 2.4). Variables having a positive impact on immunization rates include referrals to private providers (B=0.090, 95% CI=0.038, 0.143), having contracts with private insurance (B=0.061, 95% CI=0.016, 0.107), having collaborative relationships (B=0.093, 95% CI=0.027, 0.159), and offering immunization services to those with private insurance (B=0.043, 95% CI=0.015, 0.071) (Table 2.4).

Variables having a negative impact on immunization rates include being a rural county, represented by membership in CMSP (B=-0.057, 95% CI=-0.085, -0.029), referrals from external agencies (B=-0.122, 95% CI=-0.178, -0.065), and billing Medi-Cal (B=-0.053, 95% CI=-0.081, -0.024) (Table 2.4).

Regression diagnostics support the validity of the model. For example, the Durbin-Watson test statistic for collinearity should be between 1.5 and 2.5, and is 2.36 for this model. Model residuals are plotted in Figure 2 and show that the regression residuals are sufficiently normal. One of the primary interests in this research is the difference between rural and non-rural counties with membership in CMSP being a proxy for rural status. While being CMSP does not have the largest negative impact on immunization rates, CMSP status is important in creating a significant model. (A generalized linear model (GLM) was created using the same measures and yielded the

same parameters as simple linear regression; therefore, simple regression results are used throughout the study.)

Table 2.2. Immunization clinic structure and operations.

| | Total LHDs | | Rural LHDs[a] | | Non-Rural LHDs | |
|---|---|---|---|---|---|---|
| | N | % | N | % | N | % |
| **Response Rate** | | | | | | |
| Survey responses | 42 | 0.69[b] | 24 | 0.69[c] | 18 | 0.69[d] |
| **Immunization Services & Operations** | | | | | | |
| Serves children with private insurance | 13 | 0.31 | 5 | 0.21 | 8 | 0.44 |
| Serves children with public insurance | 38 | 0.90 | 21 | 0.88 | 17 | 0.94 |
| Serves non-insured children | 39 | 0.93 | 21 | 0.88 | 17 | 0.94 |
| Refers children with private insurance to FQHCs[e] | 22 | 0.52 | 15 | 0.63 | 7 | 0.39 |
| Refers children with public insurance to FQHCs | 18 | 0.43 | 11 | 0.46 | 7 | 0.39 |
| Refers non-insured children to FQHCs | 16 | 0.38 | 10 | 0.42 | 6 | 0.33 |
| Receives referrals from private providers | 32 | 0.76 | 19 | 0.79 | 9 | 0.50 |
| Have contracts with private insurance | 4 | 0.1 | 2 | 0.08 | 2 | 0.11 |
| Bills Medi-Cal reimbursement | 21 | 0.5 | 9 | 0.38 | 12 | 0.67 |

[a] A subset of the 61 LHDs. These are 34 counties participating in California Medical Services Program

[b] Total number of respondents/total number of Local Health Departments in California

[c] Total number of respondents that participate in California Medical Services Program/total CMSP counties

[d] Total number of non-rural LHDs respondents/total number of non-rural LHDs

[e] Federally Qualified Health Centers

[f] Rural Health Centers

Table 2.3. Summary of model to predict kindergarten immunization rates.

Model Summary

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Durbin-Watson |
|---|---|---|---|---|---|
| 1 | .790[a] | 0.624 | 0.541 | 0.039 | 2.360 |

a. Predictors: (Constant), Offer IZ Services Private Ins, Bill Medi-Cal, Refer to Private Medical, Collaborative, Contracted Private, Member CMSP, Referral from External

Table 2.4. Predictive variables for kindergarten immunization rates.

| Characteristics of Local Health Departments | B | Std. Error |
|---|---|---|
| Member of CMSP | -.057 | .014 |
| Refer to private medical providers | .090 | .026 |
| Referral from external partners | -.122 | .028 |
| Contracted Private | .061 | .022 |
| Bill Medi-Cal | -.053 | .014 |
| Participate in immunization collaborative | .093 | .032 |
| Accepts private insurance for immunization services | .043 | .014 |

Dependent Variable: Kindergarten Immunization Rate

Variables having a negative impact on immunization rates include being a rural county, represented by membership in CMSP (B=-0.057, 95% CI=-0.085, -0.029), referrals from external agencies (B=-0.122, 95% CI=-0.178, -0.065), and billing Medi-Cal (B=-0.053, 95% CI=-0.081, -0.024) (Table 2.4).

Regression diagnostics support the validity of the model. For example, the Durbin-Watson test statistic for collinearity should be between 1.5 and 2.5, and is 2.36 for this model. Model residuals are plotted in Figure 2 and show that the regression residuals are sufficiently normal. One of the primary interests in this research is the difference between rural and non-rural counties with membership in CMSP being a proxy for rural status. While being CMSP does not have the largest negative impact on immunization rates, CMSP status is important in creating a significant model. (A generalized linear model (GLM) was created using the same measures and yielded the same parameters as simple linear regression; therefore, simple regression results are used throughout the study.)

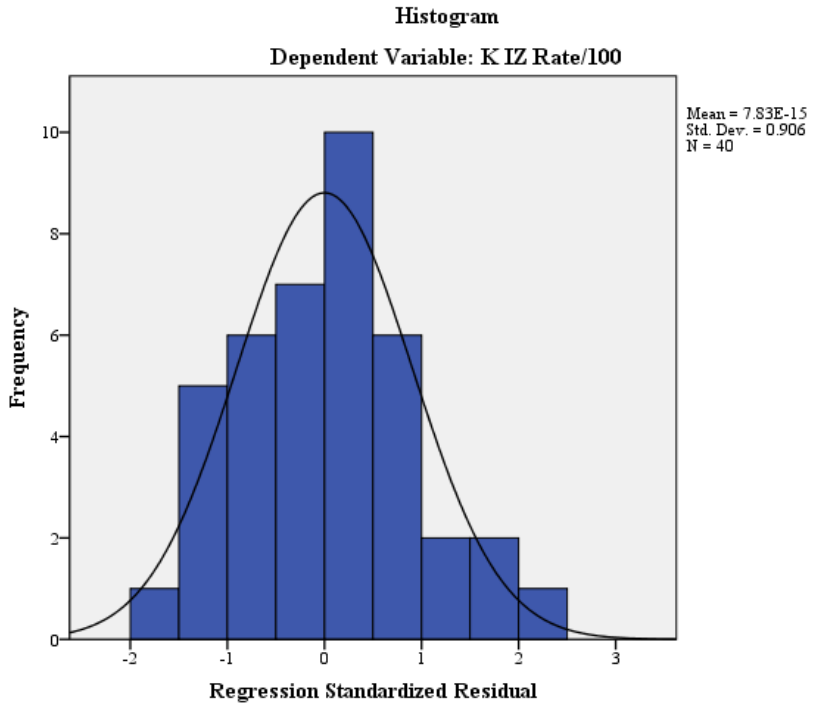


*Figure 2.1.* Immunization rate regression residuals plot.

Further testing of CMSP status was conducted by comparing regression coefficients for each of the measures included in the first model for each CMSP status, member (1) or non-member (0). This found no statistically significant difference in regression parameters for CMSP versus non-CMSP for the parameters used in the primary regression result (not shown). One further way to check for statistical differences in barrier measures by CMSP is to regress on the barrier parameters for each group separately. Results for stepwise regression across LHD barrier measures are shown in Tables 2.5 and 2.6. Six iterations produced a model for CMSP=0 that includes referring to school based, referring to private medical, referring from external, and billing private and contract IZ services. For CMSP=1, after four iterations, the significant measures are referring to school based clinics, referring to private providers, receiving referrals from external providers, billing Medi-Cal, billing private insurance, offering immunization services to private insurance, contracting for immunization service, and convening collaborative work groups to improve local immunization rates.

Table 2.5. Regression models by CMSP.

| Member CMSP | Model | | Coefficients B | Coefficients Std. Error |
|---|---|---|---|---|
| 0 | 6 | (Constant) | 0.886 | 0.026 |
| | | Refer to School Based | 0.036 | 0.016 |
| | | Refer to Private Medical | 0.145 | 0.036 |
| | | Referral from External | -0.104 | 0.043 |
| | | Bill Private | 0.055 | 0.022 |
| | | Contract IZ Services | -0.053 | 0.015 |
| 1 | 4 | (Constant) | 0.847 | 0.045 |
| | | Refer to School Based | 0.122 | 0.047 |
| | | Refer to Private Medical | 0.086 | 0.036 |
| | | Referral from External | -0.181 | 0.034 |
| | | Bill Medi-Cal | -0.076 | 0.017 |
| | | Bill Private | 0.164 | 0.036 |
| | | Offer IZ Services Private Ins | 0.052 | 0.017 |
| | | Contract IZ Services | -0.069 | 0.031 |
| | | Collaborative | 0.127 | 0.031 |

The separate regressions show that differences in the response of immunization rates to LHD barriers exist between CMSP counties and non-CMSP counties. It should be noted that all the measures in the CMSP=0 model are included in the CMSP=1 model, although neither is exactly the same set of measures as in the model that includes CMSP itself as a predictor. Further discussion of these results is shown below.

**Immunization Clinic – Structure and Operations**

Fewer rural LHDs reported providing childhood immunization services than their non-rural LHDs, having contracts to provide these services, and billing for these services. The percentage of non-rural LHDs offering immunization services to children with private insurance was 44% as compared to 21% for rural LHDs. Correspondingly, 63% of the rural LHDs reported referring children to safety net private providers for immunization services compared to 39% of non-rural LHDs (Table 6).

Regression showed that offering immunization services to children with private insurance is associated with increasing rates as an average of 4.3% (95% CI=0.015, 0.071%). When looking at rural versus non-rural separately, the measure is no longer significant for CMSP=0; but remains in the model for CMSP=1. Referrals were important in predicting immunization rates for both rural and non-rural counties. However, receiving referrals is associated with lower overall immunization rates.

Table 2.6. Role of LHDs regarding childhood immunization services.

| | Total LHDs | | Rural LHDs[a] | | Non-Rural LHDs | |
|---|---|---|---|---|---|---|
| | N | % | N | % | N | % |
| Survey responses | 42 | 0.69[b] | 24 | 0.71[c] | 18 | 0.69[d] |
| Respondents who agree or strongly agree with having an effective and collaborative partnership with medical providers to improve immunization rates | 33 | 0.79 | 18 | 0.75 | 14 | 0.78 |
| Respondents who agree or strongly agree with having an effective and collaborative partnership with Federally Qualified Health Centers to improve immunization rates | 32 | 0.76 | 17 | 0.71 | 15 | 0.83 |
| Respondents who agree or strongly agree with having an effective and collaborative partnership with Rural Health Centers to improve immunization rates | 19 | 0.45 | 14 | 0.58 | 5 | 0.28 |
| Respondents who agree or strongly agree with having an effective and collaborative partnership with private health plans to improve immunization rates | 9 | 0.21 | 3 | 0.13 | 6 | 0.33 |
| Respondents who agree or strongly agree with having an effective and collaborative partnership with schools to improve immunization rates | 36 | 0.86 | 18 | 0.75 | 17 | 0.94 |
| Respondents planning to maintain current level of immunization services | 31 | 0.74 | 16 | 0.67 | 15 | 0.83 |
| Respondents planning to increase current level of immunization services | 6 | 0.14 | 4 | 0.17 | 2 | 0.11 |
| Respondents planning to decrease current level of immunization services | 1 | 0.02 | 1 | 0.04 | 0 | 0.00 |

[a] A subset of the 61 LHDs. These are 34 counties participating in California Medical Services Programs

[b] Total number of respondents/total number of Local Health Departments in California

[c] Total number of respondents that participate in California Medical Services Program/total CMSP counties.

[d] Total number of non-rural LHDs respondents/total number of non-rural LHDs.

**Barriers to Immunization Services**

Of the identified barriers to childhood immunizations, both rural and non-rural survey respondents ranked the lack of available appointments as the leading barrier to childhood immunizations, followed by provider costs, anti-vaccination movement, and inadequate safety-net providers (Figure 3). More rural LHDs cited the anti-vaccination movement as a barrier than their non-rural counterparts as 18% compared to 8%, respectively.

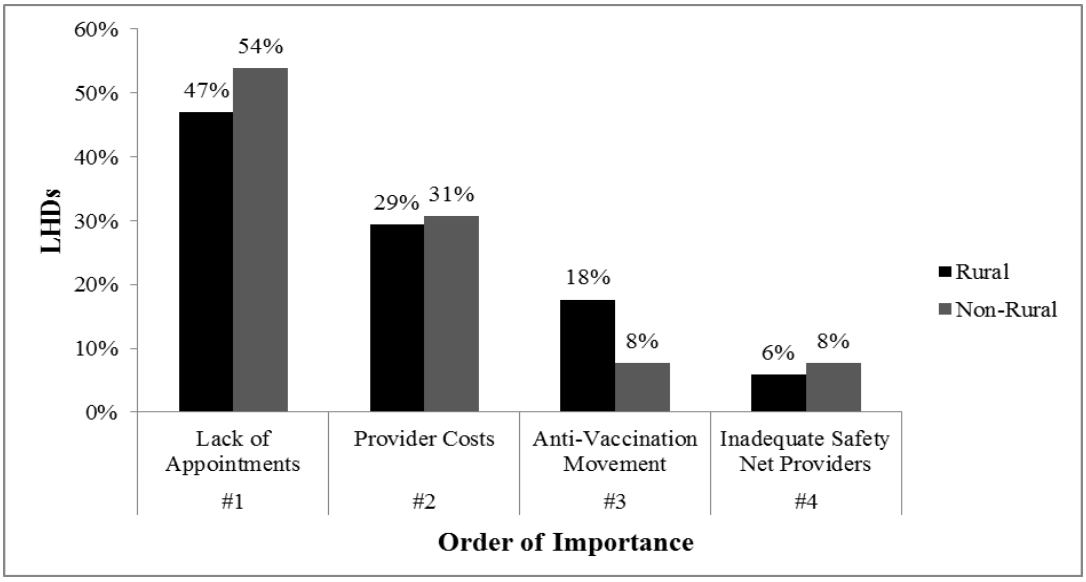


*Figure 2.2.* Perceived barriers to childhood immunizations.

**Cost of Childhood Immunization Services**

Of the 18 LHDs that provided cost information about their childhood immunizations, nine were rural LHDs and nine non-rural LHDs. Both rural and non-rural LHDs had similar minimum annual cost to immunize a child as $18.75 and $18.62, respectively. However, the maximum cost was approximately 3.2 times higher as reported by a rural LHD compared to its non-rural counterpart (Table 2.7).

Table 2.7. Annual cost of childhood immunizations.

| | Rural LHDs N=9 | Non-Rural LHDs N=9 |
|---|---|---|
| Minimum cost per child immunized | $ 18.75 | $ 18.62 |
| Maximum cost per child immunized | $ 1,218.18 | $ 395.65 |
| Mean cost per child immunized | $ 255.58 | $ 150.54 |
| Std. Deviation | $ 348.73 | $ 131.86 |

**Roles of Local Health Departments**

Survey results indicate that rural counties were less likely than their non-rural counterparts to perceive that the ACA has led to improvement in IZ by increasing access to services (38% versus 83% respectively, $p < 0.004$, Fisher's exact test). Approximately 52% of rural counties reported no changes in the number of uninsured children seeking immunization services, while 48% reported a significant decrease from children covered by Medi-Cal. Both rural and non-rural LHDs have similar perceptions of the LHDs' role about childhood immunization (Table 6). The notable differences are the ratings of partnerships with private health plans and schools to improve immunization rates. Fewer rural LHDs agreed or strongly agreed with having effective and collaborative partnerships with private health plans than their non-rural counterparts as 12% compared to 35%. Similarly, only 72% of rural LHDs agreed or strongly agreed with having effective and collaborative partnerships with schools to improve immunization rates, compared to 100% rating by their non-rural counterparts. LHDs in rural areas are also more likely to refer to external providers, such as Federally Qualified Health Centers, Rural Health Centers, school-based clinics, and private providers (Figure 2.2).

Overall, 74% of the rural counties planned to maintain the same level of service for the next five years, with increasing efforts in conducting outreach and education to improve immunization rates compared to 88% of their non-rural counterparts.

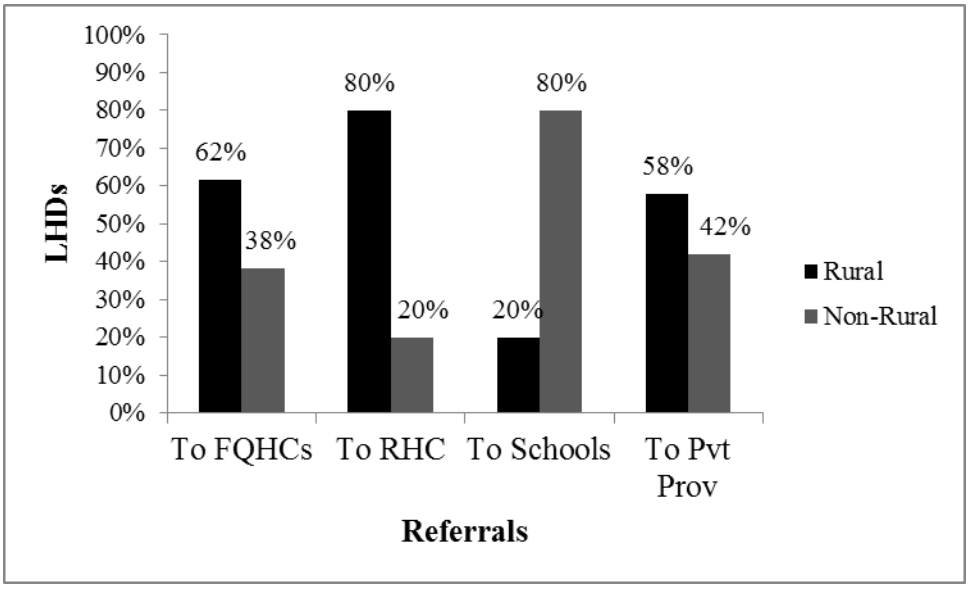


*Figure 2.3.* Referrals to external providers for childhood immunization services.

## Discussion

The Affordable Care Act has increased the number of children covered by public or private health insurance. However, access to health care services may still be a challenge for children in rural areas (Caldwell et al., 2016; DeVoe et al., 2009). Our study confirms that disparities in kindergarten rates may be partly due to differences between rural and non-rural local health departments. The key informant interviews and survey results indicate that LHDs in rural counties may experience more barriers in delivering childhood immunization services than their non-rural counterparts. These geographic variations include more rural LHDs reporting lower immunization coverage rates, barriers such as lack of timely appointments, high cost to provide immunizations, and anti-vaccination concerns, and lack of reimbursement for services from both public and private health insurance providers.

Regardless of the limited reimbursement and funding for immunization services, both rural and non-rural LHDs are committed to maintaining or increasing their childhood immunization services. LHDs are less likely to discontinue services when residents lack access to healthcare (Hsuan et al., 2014). Rural LHDs are committed to providing childhood immunizations to maintain or improve immunization rates, especially to underserved population. A recent national survey of LHDs indicates that rural jurisdictions are more likely to offer childhood immunization services than their urban counterparts. Of the respondents, 95% Rural LHDs reported offering childhood immunization services as compared to 77% of their urban counterparts (NACCHO, 2016).

However, because changes in health care policies on the federal and state level may likely result in diminishing allocations for public health services, we suggest concerted efforts by LHDs in examining the organizational structure, administrative processes, and service delivery models to increase childhood immunization coverage rates (Ransom et al., 2012). As demonstrated in our predictive model, practices such as referring to private providers, contracting with private insurance, engaging in collaborative relationships with external agencies, and offering immunization services to privately insured children will have a positive impact on kindergarten immunization rates. In addition, a recent study noted that improvements in immunization coverage rates are achievable using community participatory framework to develop culturally appropriate strategies (Willis et al., 2016). Rural LHDs may need to strengthen partnerships with local stakeholders such as providers and health plans to resolve barriers to timely access, since limited access to immunizations may also indicate limited access to other prevention services (Douthit et al., 2015).

The results showed some differences in immunization rates for rural versus non-rural as measured by CMSP membership. Further work should focus on what drives the differences. For example, rural counties were less likely to engage in collaborative behavior; but collaboration was found to be statistically significant in raising immunization rates in CMSP counties by an average of 12.7% (95% CI=0.06, 0.194).

To increase revenues and allocations, we suggest concerted efforts to capture specific cost information related to the provision of childhood immunization services.

Lastly, the higher reported costs in rural LHDs to provide services may be due to the low number of children seeking services. Rural LHDs may also benefit from cross-jurisdictional sharing regarding cost accounting processes and economic analyses in order to determine break-even points and feasibility of providing childhood immunizations to various populations in the community.

## Limitations

This study had several limitations. First, the results of the survey were based on the subjective perceptions of the respondents; and therefore, generalizability to other LHDs is limited. In addition, this was a cross-sectional analysis of a subset of the 61 local health departments in California. Rural LHDs in California may be significantly different in population size, governance, culture, and services from other LHDs across the United States. Therefore, generalizability of the results to all LHDs is limited.

## References


Allen, S. M., Ballweg, R. A., Cosgrove, E. M., Engle, K. A., Robinson, L. R., Rosenblatt, R. A., . . . Wenrich, M. D. (2013). Challenges and opportunities in building a sustainable rural primary care workforce in alignment with the Affordable Care Act: the WWAMI program as a case study. *Acad Med, 88*(12), 1862-1869. doi:10.1097/acm.0000000000000008

Bekemeier, B., Yang, Y., Dunbar, M. D., Pantazis, A., & Grembowski, D. E. (2014). Targeted Health Department Expenditures Benefit Birth Outcomes at the County Level. *American journal of preventive medicine, 46*(6), 569-577. doi:10.1016/j.amepre.2014.01.023

Berlin, M. F., & Smith, T. H. (2004). Evaluation of activity-based costing versus resource-based relative value costing. *J Med Pract Manage, 19*(4), 219-227.

Bernet, P. M., & Singh, S. (2015). Economies of scale in the production of public health services: an analysis of local health districts in Florida. *Am J Public Health, 105 Suppl 2,* S260-267. doi:10.2105/ajph.2014.302350

Bolin, J. N., Gamm, L., Vest, J. R., Edwardson, N., & Miller, T. R. (2011). Patient-centered medical homes: will health care reform provide new options for rural communities and providers? *Fam Community Health, 34*(2), 93-101. doi:10.1097/FCH.0b013e31820e0d78

Bradley, E. H., Curry, L. A., Ramanadhan, S., Rowe, L., Nembhard, I. M., & Krumholz, H. M. (2009). Research in action: using positive deviance to improve quality of health care. *Implement Sci, 4*, 25. doi:10.1186/1748-5908-4-25

Caldwell, J. T., Ford, C. L., Wallace, S. P., Wang, M. C., & Takahashi, L. M. (2016). Intersection of Living in a Rural Versus Urban Area and Race/Ethnicity in Explaining Access to Health Care in the United States. *Am J Public Health*, e1-e7. doi:10.2105/ajph.2016.303212

Canby, J. B. t. (1995). Applying activity-based costing to healthcare settings. *Healthc Financ Manage, 49*(2), 50-52, 54-56.

CDC. (2015). *Sexually Transmitted Disease Surveillance 2014*. Retrieved from CDC: https://stacks.cdc.gov/view/cdc/36835/cdc_36835_DS1.pdf

Chesson, H., & Owusu-Edusei, K., Jr. (2008). Examining the impact of federally-funded syphilis elimination activities in the USA. *Soc Sci Med, 67*(12), 2059-2062. doi:10.1016/j.socscimed.2008.09.049

Chesson, H. W. (2006). Estimated effectiveness and cost-effectiveness of federally funded prevention efforts on gonorrhea rates in the United States, 1971-2003, under various assumptions about the impact of prevention funding. *Sex Transm Dis, 33*(10 Suppl), S140-144. doi:10.1097/01.olq.0000194575.79728.72

Chesson, H. W., Harrison, P., Scotton, C. R., & Varghese, B. (2005). Does funding for HIV and sexually transmitted disease prevention matter? Evidence from panel data. *Eval Rev, 29*(1), 3-23. doi:10.1177/0193841x04270613

Collins, C. (2015). Rural health care: redefining access. *N C Med J, 76*(1), 20-23.

Corso, P. S., Ingels, J. B., Taylor, N., & Desai, S. (2014). Linking costs to health outcomes for allocating scarce public health resources. *EGEMS (Wash DC), 2*(4), 1128. doi:10.13063/2327-9214.1128

CSAC. (2013). *California State Association of Counties Reader's Guide to AB 85*. Retrieved from Sacramento, CA: www.counties.org/sites/main/files/readers_guide_ab_85_june_20_final.pdf

CSAC (2017, February 24, 2017). [Dismantling the CCI, the County IHSS MOE, and Shifting IHSS Collective Bargaining to Counties].

Current Status of State Medicaid Expansion Decisions. (2017). *State Health Facts.* Retrieved from http://kff.org/health-reform/slide/current-status-of-the-medicaid-expansion-decision/

de Wit, G. A., Over, E. A., Schmid, B. V., van Bergen, J. E., van den Broek, I. V., van der Sande, M. A., . . . Kretzschmar, M. E. (2015). Chlamydia screening is not cost-effective at low participation rates: evidence from a repeated register-based implementation study in The Netherlands. *Sex Transm Infect, 91*(6), 423-429. doi:10.1136/sextrans-2014-051677

Demeere, N., Stouthuysen, K., & Roodhooft, F. (2009). Time-driven activity-based costing in an outpatient clinic environment: development, relevance and managerial impact. *Health Policy, 92*(2-3), 296-304. doi:10.1016/j.healthpol.2009.05.003

DeVoe, J. E., Krois, L., & Stenger, R. (2009). Do children in rural areas still have different access to health care? Results from a statewide survey of Oregon's food stamp population. *J Rural Health, 25*(1), 1-7. doi:10.1111/j.1748-0361.2009.00192.x

Directors, N. C. o. S. (2016). *New CDC Surveillance Shows STDs Surge to 20 Year High* [Press release]. Retrieved from http://www.ncsddc.org/who-we-are/press-releases/new-cdc-surveillance-shows-stds-surge-20-year-high

Douthit, N., Kiv, S., Dwolatzky, T., & Biswas, S. (2015). Exposing some important barriers to health care access in the rural USA. *Public Health, 129*(6), 611-620. doi:10.1016/j.puhe.2015.04.001

Ehman, M., Flood, J., & Barry, P. M. (2014). Tuberculosis Treatment Managed by Providers outside the Public Health Department: Lessons for the Affordable Care Act. *PLoS One, 9*(10), e110645. doi:10.1371/journal.pone.0110645

Escaron, A. L., Chang Weir, R., Stanton, P., Vangala, S., Grogan, T. R., & Clarke, R. M. (2016). Testing an Adapted Modified Delphi Method: Synthesizing Multiple Stakeholder Ratings of Health Care Service Effectiveness. *Health Promot Pract, 17*(2), 217-225. doi:10.1177/1524839915614308

Esposito, S., Principi, N., & Cornaglia, G. (2014). Barriers to the vaccination of children and adolescents and possible solutions. *Clin Microbiol Infect, 20 Suppl 5*, 25-31. doi:10.1111/1469-0691.12447

Fairbrother, G., Kuttner, H., Miller, W., Hogan, R., McPhillips, H., Johnson, K. A., & Alexander, E. R. (2000). Findings from case studies of state and local immunization programs. *Am J Prev Med, 19*(3 Suppl), 54-77.

Fronstin, P. (2016). *California's Uninsured: Coverage Expands, but Millions Left Behind*. Retrieved from Oakland, CA: http://www.chcf.org/~/media/MEDIA%20LIBRARY%20Files/PDF/PDF%20C/PDF%20CaliforniaUninsured2016.pdf

Garrett, B., & Gangopadhyaya, A. (2016). *ACA Implementation—Monitoring and Tracking: Who Gained Health Insurance Coverage Under the ACA, and Where Do They Live?* Retrieved from http://www.urban.org/sites/default/files/publication/86761/2001041-who-gained-health-insurance-coverage-under-the-aca-and-where-do-they-live.pdf

Gift, T. L., Haderxhanaj, L. T., Torrone, E. A., Behl, A. S., Romaguera, R. A., & Leichliter, J. S. (2015). Estimating the Size and Cost of the STD Prevention Services Safety Net. *Public Health Rep, 130*(6), 602-609.

Golden, M. R., & Kerndt, P. R. (2015). What is the role of sexually transmitted disease clinics? *Sex Transm Dis, 42*(5), 294-296. doi:10.1097/olq.0000000000000271

Gore, P., Madhavan, S., Curry, D., McClung, G., Castiglia, M., Rosenbluth, S. A., & Smego, R. A. (1999). Predictors of childhood immunization completion in a rural population. *Soc Sci Med, 48*(8), 1011-1027.

Groom, H., Kolasa, M., Wooten, K., Ching, P., & Shefer, A. (2007). Childhood immunization coverage by provider type. *J Public Health Manag Pract, 13*(6), 584-589. doi:10.1097/01.PHH.0000296134.70014.b0

Hale, N. L., Klaiman, T., Beatty, K. E., & Meit, M. B. (2016). Local Health Departments as Clinical Safety Net in Rural Communities. *Am J Prev Med*. doi:10.1016/j.amepre.2016.05.012

Hartley, D. (2004). Rural health disparities, population health, and rural culture. *Am J Public Health, 94*(10), 1675-1678.

Health, T. f. A. s. (2013). *Investing In America's Health: A State-by-State Look at Public Health Funding and Key Health Facts*. Retrieved from http://healthyamericans.org/assets/files/TFAH2013InvstgAmrcsHlth05%20FINAL.pdf

Hogben, M., Chesson, H., & Aral, S. O. (2010). Sexuality education policies and sexually transmitted disease rates in the United States of America. *Int J STD AIDS, 21*(4), 293-297. doi:10.1258/ijsa.2010.009589

Hoover, K. W., Parsell, B. W., Leichliter, J. S., Habel, M. A., Tao, G., Pearson, W. S., & Gift, T. L. (2015). Continuing Need for Sexually Transmitted Disease Clinics After the Affordable Care Act. *Am J Public Health, 105 Suppl 5*, S690-695. doi:10.2105/ajph.2015.302839

HRSA. (2012). *The Affordable Care Act and Health Centers*.

Hsiao, W. C., Braun, P., Dunn, D., & Becker, E. R. (1988). Resource-based relative values. An overview. *JAMA, 260*(16), 2347-2353.

Hsuan, C., & Rodriguez, H. P. (2014). The adoption and discontinuation of clinical services by local health departments. *Am J Public Health, 104*(1), 124-133. doi:10.2105/ajph.2013.301426

Jones, K. B., Spain, C., Wright, H., & Gren, L. H. (2015). Improving Immunizations in Children: A Clinical Break-even Analysis. *Clinical Medicine & Research, 13*(2), 51-57. doi:10.3121/cmr.2014.1234

Kent, J. (2017). *Summary and Preliminary Fiscal Analysis of the Medicaid Provisions in the Federal American Health Care Act*. Sacramento.

Kimball, A. M., Lafferty, W. E., Kassler, W. J., Hundt, A., MacCornack, R., & Bolan, G. (1997). The impact of health care market changes on local decision making and STD care: experience in three counties. *Am J Prev Med, 13*(6 Suppl), 75-84.

Kimmel, S. R., Burns, I. T., Wolfe, R. M., & Zimmerman, R. K. (2007). Addressing immunization barriers, benefits, and risks. *J Fam Pract, 56*(2 Suppl Vaccines), S61-69.

Leider, J. P., Castrucci, B. C., Russo, P., & Hearne, S. (2015). Perceived impacts of health care reform on large urban health departments. *J Public Health Manag Pract, 21 Suppl 1*, S66-75. doi:10.1097/phh.0000000000000145

Liu, T. C., Chen, C. S., & Chen, L. M. (2002). The impact of National Health Insurance on neonatal care use and childhood vaccination in Taiwan. *Health Policy Plan, 17*(4), 384-392.

Lucia, L., Jacobs, K., Graham-Squire, D., Watson, G., Roby, D., Pourat, N., & Kominski, G. (2014). *A Little Investment Goes a Long Way: Modest Cost to Expand Preventive and Routine Health Services to All Low-Income Californians.* Retrieved from http://laborcenter.berkeley.edu/a-little-investment-goes-a-long-way/

Mays, G. P. (2014). *Estimating the Costs of Foundational Public Health Capabilities: A Recommended Methodology.* Lexington, KY.

Mays, G. P., Scutchfield, F. D., Bhandari, M. W., & Smith, S. A. (2010). Understanding the organization of public health delivery systems: an empirical typology. *Milbank Q, 88*(1), 81-111. doi:10.1111/j.1468-0009.2010.00590.x

Morgan, J. R., Drainoni, M. L., Sequeira, S., Sullivan, M., & Hsu, K. K. (2016). Getting What You Pay For: The Economics of Quality Care for Sexually Transmitted Infections. *Sex Transm Dis, 43*(1), 18-22. doi:10.1097/olq.0000000000000377

NACCHO. (2013). *Local health department job losses and program cuts: findings from the 2013 Profile Study*. Retrieved from www.naccho.org/topics/infrastructure/lhdbudget/upload/Survey-Findings-Brief-8-13-13-3.pdf

NACCHO. (2014). *2013 National Profile of Local Health Departments*. Retrieved from Washington, DC: http://www.naccho.org/topics/infrastructure/profile/upload/2013-National-Profile-of-Local-Health-Departments-report.pdf

NACCHO. (2016). *2016 National Profile of Local Health Departments*. Retrieved from NACCHO: https://nacchovoice.naccho.org/2017/01/25/2016-national-profile-of-local-health-departments/

Ortiz, J., Meemon, N., Zhou, Y., & Wan, T. T. (2013). Trends in rural health Clinics and needs during U.S. health care reform. *Prim Health Care Res Dev, 14*(4), 360-366. doi:10.1017/s1463423612000503

Ozer, E. M., Adams, S. H., Lustig, J. L., Gee, S., Garber, A. K., Gardner, L. R., . . . Irwin, C. E., Jr. (2005). Increasing the screening and counseling of adolescents for risky health behaviors: a primary care intervention. *Pediatrics, 115*(4), 960-968. doi:10.1542/peds.2004-0520

Ransom, J., Schaff, K., & Kan, L. (2012). Is there an association between local health department organizational and administrative factors and childhood immunization coverage rates? *J Health Hum Serv Adm, 34*(4), 418-455.

Rodriguez, H. P., Chen, J., Owusu-Edusei, K., Suh, A., & Bekemeier, B. (2012). Local public health systems and the incidence of sexually transmitted diseases. *Am J Public Health, 102*(9), 1773-1781. doi:10.2105/ajph.2011.300497

Schulman, K., Burke, J., Drummond, M., Davies, L., Carlsson, P., Gruger, J., . . . Glick, H. (1998). Resource costing for multinational neurologic clinical trials: methods and results. *Health Econ, 7*(7), 629-638.

Shah GH, L. H., Sotnikov S. . (2014). Public Health Services Commonly Provided by Local Health Departments in the United States. *Frontiers in Public Health Services & Systems Research, 3(1): Article 2.*

Shen, A. K., O'Grady, M. J., McDevitt, R. D., Pickreign, J. D., Laudenberger, L. K., Esber, A., & Shortridge, E. F. (2014). How might immunization rates change if cost sharing is eliminated? *Public Health Rep, 129*(1), 39-46.

Smith, K. (2015). *The Immunization Status of Young Children in California*. Retrieved from Sacramento, CA: https://www.cdph.ca.gov/programs/immunize/Documents/2011-2015ImmunizationBranchReportToLegislature.pdf

Stewart, A. M., Richardson, O. L., Cox, M. A., Hayes, K. J., & Rosenbaum, S. J. (2010). *The Affordable Care Act: US vaccine policy and practice*. Retrieved from http://hsrc.himmelfarb.gwu.edu/cgi/viewcontent.cgi?article=1168&context=sphhs_policy_facpubs

Talbot, J. A., Coburn, A., Croll, Z., & Ziller, E. (2013). Rural considerations in establishing network adequacy standards for qualified health plans in state and regional health insurance exchanges. *J Rural Health, 29*(3), 327-335. doi:10.1111/jrh.12012

Tan, L. (Producer). (2011, December 15, 2012). *Impact of the Affordable Care Act on immunization*. Retrieved from http://www.ama-assn.org/resources/doc/public-health/immunization101-tan2.pdf

Thomas, T. L., DiClemente, R., & Snell, S. (2014). Overcoming the triad of rural health disparities: How local culture, lack of economic opportunity, and geographic location instigate health disparities. *Health Educ J, 73*(3), 285-294. doi:10.1177/0017896912471049

West, T. D., Balas, E. A., & West, D. A. (1996). Contrasting RCC, RVU, and ABC for managed care decisions. A case study compares three widely used costing methods and finds one superior. *Healthc Financ Manage, 50*(8), 54-61.

Willis, E., Sabnis, S., Hamilton, C., Xiong, F., Coleman, K., Dellinger, M., . . . Simpson, P. (2016). Improving Immunization Rates Through Community-Based Participatory Research: Community Health Improvement for Milwaukee's Children Program. *Prog Community Health Partnersh, 10*(1), 19-30. doi:10.1353/cpr.2016.0009

Wilson, T. (2000). Factors influencing the immunization status of children in a rural setting. *J Pediatr Health Care, 14*(3), 117-121.

Wright, B., Damiano, P. C., & Bentler, S. E. (2015). Implementation of the Affordable Care Act and rural health clinic capacity in Iowa. *J Prim Care Community Health, 6*(1), 61-65. doi:10.1177/2150131914542613

Zhou, F. S., A.; Wenger, J.; Messonnier,M.; Wang,LY.; Lopez, A.; Moore,M.; Murphy,T.V.; Cortese, M.; Rodewald, L. (2014). Economic evaluation of the routine childhood immunization program in the United States, 2009. *Pediatrics, 2014 Apr*(133(4)), 577-585. doi: 510.1542/peds.2013-0698.

## 3. Cost Estimation of Child Immunization and TB Services in LDHs

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## Abstract

***Background:*** Changes in resources and roles due to new federal and state healthcare mandates have given impetus to Local Health Departments (LHDs) to engage in evidence-based planning for the delivery of traditional public health services.

***Purpose:*** This study will provide LHDs in rural areas with information about their cost of delivering childhood immunization and tuberculosis prevention and treatment services and the outcomes that are being achieved.

***Method:*** Primary data on program costs and outcomes were collected from Childhood Immunization and Tuberculosis (TB) Clinics three San Joaquin Valley Public Health Clinics. The cost to deliver these two services was calculated in using a resource based costing approach and compares it with the county's reported cost (RC) to if service. The resource based costing (RBC) approach utilized data from time motion studies, services and supplies consumed, and indirect costs to estimate cost per tuberculin skin test, latent TB infection (LTBI) treatment, successful LTBI treatment completion, and annual cost per child immunized.

***Results:*** Three local Health departments in rural California participated in this study, and an additional five rural jurisdictions guided the project. The processes by which the three LHDs deliver TB and immunization services were almost identical. All three counties have similar activities to produce the major outcomes. The counties differed in the types of resources used to perform the activities in both clinics and thus also had different cost drivers. The cost per completed treatment using RBC calculations ranged from $1,367 to $85,602 whereas the RCs ranged from $815 to $32,584. The reported treatment completion rate ranged from 27% to 74%. To immunize a child, the RBC approach estimated costs ranging from $104 to $608, whereas the reported costs ranged from $28 to $466.

***Implication:*** Despite increasing access to health care coverage via the implementation of the ACA, most LHDs continue to offer LTBI and childhood immunization services regardless of the limited reimbursement opportunities. LHDs also have challenges estimating the costs to deliver these clinical services due organization budgeting practices or difficulty accessing fiscal information. Precise cost estimation for clinical services will assist LHDs in making strategic decisions regarding whether to continue to provide clinical services. LHDs can reduce the costs by examining the resources used in the program. Opportunities exist in each county to streamline these two traditional public health services to capture more efficiencies and greater outcomes.

## Background

The National Association of County & City Health Officials' National Profile of Local Health Departments Surveys in 2013 found that immunizations and tuberculosis screening/treatment services were provided by more than three-quarters of all Local Health Departments (LHDs) nationwide (NACCHO, 2014). However, the role of LHDs in providing these services is unclear in the expansion in Medicaid and private insurance under the Affordable Care Act. The Urban Institute estimated that 19.2 million non-elderly adults gained health insurance coverage from 2010 to 2015, including 2.8 million children aged from 0 to 18 years.(Garrett et al., 2016) As a result of the expanded health insurance coverage and corresponding increased access to health services, LHDs need to consider whether to continue offering the same level of services as before to reduce their service delivery to serve the remaining uninsured, or rely on community health centers or private medical providers (PMPs) to be the sole providers of these services. In addition to the decreasing demand for services, LHDs have been experiencing a decrease in funding since 2008 (Health, 2013). The decreasing demand for services and the decreasing funding require LHDs to consider the cost of providing services in this changing landscape. Yet little is known about the cost of providing services such as childhood immunization and tuberculosis screening.

One way to estimate the cost of a service is to examine the financial records of the LHDs. The problem, as previously noted is that very few LHDs report their annual expenditures at the service-specific level (Bekemeier, Betty et al., 2014; Corso et al., 2014). No standard or mandated procedure are available for reporting the costs of specific services (Bernet et al., 2015). For instance, while some LHDs may treat immunization services as an activity center and assign costs to that activity, others might consider immunizations to be part of a larger activity division such as clinical services; and thus, no study differentiating the resources associated with each activity. In addition, total expenditures can overstate or understate the true cost of providing the services if inefficiencies occur, such as missed appointments, expired supplies, and mixed staffing structure where clinic staff are assigned responsibilities in more than one activity center.

An alternative is to use a costing method that identifies the value of the resources required to deliver the service. A commonly used method in health is Resource-Based Costing (RBC), which has been noted as having the potential to be the most accurate cost estimation method since it delineates major activities in a process and determines costs associated with these activities (Berlin et al., 2004; West et al., 1996). For immunization and TB services, this would require identifying the pathways and outcomes that can result from providing the service (e.g., providing an immunization or identifying and treating a case of TB), the type and amount of resources associated with each outcome (e.g., staff time, travel expenses, and immunizations), a common price or cost per unit (e.g., $35 per hour for a nurse, and $23 for a TB test), and an appropriate overhead rate (e.g., 25%). These can be combined to estimate the value of the resources required to deliver the service.

The aim of this study is to estimate the cost of delivering TB and child immunization services in three rural LHDs in California. TB control is a service that LHDs are currently *mandated* to perform, but treatment in theory could be shared with

the private sector (Ehman et al., 2014). Childhood immunizations are provided mainly by community health centers and private providers, in which HDs playing a more limited role (Groom et al., 2007). An RBC approach is used to estimate the costs of providing immunization and TB services, and then compared to the estimates reported by the corresponding LHD.

## Method

### Participants

The participating LHDs were part of a Public Health Consortium in California, whose members included Health Directors and Health Officers. Three of the LHDs in the Consortium volunteered to participate in the study because they were interested in determining the costs of their tuberculosis (TB) and immunization (IZ) clinics. These three Local Health Departments served clients with similar demographics. All of them are in counties with diverse ethnic populations, and agricultural-related industries as the primary source of employment. According to the U.S. Census Bureau, all three are among counties with the lowest per capita income in California, ranging from $17,797 to $20,231.

An approach with mixed methods was used to identify the process by which services are delivered, the resources associated with each aspect of the delivery system, the number of people using the service, and the outcomes. The approach involved quantitative analysis of existing and primary data and qualitative interviews. The members of the consortium were consulted throughout the process including the development of the tools and the interpretation of the data. The University of California at Merced Institutional Review Board provided ethics approval for the study.

### Outcomes & Resources

Based on initial interviews to determine the clinic processes, clinical and fiscal information were collected from the participating counties for the 2012-2013 fiscal years. The data collection forms were distributed electronically to the Public Health Directors or their designees and responses were returned via email. Primary outcomes measures were collected for the TB clinic, which included tuberculin skin tests (TSTs), positive TSTs, x-rays, laboratory tests, treatment started, and treatment completed. Collected data included the number of immunized children, the number of full-time equivalents (FTEs) assigned, sources of revenues, and total budget from both immunization clinics.

### Resource Based Costing

The cost of the resources needed for TB control and child immunization services was estimated by the following steps. Firstly, the service process was identified. Secondly, the resources were identified to estimate the cost at each stage of the service process. Thirdly, the total cost per client was estimated based on the service process and resources, which was multiplied by the total number of clients in each county.

## Process Maps

Semi-structured interviews in each LHD were used to identify the pathway by which children were immunized; as well as the members of the public that were screened and treated for TB. The interview began with the Public Health Director or Assistant Public Health Director, and a snowball method was used to identify key clinical staff. The interviews were transcribed and the information was used to refine process maps for the tuberculosis and immunization clinics. The research team then developed the resulting maps, which detailed the process by which individuals received immunizations or TB testing and treatment. The resulting process maps were shown to the appropriate clinical staff to verify key steps in the processes and clarify areas of uncertainty.

Participating counties reported eight major steps relating to their immunization clinic: client registration, review of documents and data entry into the immunization registry, counseling, preparing the vaccines, injecting the vaccines, administrative duties relating to managing the vaccines, and administrative services for clients. In the TB clinic, the participating counties had nine steps: client registration, screening and/or placement of TSTs, reading the TSTs results, entering data into TB registry and health education, confirmation tests, case decision, latent tuberculosis infection treatment, case management, and case closure.

The process maps were developed showing the pathways that patient/clients were followed to reach each potential outcome node. For TB control, outcomes included clients either being screened and tested negative; screened and tested positive, but did not receive follow up testing; screened and tested positive, received a follow up test and tested negative; screened and tested positive, received a follow up test, tested positive but did not complete treatment; or screened and tested positive, received a follow up test, tested positive, and completed treatment. For immunizations, outcomes were that the client was given the immunization.

## Resources Required for Each Stage of the Process

During the interviews, participants were asked to identify the types of resources required to complete the stage of the process. For those activities deemed key to the process, time-and-motion surveys were administered. The time-and-motion surveys were designed with input from key staff, such as program managers, clinic managers, and clinic supervisors at the participating LHDs. The final surveys were distributed first to clinical managers who were trained to complete the forms so that they can serve as the on-site expert for staff during the data collection. The paper surveys were given to all staff involved in the delivery of the clinical service to be studied. Time and motion surveys for the TB clinics were collected in February and March 2014, and in May 2014 for the Immunization clinics.

All staff working in the clinics were asked to the document the time it took to perform key activities during each encounter with clients during the assigned week. Surveys were dropped off at the clinics at a convenient time a few days before the data collection period. The research team collected the surveys immediately after the data collection week was completed. Collectively for the TB clinics, 31 staff at the three sites

completed the time and motion surveys for 774 client encounters. For the Immunization clinics, 17 staff at three sites completed the time and motion surveys for 296 client encounters. Information on staff that completed the surveys, mean salaries and benefits, and activities in the TB and immunization clinics are shown in Table 8 and Table 9. Unit prices were obtained from the LHDs or their Human Resources Department, and were in USD $2012.

Table 3.1. Resources consumed in TB Clinic.

| | | | Average time for LHDs to complete activity (in minutes) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Resource** | **County** | **Average Salary & Benefits (per FTE)** | **Client registration** | **TB Screening** | **TB Skin Test** | **TST Reading** | **Education & Clearance** | **Treatment & Case Management** | **Admin** |
| Clerical Assistant | A | $53,013 | 4 | - | - | - | - | - | |
| | B | $42,475 | 4 | - | - | - | - | - | |
| | C | $40,182 | 10 | - | 16 | - | 7 | - | 138 |
| Medical Assistant | B | $67,880 | 2 | 5 | 89 | 2 | - | 51 | 10 |
| | C | $65,988 | - | - | 4 | - | - | 101 | - |
| Communicable Disease Specialist | C | $82,849 | - | - | 26 | | 15 | 253 | - |
| Licensed Vocation Nurse | A | $59,943 | 2 | 2 | 4 | 1 | 2 | 63 | 28 |
| | C | $74,043 | - | - | 6 | 2 | 2 | - | - |
| Registered Nurse | B | $92,906 | 10 | 8 | 14 | 1 | - | 31 | - |
| Public Health Nurse I/II | A | | - | - | 9 | 2 | 10 | 122 | 14 |
| | B | $90,147 | 2 | 6 | 26 | 2 | - | 25 | 12 |
| | C | | - | - | 5 | 3 | - | 237 | - |
| Supervising Public Health Nurse/Program Manager | A | $118,383 | - | - | 20 | 2 | - | - | 98 |
| | B | $102,784 | 2 | 5 | 6 | - | - | 10 | - |
| | C | $143,917 | - | - | 2 | 2 | - | - | - |
| Physician/TB Controller | A | $283,626 | - | - | - | - | - | 93 | - |
| | B | $163,200 | - | - | - | - | - | 16 | - |
| | C | $174,254 | - | - | - | - | - | 87 | - |
| | | Average time to conduct activity | **4** | **5** | **17** | **2** | **7** | **91** | **50** |

Participating counties were also asked to provide direct cost information such as full-time equivalents (FTEs) and costs of services and supplies, indirect costs, revenues, and allocated clinic budgets. The indirect cost for each clinic was calculated based on the state approved indirect rate (IDR) per FTE. The costs for services and supplies were calculated based on the number of staff assigned to the clinic.

### Total Cost of Immunization or TB Services

The total cost of resources for providing TB or immunization services was calculated by multiplying the total cost of reaching an outcome node by the number of clients who reached that endpoint. The total resource-based cost was the sum of the costs associated with each outcome node.

### Reported Cost in Each County

The cost of child immunization and TB services was also calculated using budget and output information provided by the LHDs. This involved interviews with the program managers to identify clinical outputs, such as number of clients served and the types of services received; and discussions with fiscal staff to review outputs budgeted information, such as expenses for salaries and benefits for assigned staff, costs for clinical supplies, indirect costs, as well as sources of revenues collected. Unlike the RBC method, the Reported Cost method was not based on time-motion studies of resources consumed. Calculations were based on a macro level using budget line items and reported units of service delivered.

Because the county population and the size of the LHDs differed, the results are presented as the cost per county member and cost per case (immunized, screened for TB, or treated for TB). The resulting cost per case was calculated using the RBC approach and the reported costs, and then compared both within a county (resource based vs. reported), and between counties.

## Results

### Clinical Process

The process by which the three LHDs delivered TB (Figure 5.1) and immunization services (Figure 5.2) was very similar. The Resource-Based Costing for the TB clinic was based on activities performed with 273 client encounters in County A, 187 client encounters in County B, and 314 client encounters in County C. For TB services, the standard process involved an individual entering the clinic (typically as a requirement to employment, or entry into an educational institution or a residential facility), going to a desk to register, completing health information forms, and returning them to the reception desk staffed by a clerical or medical assistant. The assistant then verified the completion of the forms and asked the client to pay the TST fee, ranging from zero to $36.20. The individual was then asked to wait until called into an exam room by a medical assistant or

nursing staff. Table 8 shows the average time to complete the registration activity as 4.48 minutes with the range from 1.67 to 10.13 minutes.

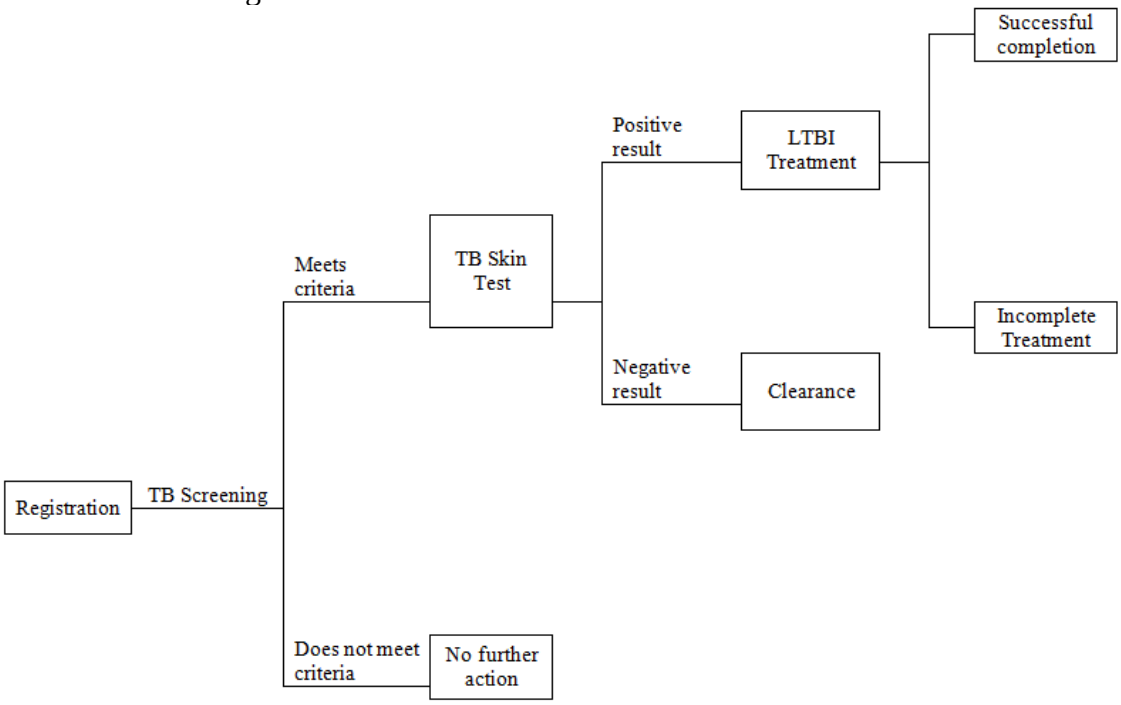


*Figure 3.1.* Process map for TB Clinic.

In the exam room, a brief conversation occurred regarding their medical history using a screening or assessment form. Table 8 shows the average time to screen clients as 5.10 minutes with the range from 1.73 to 8.24 minutes. In most cases, the TB skin test was then administered by a medical assistant or nursing staff (Licensed Vocational Nurse, Registered Nurse, or Public Health Nurse). The individual was asked to return in two days to have the test read. Table 8 shows the average time to perform the TB skin test as 17.30 minutes with the range from 2 to 88.64 minutes.

If the individual returned, they registered at the reception area; and after a brief wait, the individual was shown into an exam room where their skin test was read by a medical assistant or nursing staff. Table 8 shows the average time to read the TST as 1.90 minutes with the range from 1 to 3.13 minutes. If the test result was negative, the individual was given a brief explanation and issued a clearance card verifying their status as free of infectious tuberculosis. If the test result was positive, then the individual was counseled about potentially having latent TB infection, scheduled for a chest x-ray, and to begin prophylactic treatment. Table 8 shows the average time for completing the health education and clearance activity as 7.23 minutes with the range from 2 to 15 minutes.

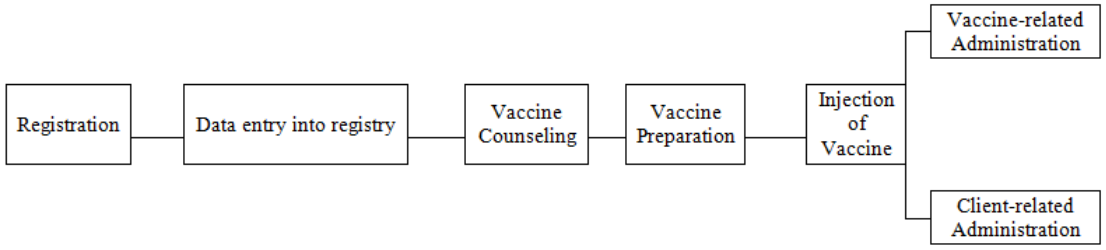


*Figure 3.2.* Process map for Immunization Clinic.

During the period of prophylactic treatment ranging from three to nine months, the medical assistant or nursing staff performed case management duties to ensure that the client was adhering to the medication regimen. Case management duties included assistance with obtaining medication, phone calls, letters, and home visits. The clinical physician periodically reviewed the medical chart and monitored laboratory results to ensure that the client was responding appropriately to the treatment and to prevent adverse outcomes due to the medication regimen. Table 8 shows the average time for treatment and case management activities as 90.71 per client with the range from 10 to 252.5 minutes.

The analysis for the Immunization clinic was based on 87 client encounters in County A, 54 in County B, and 155 in County C. Individuals typically were seeking services because of a school requirement for their children. The process was similar to the TB testing in which individuals initiated the service encounter by approaching the registration desk. After verifying that the child was eligible to receive an immunization, the clerical assistant asked the responsible party to complete an assessment of the child's medical history and other information. After the forms were returned to the registration desk, the family was asked to wait to be called. As shown in Table 9, the average time for the registration activity was 7.67 minutes with the range 2.91 to 12.75 minutes. During the wait, a medical assistant or nursing staff used the California Immunization Registry to verify and enter the needed immunizations. Table 9 shows the average time to conduct this activity as 3.84 minutes with the range 1.33 to 5.60 minutes.

When called, the family was taken to an exam room by a medical assistant or nursing staff that provided brief counseling about the required vaccines. Table 9 shows the average time to conduct this activity in one county as 3.05 minutes. After preparing the vaccines, the clinic staff proceeded to give the injections. Table 9 shows the average time to prepare the vaccines as 3.04 minutes and 3.30 minutes to complete the injections. After the injections, the medical assistant or nursing staff updated the immunization registry; and before exiting the clinic, the family was given an updated immunization card by the registration desk. Table 9 shows the average client-related administrative activities such as translation of immunization cards and linkages to other services as 8.78 minutes with the range 2.73 minutes to 16.75 minutes.

The counties differed in the types of resources used to perform the activities in both clinics, as shown in Table 3.1 and Table 3.2. For the TB Clinic, non-licensed staff in all three sites were restricted to registration activities. Medical assistants were used for all

activities in County B, except to do health education and issue clearance cards. Only County C employed Communicable Disease Specialists, who had similar duties as the Licensed Vocation Nurse in the same county, but costed more in Salary & Benefits. Licensed staff in County C reported time spent performing strictly clinical activities whereas they performed all activities in the TB Clinic in other counties.

For the immunization clinic, clerical staff performed registration in all three counties. County B reported registered nurses and public health nurses performing registration as well. Medical assistants, licensed vocational nurses, registered nurses, and public health nurses performed data entry into the immunization registry, vaccine counseling, preparation, and injection. The medical assistants in County B performed more activities in the immunization clinic than their counterpart in County C. In all counties, the supervising public health nurse/program managers minimally capture their activities spent in immunization clinic during the time-motion study weeks due to vacations and coverage in other areas.

**Cost per Case**

Table 3.3 summarizes the RBCs for the TB Clinic. For County A, the major drivers of cost were the services and supplies at 56% of total TB clinic cost, and indirect costs at 37%. For County B, the significant cost drivers were indirect costs at 46%, and TB Skin Tests at 17%. For County C, the significant cost drivers were indirect costs at 58%, and services and supplies at 25% of total cost. In terms of outcomes, County B had the lowest cost to operate the TB clinic, but the highest number of skin tests performed and the highest number of people initiating LTBI treatment. County C had the highest cost to operate the TB clinic, and the highest number of LTBI treatment completion.

Table 3.2. Comparison of Resource-Based Costs for Immunization Clinic.

| | | | Average time for LHDs to complete activity (in minutes) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Resources** | **County** | **Average Salary & Benefits (FTE)** | **Client registration** | **Data entry** | **Vaccine Counseling** | **Vaccine Preparation** | **Vaccine injection** | **Vaccine Administration** | **Client related admin** |
| Clerical Assistant | A | $53,013 | 3 | - | - | - | - | - | 4 |
| | B | $42,475 | 6 | - | - | - | - | - | 8 |
| | C | $40,182 | 10 | - | - | - | - | - | - |
| Medical Assistant | B | $67,880 | 10 | 4 | - | 2 | 2 | 120 | - |
| | C | $65,988 | - | - | - | - | - | - | - |
| Licensed Vocation Nurse | A | $59,943 | 3 | 6 | - | - | 5 | - | 17 |
| | C | $74,043 | - | 4 | 3 | 2 | 2 | 10 | 3 |
| Registered Nurse | B | $92,906 | 10 | 5 | - | 5 | 4 | - | - |
| Public Health Nurse I/II | B | $90,147 | 13 | 4 | - | - | 3 | - | 13 |
| Supervising Public Health Nurse/Program Manager | A | $118,383 | - | 1 | - | - | - | 1 | - |
| | B | $102,784 | - | - | - | - | - | - | - |
| | C | $143,917 | - | - | - | - | - | - | - |
| | | Average time to conduct activity | 8 | 4 | 3 | 3 | 3 | 44 | 9 |

Table 3.3. Comparison of Resource-Based Costs for TB Clinic.

| **Activity** | **County A** | | **County B** | | **County C** | |
|---|---|---|---|---|---|---|
| | % of Cost | Cost | % of Cost | Cost | % of Cost | Cost |
| Registration | 0.85% | $ 5,025 | 2.71% | $ 4,622 | 0.95% | $ 6,508 |
| Screening | 0.44% | $ 2,620 | 3.52% | $ 6,018 | 0.38% | $ 2,601 |
| TB Skin Test | 2.15% | $ 12,680 | 17.05% | $ 29,125 | 4.49% | $ 30,752 |
| TST Reading | 0.32% | $ 1,868 | 3.43% | $ 5,867 | 0.41% | $ 2,832 |
| Clearance | 2.11% | $ 12,437 | 1.44% | $ 2,458 | 0.16% | $ 1,088 |
| Treatment | 1.97% | $ 11,621 | 11.56% | $ 19,749 | 10.83% | $ 74,111 |
| Services & Supplies | 55.65% | $ 328,420 | 14.63% | $ 25,000 | 25.15% | $ 172,096 |
| Indirect Costs | 36.52% | $ 215,528 | 45.66% | $ 78,015 | 57.62% | $ 394,223 |
| Total Cost | $590,199 | | $170,853 | | $684,211 | |
| **Outcomes** | | | | | | |
| No. people tested for TB (per 100,000) | 959 | | 3323 | | 139 | |
| No. people treated for LBTI (per 100,000) | 29 | | 87 | | 7 | |
| Percent LBTI treatment completion | 27% | | 52% | | 74% | |

Table 3.4 captures the wide variance between RBCs and the reported costs (RCs). For TSTs, the RBCs ranged from $33 to $704 whereas the RCs ranged from $20 to $1,164. The cost per completed treatment using RBC calculations ranged from $1,367 to $85,602 whereas the RCs ranged from $815 to $32,584. The reported treatment completion rate ranging from 27% for County A, 52% for County B, and 74% for County C. To immunize a child, the RBC approach estimated costs ranging from $104 to $608. The highest RBC occurring at this LHD coincided with this county having the highest combined percentage of services & supplies and indirect costs. In comparison, the calculated RCs ranged from $28 to $466. In all three counties, the RBC differs from the RC. For County A, the difference between the RBC and the RC for the major outcomes in the TB and immunization clinics ranged from 23% to 87%. For County B, the difference ranged from 40% to 73% whereas, for County C, the difference ranged from 89% to 129%.

Table 3.4. Differences between Resource-Based Costs and Reported Costs

| | | County A | County B | County C |
|---|---|---|---|---|
| Cost per TB Skin Test | | | | |
| | Resource-Based Cost | $ 704 | $ 33 | $ 509 |
| | Reported Cost | $ 93 | $ 20 | $ 1,164 |
| | *Difference* | $ 611 | $ 13 | $ (665) |
| Cost per LBTI treated | | | | |
| | Resource-Based Cost | $ 23,346 | $ 1,275 | $ 10,526 |
| | Reported Cost | $ 3,083 | $ 760 | $ 24,062 |
| | *Difference* | $ 20,263 | $ 515 | $ (13,535) |
| Cost per completed treatment | | | | |
| | Resource-Based Cost | $ 85,602 | $ 1,367 | $ 14,254 |
| | Reported Cost | $ 11,303 | $ 815 | $ 32,584 |
| | *Difference* | $ 74,299 | $ 552 | $ (18,329) |
| Cost per child immunized | | | | |
| | Resource-Based Cost | $ 608 | $ 104 | $ 165 |
| | Reported Cost | $ 466 | $ 28 | $ 312 |
| | *Difference* | $ 142 | $ 76 | $ (147) |

## Discussion

The purpose of this study was to examine the cost of providing immunization and TB services in three rural counties in California. Both the RBC and the RC approach showed the cost for TB services varied widely across LHDs. In contrast, the RBC for immunization per child was fairly similar in two counties with the third as an outlier. Both the RBC and the RC estimates for childhood immunizations delivered by LHDs were less than the costs noted in previous studies. A recent study of two urban family medicine residency clinics in Salt Lake City, Utah found the variable and fixed cost per child immunized to be $1,085.92, not including non-intervention fixed costs, such as electricity, rent, and phone lines (Jones et al., 2015). A study analyzing the national 2009 immunization program noted that the cost to administer one vaccine dose at a public clinic was $7.20 compared to $25.68 at a private provider (Zhou, 2014). All three participating sites in this study noted that the typical family seeking services in their immunization clinics require multiple vaccines to meet school entry requirements.

During the data collection phase, we observed that some counties could not readily offer direct and indirect cost information for TB or immunization clinics since their department budgets were not constructed based on resources required for specific clinical services. Instead, these budgets were developed for all clinical services offered by the department. We also observed inconsistencies of information provided between program and administrative staff. On occasion, clinical staff either under-reported or were not aware of resources used for the TB or immunization clinic. We attribute these challenges in collecting cost information to the size and structure of the LHDs. We noted that clinical staff in the smaller LHDs had easier access to fiscal info than their counterparts in larger LHDs.

As shown in Table 3.4, the Reported Costs for TB and immunization services were lower than the Resource-Based Costs in County A & B, whereas the reverse was

seen in County C. These lower RC estimates in County A & B are reflective of these clinics consuming more resources than what has been allocated to deliver the needed services to the clients. Estimates for County C showed higher Reported Costs than Resource-Based Costs in their delivery of services. Possible reasons for consuming less resources are that they may be more efficient in delivering TB and immunization services; or they may have less units of service than anticipated by their budget allocation.

Several reasons can be identified that the RBC estimates might differ between LHDs. The RBC used time and salary estimates from each LHD, so that differences in cost can arise from differences in the amount of time spent on each step and/or the salary of the staff. Staff at one site may spend more time performing a function during clinic because of language barrier or the client presenting complex needs that must be addressed. For instance, we noted that the medical assistant in the Immunization Clinic in County B routinely spent significantly more time during the administration of the vaccines because she offered the families additional support and linkages to social and medical services. Comparisons of the average cost per TB case can also vary because of the number of clients found to have active TB. While the results suggesting that higher costs per TB treatment occurred in the county with the higher completion rates, any suggested association between resources spent and outcomes is required to be examined using a larger sample.

The RBC was chosen to estimate the value of the resources required to deliver the service because it provides information on the cost to the LHD given its process and staffing. The study used a RBC rather than the ratio-of-cost-to charges method, which aims to identify reimbursements to revenues (West et al., 1996), because LHD clinics were funded by a number of sources (e.g., state allocations, client fees, and reimbursement from third party payers); and may not be able to stay with a specific activity. In addition, LHDs are mandated to provide TB control, and thus must provide it even if the revenues do not cover the cost.

An alternative cost method is the RVU. The RVU, which forms the basis of Medi-Cal reimbursements, identifies the service process that *should* be delivered, estimates the resources needed to provide the service, and uses a common valuation to estimate the cost of the service. Thus, it does not describe the actual cost to the LHDs, but rather the cost associated with the most efficient or effective way of delivering the service. This information would be extremely useful to third party payers and other agencies seeking to contract for the services, but would require a different methodology than the one used in this study.

There are several limitations to estimating costs with the RBC approach. The estimates were based on the information provided by the LHDs, and thus were dependent upon the accuracy of self-reports of time and staffing. Which attempts were made to verify the time estimates using administrative records, these were frequently not detailed enough to provide assurance in the reported numbers. In addition, the time-and-motion study period occurred during the spring and thus may not accurately reflect the clinic flows throughout the year. While the results were discussed with the participating Directors, the accuracy of the results cannot be independently verified. Finally, the study

focused on only three LHDs in a particular region of California. The extent to which these results were representative of other LHDs was unknown.

## Implications for LHDS

This study was among the first to use a resource based costing approach to estimate the cost for clinical services delivered in rural local health departments. Although this case study was based on the experience of three rural local health departments, the methods used here could be adopted by other LHDs seeking to understand the cost of their services. This would provide information to LHDs which can be used when deciding whether and how to deliver services to the public.

It is likely that, for the near future, LHDs would continue to face with the decision whether to deliver services either because of legal mandates or because of gaps in the public health system. For instance, while the ACA is expanding the number of people eligible for health care coverage via Medicaid, it remains unclear how undocumented individuals will receive access to preventive health care services. It also remains unclear whether the provider community is prepared to provide services to newly eligible individuals who have been traditionally served by LHDs. These private or community providers may not have the capacity to offer culturally appropriate treatment options or to follow recommended TB treatment protocol for the newly insured individuals. Citing LHDs as having more competency in screening and treating tuberculosis, a recent study recommends close collaboration between LHDs and community providers as a necessary alliance to effectively treat TB patients that should be included in ACA implementation (Ehman et al., 2014).

The three counties participating in the study reported limiting the delivery of TB and childhood immunization services to uninsured clients due to the increase in the number of people with health insurance coverage and decreasing state allocations to LHDs to provide these two clinical services. Only one out of the three participating counties reported challenges for community residents in accessing TB and immunization services at community provider offices. Reported challenges relating to TB included lack of knowledge to diagnose and treat the condition. The reported challenges relating to immunization included lengthy wait for appointments and share of cost for services.

Communities with successful childhood immunization coverage rates were in part due to the LHD organizational structure, leadership, external partnerships providers, policymakers, and health plans (Fairbrother et al., 2000; Ransom et al., 2012).

This study identified additional questions facing Local Health Departments regarding TB and immunization. These questions are whether LHDs should continue to provide these safety net services or instead refer clients to community health centers and other providers; whether LHDs need to build partnership with Managed Care plans to leverage authority to enforce providers to offer TB and immunization services; whether to allocate resources to standardize service delivery and scope to improve efficiency & quality; and whether to standardize cost accounting and budgeting practices for specific clinical services.

## References


Bekemeier, B., Yang, Y., Dunbar, M. D., Pantazis, A., & Grembowski, D. E. (2014). Targeted Health Department Expenditures Benefit Birth Outcomes at the County Level. *American journal of preventive medicine, 46*(6), 569-577. doi:10.1016/j.amepre.2014.01.023

Berlin, M. F., & Smith, T. H. (2004). Evaluation of activity-based costing versus resource-based relative value costing. *J Med Pract Manage, 19*(4), 219-227.

Bernet, P. M., & Singh, S. (2015). Economies of scale in the production of public health services: an analysis of local health districts in Florida. *Am J Public Health, 105 Suppl 2*, S260-267. doi:10.2105/ajph.2014.302350

Corso, P. S., Ingels, J. B., Taylor, N., & Desai, S. (2014). Linking costs to health outcomes for allocating scarce public health resources. *EGEMS (Wash DC), 2*(4), 1128. doi:10.13063/2327-9214.1128

Ehman, M., Flood, J., & Barry, P. M. (2014). Tuberculosis Treatment Managed by Providers outside the Public Health Department: Lessons for the Affordable Care Act. *PLoS One, 9*(10), e110645. doi:10.1371/journal.pone.0110645

Fairbrother, G., Kuttner, H., Miller, W., Hogan, R., McPhillips, H., Johnson, K. A., & Alexander, E. R. (2000). Findings from case studies of state and local immunization programs. *Am J Prev Med, 19*(3 Suppl), 54-77.

Garrett, B., & Gangopadhyaya, A. (2016). *ACA Implementation—Monitoring and Tracking: Who Gained Health Insurance Coverage Under the ACA, and Where Do They Live?* Retrieved from http://www.urban.org/sites/default/files/publication/86761/2001041-who-gained-health-insurance-coverage-under-the-aca-and-where-do-they-live.pdf

Groom, H., Kolasa, M., Wooten, K., Ching, P., & Shefer, A. (2007). Childhood immunization coverage by provider type. *J Public Health Manag Pract, 13*(6), 584-589. doi:10.1097/01.PHH.0000296134.70014.b0

Health, T. f. A. s. (2013). *Investing In America's Health: A State-by-State Look at Public Health Funding and Key Health Facts*. Retrieved from http://healthyamericans.org/assets/files/TFAH2013InvstgAmrcsHlth05%20FINAL.pdf

Jones, K. B., Spain, C., Wright, H., & Gren, L. H. (2015). Improving Immunizations in Children: A Clinical Break-even Analysis. *Clinical Medicine & Research, 13*(2), 51-57. doi:10.3121/cmr.2014.1234

NACCHO. (2014). *2013 National Profile of Local Health Departments*. Retrieved from Washington, DC: http://www.naccho.org/topics/infrastructure/profile/upload/2013-National-Profile-of-Local-Health-Departments-report.pdf

Ransom, J., Schaff, K., & Kan, L. (2012). Is there an association between local health department organizational and administrative factors and childhood immunization coverage rates? *J Health Hum Serv Adm, 34*(4), 418-455.

West, T. D., Balas, E. A., & West, D. A. (1996). Contrasting RCC, RVU, and ABC for managed care decisions. A case study compares three widely used costing methods and finds one superior. *Healthc Financ Manage, 50*(8), 54-61.

Zhou, F. S., A.; Wenger, J.; Messonnier,M.; Wang,LY.; Lopez, A.; Moore,M.; Murphy,T.V.; Cortese, M.; Rodewald, L. (2014). Economic evaluation of the routine childhood immunization program in the United States, 2009. *Pediatrics, 2014 Apr*(133(4)), 577-585. doi: 510.1542/peds.2013-0698.

## 4. Cost Estimation of Sexually Transmitted Disease Services

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## Abstract

***Background*:** Local Health Departments (LHDs) and their system partners play a critical role in controlling the spread of STDs through prevention and treatment services. Little is known about the costs LHDs incur as they continue providing these services in an uncertain environment with continued growth in insurance coverage under the ACA and decreasing federal funding for STD prevention and treatment services.

***Purpose:*** As part of a two-state study on the delivery of STD services by Local Health Departments, this study examined variations in delivering STD clinical services at six different sites and compared the reported costs of these clinics to estimated costs using a resource based costing approach.

***Method:*** All STD programs operated by Local Health Departments in Alabama and California were surveyed about STD prevention, screening, and treatment services, organizational partnerships, and clinic operations. A Resource Based Costing approach was used to estimate the cost of STD clinical services. Sources of data included a web-based survey of LHD STD program directors, key informant interviews of local STD program staff, and administrative records from STD programs.

***Results***: The surveys achieved 97% response rate in Alabama and 93% in California. Small and medium counties were less likely to fund their STD programs separately from other public health programs. Medium and large counties in both states were more likely to receive local support for their STD programs than their small counterparts. Decreases in staffing and closure of STD clinics occurred more in CA than in AL. California counties were more likely to collect fees from clients for STD services and engage in billing insurance for STD services than their AL counterparts. Cost estimation using available clinic outputs and fiscal data indicate a wide variance between reported costs to provide STD services. Reported cost per client ranged from $40 to $2,682 and cost per assessment ranged from $113 to $481. The resource based cost to operate STD clinics in the six positive deviant counties ranged from $7,573 to $1,513,490. Cost estimation comparing the estimated resource based costs to reported budget yielded only one close approximation.

***Implications:*** The six selected positive deviant counties were generally unable to provide precise data on staffing, client visits, and screening tests. This study encountered limited and inconsistent administrative and fiscal data among the STD clinics that we interviewed and in the collected surveys of local health departments. The use of RBC methods to estimate true and accurate costs will likely require either more labor-intensive time and motion studies or more accurate and improved LHDs clinical and fiscal information system. Such information is needed to help guide LHDs in optimizing models of service delivery.

## Introduction

The Center for Disease Control and Prevention (CDC) estimates that nearly 20 million new sexually transmitted infections occur every year in this country, and account for almost $16 billion in health care costs(CDC, 2015). Preventing sexually transmitted diseases (STDs) continues to be one of the core responsibilities of public health systems. It is a widely accepted view that LHDs and their system partners play a critical role in controlling the spread of STDs (Chesson, H. W., 2006; Hogben et al., 2010; Kimball et al., 1997). The way these services are actually delivered, however, is in profound transition, and varies across jurisdictions. In part following the Institute of Medicine's (IOM) vision for the future of public health, and with the expansion of access to care through health care reform and expanded safety nets, many Local Health Departments (LHDs) are moving away from the direct provision of preventive and clinical services for the underserved (Hsuan et al., 2014); and increasing their focus on public health functions of assurance, assessment, and policy development (Mays, G. P. et al., 2010).

Nevertheless, in most jurisdictions, LHDs still have significant responsibility for preventing, screening and treating STDs (Shah GH, 2014). The 2013 National Profile of Local Health Departments reported 64% of the responding LDH provided STD screening and 60% provided treatment services. Jurisdictions serving the largest populations had the highest percentages of LHDs providing STD screening (92%) and treatment services (87%) (NACCHO, 2014). Others argue that specialized, public STD clinics provide the highest quality STD care at lowest cost, and that they continue to play an important role for vulnerable and stigmatized populations, even post Affordable Care Act (ACA) (de Wit et al., 2015; Golden et al., 2015; Hoover et al., 2015). However, little is known about the costs that LHDs incur as they continue providing these services in an uncertain environment with continued growth in insurance coverage under the ACA and decreasing federal funding for STD prevention and treatment services. According to the National Coalition of STD Directors, the Congress has provided no funding increases for STD programs since 2003, and is considering possible decreases in 2017 (Directors, 2016).

One way to estimate the cost of a service is to examine the financial records of the LHDs. Yet, very few LHDs report annual expenditures at the service-specific level (Berlin et al., 2004; Bernet et al., 2015). There is no standard or mandated procedure for reporting the costs of specific services (Bernet et al., 2015). For instance, while some LHDs may treat STD services as an activity center and assign costs to that activity, others might consider these services to be part of a larger group of clinical services, and not differentiate the resources associated with each activity. In addition, total expenditures can overstate or understate the true cost of providing the service if there are inefficiencies, such as missed appointments, expired supplies, or mixed staffing structure where clinic staff support more than one activity center, or services are part of a larger primary care delivery system.

An alternative is to use a costing method that identifies the value of the resources required to deliver the service. Three commonly used methods in health care are the ratio-of-costs-to-charges method (RCC), the relative value unit method (RVU), and the activity-based costing method (ABC) which is also known as Resource-Based Costing (RBC) (Berlin et al., 2004; West et al., 1996). The RCC examines the ratio of treatment

costs to charges as a way of linking charges to costs, while the RVU approach establishes standard measures of treatment intensity based on the complexity of a procedure, the amount of resources consumed, and the time spent delivering a treatment. In contrast, the ABC method focuses on the cost of resources consumed by different treatments, patient groups, or physicians (West et al., 1996).

While all methods have previously been used to examine the cost of medical practices, medical technologies, and outpatient clinics (Canby, 1995; Demeere et al., 2009; Hsiao et al., 1988; Schulman et al., 1998), ABC and RBC have been noted as having the potential to be the most accurate cost estimation method since it delineates major activities in a process and determines costs associated with these activities (Hsuan et al., 2014; Mays, G. P. et al., 2010; Shah GH, 2014). For STD services, this would require identifying the pathways and outcomes that can result from providing the service, the type and amount of resources associated with each outcome (e.g., staff time), a common price or cost per unit (e.g., $35 per hour for a nurse, and $23 for a syphilis test), and an appropriate overhead rate (e.g., 25%). These are combined with estimates of services provided to estimate the value of the resources required to deliver the service.

As part of a two-state study on the delivery of STD services by Local Health Departments, we examined cost variations in delivering STD clinical services at six different sites, and compared these reported expenditures to the published Medicare rates for STD services.

## Method

The methodology employed multiple sources of data for estimating the volume of specific STD services and associated clinic costs using a RBC approach including a web-based survey of LHD STD program directors, key informant interviews of local STD program staff, and administrative records from STD programs.

### Statewide Survey

STD controllers, health officers, and additional local STD leadership and staff in California (CA) LHDs were surveyed between February and May 2015, to examine the availability and organization of STD services in local jurisdictions. The web-based survey followed a typology used in health systems research (Mays, G. P. et al., 2010) to gather data at the jurisdiction level about availability of STD services. The survey assessed 15 STD prevention, screening, treatment, and follow-up services; as well as measures of county-run STD program funding; organization and staffing, partnerships with other stakeholders, clinic closures and openings; number of dedicated FTE for STD care, numbers of STD clinics funded, and local funding amounts and billing structures. Web-supported survey platform Qualtrics was used for issue and completion of all surveys using respondent panels. Data collected was specified for fiscal year 2014-15.

**Key Informant Interviews Based on Positive Deviance**

Counties were selected for key informant interviews using a "positive deviant" approach to enable insights for dissemination of best practices (Bradley et al., 2009). Since STD incidence rates can reflect prevalence in the community, outbreaks, quality of treatment, contact tracing, and extent of community screening; low or falling rates are not always a clear gold standard for quality. In our research, we used positive deviance to identify LHDs with a broad range of STD services, organizational capabilities, and comparatively low STD rates. We classified jurisdictions as "positive deviants" using a composite measure of deviance derived from five measures selected in consultation with six expert STD services and public health advisors, using a three round modified Delphi expert panel method to prioritize positive criteria and weighing (Escaron et al., 2016). The final Delphi panel results resulted in a composite score of positive deviance score based on the following factors: 1) change in gonorrhea incidence from 2008 to 2013 (weight 0.08); 2) number of routine screening programs reported in the survey for at-risk groups (weight 0.3); 3) Full time equivalents (FTE) per county capita dedicated to STD activities (weight 0.24); 4) reported availability of core STD services on survey (weight 0.3); and 5) operation of >=1 county-run STD clinic (weight 0.08). All LHDs responding to the surveys were assessed for these five measures. Counties with very few STD cases were excluded from the positive deviance scoring procedure.

Eleven "positive deviant" LHDs were recruited for the cost study: five LHDs in California and six in Alabama. STD staff in these LHDs were interviewed about organizational partnerships for STD care delivery, perceptions on county STD trends, and the resources used to provide STD clinic care and partner notification. Counties were recruited for key informant interviews based on their overall positive deviance score and county size criteria. We recruited the top counties in each of three size categories for interviews: 500,000+ as large; 100,000-499,999 as medium; and 25,000-99,999 as small. STD controllers and clinic staff were invited to participate in interviews for 60-90 minutes. A total of eleven sets of key informants were interviewed. During the interviews, the participants were asked to clarify the clinical, fiscal, and administrative information and clinic workflow for STD clinic services during the 2014-15 fiscal year. In addition, participants were asked to complete a cost estimation worksheet. Cost estimation worksheets requested information on sources of revenues, number and type of staffing, type and number of clients seen, STD screening tests provided, type and number of positive STD cases, and number of STD cases treated in the last year. Worksheets were distributed electronically to the Public Health Directors or their designees and responses prior to the interviews and collected during the interviews or returned via emails after the interviews.

In each interview, county key informants were given as a generic clinic flow diagram for STD clinic services to verify the process, identify key personnel involved in the major activities, and estimate the average amount of time needed for the major activities (Figure 6). Interview recordings were transcribed and distributed to the team for analysis. Because key informants had different access to information based on the robustness of their performance and financial tracking systems, we used a cost estimation for STD services based on combined information from the survey and data collected

during the key informant interviews. If requested data were unavailable or unclear, clarifications were made through outreach to key informants and the LHD STD program leadership to obtain additional information or clarification.

### Costing Analysis

The cost to deliver STD clinic services was estimated using information provided by the LHD in the survey and key informant interviews. Data and clinical outputs were used to calculate cost per client screened and treated. These data included total clinic revenues; and the clinical outputs included number of clients served, number and types of STD screening tests given, number of positive cases, and number of clients treated. We compared the reported costs to published regional Medicare reimbursement rates for STD services, which included a level 3 office visit for new patients counseling during the visit, and laboratory tests to screen for gonorrhea/chlamydia, syphilis, HIV, and Hepatitis C.

## Results

All LHD STD programs in 68 and 61 jurisdictions in Alabama and California, respectively, were surveyed between February-August 2015 about their services during the year 2014. The survey included questions regarding STD prevention, screening, and treatment services, organizational partnerships, and clinic operations. The surveys achieved 97% and 93% response rates in AL and CA, respectively.

Table 12 summarizes the operational characteristics of local STD programs in FY 2014. Funding for STD programs varied between small and medium counties and their larger counterparts. Small and medium counties were less likely to fund their STD programs separately from other public health programs. Of the survey responses, 29% of small CA counties, 11% of small AL counties, 28% of medium CA counties, and 30% of medium AL counties reported that funding for their STD program is funded separately from their HIV, Tuberculosis, Hepatitis, Family Planning, or Communicable Disease programs, compared to 53% of large CA counties and the large county in AL. Medium and large counties in both states were more likely to receive local support for their STD programs than their small counterparts. Of the survey responses, 91% STD programs in large CA counties, 100% in AL, 86% in medium CA counties and 100% in AL counties received local funding, compared to 33% of the small CA counties and 6% of the small AL counties.

Decreases in staffing and closure of STD clinics occurred more in CA than in AL. Of the total responses from CA counties, 35% reported clinic closures in the past 10 years, compared to 3% of all AL counties. Of the total responses 54% of CA counties reported a decrease in Full Time Equivalents (FTE) over the past 5 years, compared to 14% of AL counties. Medium counties in both states reported the highest number of STD clinics closure and decrease in FTEs.

Collection of fees from clients varied widely. In California, only 9% of small county survey respondents reported collecting fees from clients for STD services, compared to 42% of medium counties and 0% in large counties. In comparison, none of 54 small county respondents in Alabama reported collecting client fees, and only one out of 11

medium county respondents observed the practice. More CA counties engaged in billing public and private insurance than their AL counterparts. Only 6% of the small counties in Alabama reported billing public insurance and private insurance companies for STD services, whereas none of the medium or large counties in the state reported pursuing this revenue source. In CA, 37% of medium counties reported billing public insurance compared to 27% of large and 5% of small counties. Additionally, 21% of CA medium counties billed private insurance companies compared to 7% of large and 0% of the small counties.

Key informant interviews of STD program staff in six positive deviant LHDs, five in CA and 1 in AL, revealed that clients access STD services at these county-operated STD clinics by drop-in or appointment (Table 13 & Figure 6). Four of the five positive deviant LHDs in CA and one from Alabama offered STD services as stand-alone clinics. Clients were registered at the front desk by completing personal and medical history forms. Clients were asked to pay a fee ranging from $0 to $85 for STD screenings; however, none of the clinics denied services if clients were unable to pay. Clients typically waited in the lobby until called into exam room by clinic staff. In the exam room, clinic staff conducted a sexual history, perform the appropriate STD screening tests via blood draws or urine analysis, and may perform a comprehensive STD physical exam if symptoms were present.

The clients also received brief counseling about STDs. Clients diagnosed with a reportable, STD such as gonorrhea, chlamydia, and syphilis, were provided additional counseling, including discussion on partner notification strategies and how to prevent future infections. Clients also received necessary medications and vaccinations, as well as information on follow-up appointments. In selected cases, they are provided expedited partner therapy in some counties. The structure of county running clinics among the selected positive deviant counties varied widely, in which some had large freestanding specialized STD clinics especially in large cities (n=4), some had specific time slots in large primary care clinics (n=1), and others increasingly integrated the clinics into their county centers federally qualified or other health centers (n=1).

We attempted to determine costs through less intrusive methods that do not include direct observation encountered special limitations. Table 14 is a summary of the available cost data from both the survey and key informant interviews. Five out of six positive deviant counties provided complete source revenues for their STD clinic during the key informant interviews. Only two of these six counties could provide data on STD services, such as number of client visits, risk assessments, physical exams, laboratory tests, STD cases, and clients treated. Only three of these counties could provide information on partner notification and partner treatment. Additionally, only two of these six counties provided data on the number of screening tests administered in their survey responses.

Cost estimation using available clinic outputs and fiscal data indicate a wide variance between reported costs to provide STD services across all six counties (Table 15 & Table 16). Cost per client ranged from $40 to $2,682 and cost per assessment ranged from $113 to $481. One of the medium counties interviewed had the highest STD treatment cost per client at $5,328, most likely due to having the lowest number of clients utilizing STD services. The reported budget for fiscal year 2014 to operate STD clinics

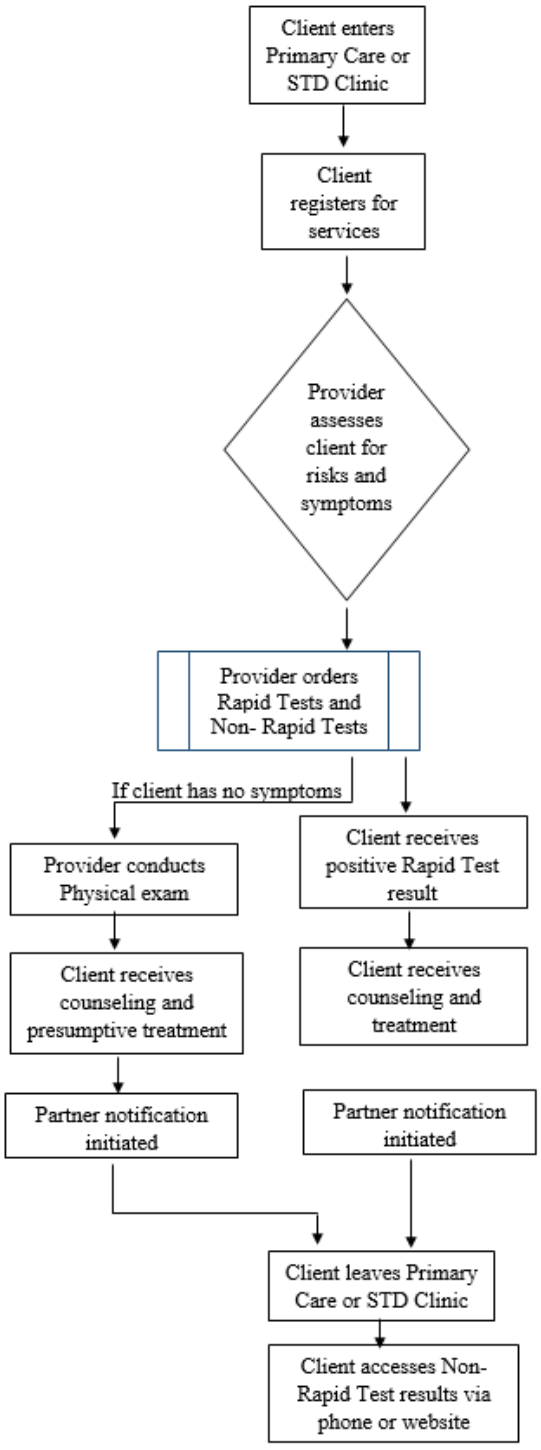


*Figure 4.1*. General work flow for STD Clinic.

Table 4.1. Operational characteristics of local STD programs in 2014.

| | CA Small LHDs[1] | | CA Medium LHDs[2] | | CA Large LHDs[3] | | Total CA LHDs | | AL Small LHDs[4] | | AL Medium LHD[5] | | AL Large LHDs[6] | | Total AL LHDs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | n | % | n | | n | | n | | n | | n | | n | | n | |
| **STD SERVICES** | | | | | | | | | | | | | | | | |
| Provided chlamydia screening tests | 19 | 42 | 11 | 45 | 8 | 88 | 38 | 54 | 35 | 83 | 7 | 86 | 1 | 100 | 43 | 84 |
| Provided syphilis screening tests | 19 | 32 | 9 | 33 | 8 | 88 | 36 | 46 | 35 | 83 | 7 | 86 | 1 | 100 | 43 | 86 |
| Provided HIV screening tests | 21 | 67 | 9 | 67 | 11 | 82 | 41 | 73% | 30 | 80 | 6 | 83 | 1 | 100 | 37 | 81 |
| Provided Hepatitis C screening tests | 20 | 30 | 10 | 30 | 9 | 56 | 39 | 37 | 14 | 0 | 5 | 0 | 1 | 0 | 20 | 0 |
| Opened an STD clinic in the past ten years | 23 | 0 | 19 | 5 | 13 | 15 | 55 | 6 | 54 | 2 | 11 | 0 | 1 | 0 | 66 | 2 |
| Closed an STD clinic in the past ten years | 23 | 17 | 19 | 58 | 13 | 31 | 55 | 35 | 54 | 2 | 11 | 9 | 1 | 0 | 66 | 3 |
| **FUNDING** | | | | | | | | | | | | | | | | |
| STD program funded separately from other public health programs | 21 | 29 | 18 | 28 | 15 | 53 | 54 | 36 | 53 | 11 | 10 | 30 | 1 | 100 | 64 | 16 |
| STD program received local funding | 9 | 33 | 7 | 86 | 11 | 91 | 27 | 73% | 17 | 6 | 2 | 100 | 1 | 100 | 20 | 20 |
| **REVENUES** | | | | | | | | | | | | | | | | |
| Requested client fees for STD services | 22 | 9 | 19 | 42 | 15 | 0 | 56 | 18 | 54 | 0 | 11 | 9 | 1 | 100 | 66 | 3 |
| Billed public insurance for STD services | 22 | 5 | 19 | 37 | 15 | 27 | 56 | 22 | 50 | 6 | 10 | 0 | 1 | 0 | 61 | 5 |
| Billed private insurance for STD services | 22 | 0 | 19 | 21 | 15 | 7 | 56 | 9 | 50 | 6 | 10 | 0 | 1 | 0 | 61 | 5 |
| **STAFFING** | | | | | | | | | | | | | | | | |
| No. of FTEs decreased over the past five years | 19 | 42 | 19 | 58 | 15 | 60 | 53 | 54 | 54 | 13 | 11 | 18 | 1 | 0 | 66 | 14 |
| No. of FTEs stayed the same over the past five years | 19 | 56 | 19 | 32 | 15 | 27 | 53 | 38 | 54 | 72 | 11 | 55 | 1 | 0 | 66 | 68 |

[1]Total CA small LHD respondents: 23

[2]Total CA medium LHD respondents: 19

[3]Total large LHDs respondents: 15

[4]:Total AL small LHD respondents: 54

[5]:Total AL medium LHD respondents: 11

[6]:Total AL Large LHD respondents: 1

Table 4.2. Characteristics of STD clinics in selected California and Ala.

| | Access to services | Organization of services | No. of Sites | Clinical Staff | Self- Pay Fee | Sources of revenues |
|---|---|---|---|---|---|---|
| **Small County A** | By appointment | Stand-alone STD clinic | 1 | PHN, MD | None | Medicaid, F- PACT[1] |
| **Medium County A** | By appointment | Stand-alone STD clinic | 1 | MA, PHN, MD | $50 to $81 | Medicaid, F-PACT, Medicare, private insurance, self-pay |
| **Medium County B** | By appointment | Integrated with Primary Care clinic | 2 | NP, PA, MD | $20 | Medicaid, Self-pay |
| **Large County A** | Drop- in | Stand-alone STD clinic in FQHC | 1 | NP, PA, MD | $25 | Self-Pay |
| **Large County B** | Drop- in | Stand-alone STD clinic | 1 | NP, MD | $10 | F-PACT |
| **Large County C[2]** | By appointment | Stand-alone STD clinic | 1 | MA, PHN, MD | $0 to $5 | Client fees, State & local funding |

[1]Family Planning Access, Care, and Treatment (Family PACT) program administered by Office of Family Planning

[2]Large County C is in Alabama. All other counties are in California

Table 4.3. Available cost data from select positive deviant counties.

| *DATA FROM KEY INFORMANT WORKSHEETS* | | | | | | |
|---|---|---|---|---|---|---|
| **Sources of revenues for STD Clinic, FY 2014** | **Small County A** | **Medium County A** | **Medium County B** | **Large County A** | **Large County B** | **Large County C** |
| Fees or insurance reimbursement collected for STD services | $4,682 | $25,000 | -77 | -99 | $79,511 | $67,268 |
| State funding for STD Program | $4,728 | $7,000 | $16,579 | $47,000 | $77,481 | $112,500 |
| Health Realignment funding for STD Program | $26,053 | $305 | $543,985 | $0 | -99 | $0 |
| Local General Fund for STD Program | $0 | $127,539 | $0 | -77 | $3,858,949 | $1,830,392 |
| Other funding for STD Program | $0 | $0 | $0 | $0 | $2,858,182 | $67,306 |
| **TOTAL** | $35,463 | $159,844 | $560,487 | $46,824 | $6,874,024 | $2,077,466 |
| **Services Provided in STD Clinic** | | | | | | |
| Number of client visits in STD Clinic | 938 | 411 | 209 | -77 | 17,660 | 18,401 |
| Number of clients who were given risk assessments for STDs | -99 | 411 | 3,068 | -99 | 14,281 | -99 |
| Number of clients who were given physical exams based on the risk assessments | -99 | 70 | 209 | -77 | 13,290 | -99 |
| Number of clients who were given laboratory tests as a result of the risk assessments | 468 | 70 | 322 | -77 | 11,268 | -99 |
| Number of positive gonorrhea cases | 2 | 15 | -77 | -99 | 969 | 610 |
| Number of positive chlamydia cases | 27 | 15 | -77 | -99 | 1,057 | 1,276 |
| Number of clients who were treated for STDs | -99 | 30 | -77 | -99 | 4,084 | -99 |
| Number of clients who were referred to an outside agency for treatment? | -99 | 1 | 0 | 0 | 0 | -99 |
| Number of partner notifications initiated? | -99 | 7 | 70 | -77 | 0 | 1,093 |
| Number of partner notifications completed? | -99 | 7 | -77 | -77 | 0 | 995 |
| Number of partners received treatment? | -99 | -99 | -77 | -77 | 0 | 991 |
| Number of partners declined treatment? | -99 | 0 | -77 | -77 | 0 | 4 |
| Number of partners referred for treatment? | -99 | 7 | -77 | -99 | 0 | -99 |
| *DATA FROM SURVEY* | | | | | | |
| Number of STD Clinics | 1 | 1 | 2 | 1 | 1 | 1 |
| Number of FTEs in STD clinic | 0.5 | 2.0 | 1.0 | 30.0 | 60.0 | 23.4 |
| Clinic Fees | -99 | $20-$81 | $20 | $25 | $10 | $0-$5 |
| Screening tests administered- Gonorrhea | 250 | -99 | -99 | 2,000 | -99 | 10,300 |
| Screening tests administered- Chlamydia | 250 | -99 | -99 | 2,000 | -99 | 10,300 |
| Screening tests administered- Syphilis | 50 | -99 | -99 | 1,000 | -99 | 16,000 |
| Screening tests administered- HIV | 50 | -99 | -99 | 2,100 | -99 | 16,000 |
| Screening tests administered- Hep C | 0 | -99 | -99 | 700 | -99 | 0 |

Notes:
"-99" denotes a blank response; "-77" denotes "Don't Know" OR "Unable to Provide" as a response

ranged from $37,204 in the smallest jurisdiction to $6,974,123 in the largest LHD (Table 16). Correspondingly, estimated RBC to operate STD clinics in the six positive deviant counties ranged from $7,573 in the smallest LHD to $1,513,490, as one of the large jurisdiction (Table 16). Cost estimation comparing the estimated RBC to reported budget yielded only one close approximation, at a difference of 5% in Medium County A.

Table 4.4. Reported costs for STD Clinics, 2014.

| | No of Clients | No of Assessment | Cost per Client | Cost per Assessment | Cost per client with exam | Cost per Client with laboratory tests | Cost per client treated for STDs |
|---|---|---|---|---|---|---|---|
| **Small County A** | 938 | NA | $40 | NA | $79 | NA | $1,860 |
| **Medium County A** | 411 | 411 | $389 | $389 | $2,283 | $2,283 | $5,328 |
| **Medium County B** | 209 | 3068* | $2,682 | $183 | $2,682 | $1,1741 | NA |
| **Large County A** | NA | NA | NA | NA | NA | NA | NA |
| **Large County B** | 17,660 | 14,281 | $389 | $481 | $517 | $610 | $1,683 |
| **Large County C[1]** | 18,401 | 18,401 | $113 | $113 | $113 | $113 | NA |
| **Totals/Ave across all counties** | **37,619** | **36,161** | **$258** | **$267** | **$340** | **$386** | **$1,771** |

NA= Data not available

* All clients visiting the primary care clinic are given an STD assessment

[1]: Large County is located in Alabama. All other counties are in California.

Table 4.5. Estimated costs for STD Clinics, 2014.

| | Estimated Resource-Based Cost (RBC) | Estimated Medicare Reimbursement | Reported Budget | Difference Between Reported Budget and Estimated RBC | % Difference between estimated RBC and Reported Budget | % Difference between Estimated Medicare Reimbursement and Reported Budget |
|---|---|---|---|---|---|---|
| **Small County A** | $7,573 | $52,350 | $37,204 | $29,631 | -80% | 41% |
| **Medium County A** | $152,635 | NA | $159,844 | $7,209 | -5% | NA |
| **Medium County B** | $28,093 | NA | $560,564 | $532,471 | -95% | NA |
| **Large County A** | $323,806 | $910,703 | NA | NA | NA | NA |
| **Large County B** | $1,513,490 | NA | $6,874,123 | $5,360,633 | -78% | NA |
| **Large County C[1]** | $1,379,838 | $6,902,889 | $2,077,466 | $697,628 | -34% | 232% |

[1]: Large County C is located in Alabama. All other counties are in California

NA: Data was not available to generate an estimation

The six selected positive deviant counties were generally unable to provide precise data on staffing, client visits, and screening tests. Data on general staff time needed to conduct STD clinic was provided by only two counties, on risk assessments by 3 counties, and screening tests by two counties. These limitations meant that the RBC method could only be applied in very limited cases. Survey data on overall STD program funding, not specific to the STD clinic, could provide an upper-bound of clinic expenses in some cases.

## Discussion

The purpose of this study was to examine cost variation in STD clinics across positive deviant jurisdictions in CA and AL. Information from a survey of LHDs in CA and AL was used to identify 11 counties that were identified as positive deviant programs with a broad range of STD services, organizational capabilities, and comparatively low STD rates. From these 11 counties, we analyzed the results from six key informant interviews and their survey responses. Analysis of collected data found that most LHDs did not have adequate fiscal or clinical information systems to accurately describe the productivity of their STD clinical activities in terms of clients visited or testing performed, nor to clearly identify the budgetary supports used for those activities.

In a comparison of a large Alabama jurisdiction and five various size jurisdictions in CA found that the reported cost per client in the STD ranging from $40 per client to $2682 (weighted average across counties of $258 per client seen). The average cost per client assessed also varied greatly across the LHDs from a low $113 to $481 (weighted average across counties of $267 per client assessed). The average cost per assessment reported here for Medium County B and Large County C were $183 and $113 respectively, which was lower than what reported in a recent study of a large safety net hospital in Massachusetts, in which the average cost per STD screening was $374 for males and $441 for females (Morgan et al., 2016). Based on the limited data provided by the participating key informants, we compared the reported costs and the estimated costs using an RBC suggested significant variations with Medicare reimbursements. Results suggested costs ranging from only 5% lower than the reported costs to nearly 95% lower (Table 12).

These findings suggest the urgency for improved information systems that permit LHDs to better assess the cost and productivity of their service provision for STDS. Only with improved information can the efficiency of alternative models of service provision be accurately assessed. Alternatively the cost could be assessed using more intensive direct observation or diary techniques (Mays, G. P. , 2014), to quantify resources used and services provided. Several reasons were identified that the RBC estimates might differ between LHDs. Producing accurate estimates of the average cost per client – whether seen or assessed – requires a data collection operation in the clinic, because this enables accurate record and identify the purpose of the clients visit. Based on the information, LHDs will be able to identify the services provided to each client that are associated with STD testing as opposed to their other health concern, and to distinguish initially from follow-up visits. However, this was not achieved even in standalone clinics where clients are only being seen for STDs, and is more complex when the clinics STD operations are not distinct and/or when patients are being seen for multiple issues. Of the six positive deviant LHDs examined in this study, the case numbers and costs for Medium County B might be the most accurate, because the data collection operations appeared to be thorough; and the clinic was dedicated to STD testing and treatment.

Data collected in this study had important limitations. Estimates were based on the information provided by the LHD key informants; and thus, are dependent upon the accuracy of self-reports of time and staffing. Accuracy of reported time and staff effort cannot be independently verified. When attempts were made to verify the information

given in the survey and the key informant interviews, the data were frequently not detailed or were conflicting diminishing confidence in reported numbers. In addition, the data regarding staff time of activity conduction in the STD Clinical process map was shown as average time by management staff rather than staff participating in a time-and-motion study. While the survey component had a very high response rate, it focused only on LHDs in two large and diverse states, and the cost component study focused only on positive deviant counties within those states, which theoretically should have been amongst the best equipped to respond. Due to these limitations, the findings therefore cannot be generalized nationally or statewide in the case of the cost study.

When clinical operations are not separated from other operations, RBC method can be used to identify the pathways, the resources, and thus the costs associated with the STD portion of an assessment. However, developing accurate RBC estimates requires accurate information from key staff. The preferred method of collecting this information, a time and motion study, can be time consuming and requires significant effort of both the staff and the administration of a participating LHD. The current study sought to generate estimates using a simplified key informant interview approach. In this approach, staff were asked to describe the pathway and estimate the amount of staff time and resources associated with each pathway, and to provide specific key indicators separately; but we had limited success. The limit is that the collected information is not as accurate as those obtained using a time and motion study, and RBC estimates should be viewed in this light. Comparisons of the average cost per assessment or STD treatment can also vary because of the number of unduplicated clients, the number of assessments offered, the types of laboratory tests used to screen, and the variability in activities during the provision of services. Some jurisdictions may also utilize higher level of personnel to perform the activities.

The six counties selected to participate could not readily offer detailed fiscal and client information, such as direct and indirect cost information for STD clinic services or the number of specific STD services provided to clients. Fiscal information was not readily available since the department budgets were not constructed based on resources required for specific services, such as STD clinics. One key informant reported that the resources for all his public health programs were so intertwined that it would be impossible to separate them for the cost accounting of his STD clinic. We also observed inconsistencies of information provided between program and administrative staff. Occasionally, clinical staff were either under-reported or unaware of resources used for the STD clinic. Size and structure of the LHDs may contribute to these problems; for example, large LHDs may provide limited information, because clinical staff in smaller LHDs may have easier access to fiscal information than their counterparts in larger LHDs.

It is likely that, for the near future, LHDs may continue to face with the decision whether to deliver STD services either because of legal mandates or gaps in the health care system. For instance, while the ACA is expanding the number of people eligible for health care coverage through Medicaid and the exchanges, it remains unclear how undocumented individuals access preventive health care services. It also remains unclear whether the provider community is prepared to provide services to newly eligible individuals who have been traditionally served by LHDs. Private or community providers

may not have the technical or cultural competency to offer appropriate treatment options or to follow recommended STD treatment protocol for lesbian, gay, bisexual or transgender individuals; those at high risk of STDS; or those newly insured individuals in general.

A recent study concludes that patients continue to choose STD clinics for services because of the convenience, low-cost, and expert care (Hoover et al., 2015). Another study identifies a substantial need for STD services for the projected 4.7 million of uninsured people needing such services (Gift et al., 2015). Annual national STD incidence rates in the United States have not declined in recent decades, and it continues to be a major source of health disparities (Ozer et al., 2005). Moreover, recent evidence indicates that increases in STD prevention funding are associated with reductions in gonorrhea (Chesson, H. W. et al., 2005) and syphilis (Chesson, H. et al., 2008) incidence rates. This current research suggested that resources available to LHDs and their system partners can affect the reachability, efficiency and effectiveness of STD prevention programs. Understanding the costs of alternative models of service delivery both for public provision of STD services and for delivery by community partners, such as nonprofit FQHCs, family planning centers and private providers will be a key to resolve the puzzle and identify the best practices for the future.

## Implications for LHDS

This study is among the first to seek to use a RBC approach to estimate the cost for clinical services delivered in local health departments. This low-cost simplified approach based on key informant interviews and survey data collection encountered limitations. We encountered limited and inconsistent administrative and fiscal data in the STD clinics interviewed and in the collected surveys of local health departments. The use of RBC methods to estimate true and accurate costs will likely require either more labor-intensive time and motion studies or more accurate and improved LHDs clinical and fiscal information system. Such information is needed to help guide LHDs in optimizing models of service delivery.

## References


Allen, S. M., Ballweg, R. A., Cosgrove, E. M., Engle, K. A., Robinson, L. R., Rosenblatt, R. A., . . . Wenrich, M. D. (2013). Challenges and opportunities in building a sustainable rural primary care workforce in alignment with the Affordable Care Act: the WWAMI program as a case study. *Acad Med, 88*(12), 1862-1869. doi:10.1097/acm.0000000000000008

Beatty, K., Harris, J. K., & Barnes, P. A. (2010). The role of interorganizational partnerships in health services provision among rural, suburban, and urban local health departments. *J Rural Health, 26*(3), 248-258. doi:10.1111/j.1748-0361.2010.00285.x

Bekemeier, B., Pantazis, A., Yip, M. P., & Kwan-Gett, T. (2017). Developing the Evidence for Public Health Systems to Battle Vaccine Preventable Disease at the Local Level: Data Challenges and Strategies for Advancing Research. *J Public Health Manag Pract, 23*(2), 131-137. doi:10.1097/phh.0000000000000411

Bekemeier, B., Yang, Y., Dunbar, M. D., Pantazis, A., & Grembowski, D. E. (2014). Targeted Health Department Expenditures Benefit Birth Outcomes at the County Level. *American journal of preventive medicine, 46*(6), 569-577. doi:10.1016/j.amepre.2014.01.023

Berlin, M. F., & Smith, T. H. (2004). Evaluation of activity-based costing versus resource-based relative value costing. *J Med Pract Manage, 19*(4), 219-227.

Bernet, P. M., & Singh, S. (2015). Economies of scale in the production of public health services: an analysis of local health districts in Florida. *Am J Public Health, 105 Suppl 2,* S260-267. doi:10.2105/ajph.2014.302350

Bolin, J. N., Gamm, L., Vest, J. R., Edwardson, N., & Miller, T. R. (2011). Patient-centered medical homes: will health care reform provide new options for rural communities and providers? *Fam Community Health, 34*(2), 93-101. doi:10.1097/FCH.0b013e31820e0d78

Bradley, E. H., Curry, L. A., Ramanadhan, S., Rowe, L., Nembhard, I. M., & Krumholz, H. M. (2009). Research in action: using positive deviance to improve quality of health care. *Implement Sci, 4*, 25. doi:10.1186/1748-5908-4-25

Caldwell, J. T., Ford, C. L., Wallace, S. P., Wang, M. C., & Takahashi, L. M. (2016). Intersection of Living in a Rural Versus Urban Area and Race/Ethnicity in Explaining Access to Health Care in the United States. *Am J Public Health*, e1-e7. doi:10.2105/ajph.2016.303212

Canby, J. B. t. (1995). Applying activity-based costing to healthcare settings. *Healthc Financ Manage, 49*(2), 50-52, 54-56.

CDC. (2015). *Sexually Transmitted Disease Surveillance 2014*. Retrieved from

Chesson, H., & Owusu-Edusei, K., Jr. (2008). Examining the impact of federally-funded syphilis elimination activities in the USA. *Soc Sci Med, 67*(12), 2059-2062. doi:10.1016/j.socscimed.2008.09.049

Chesson, H. W. (2006). Estimated effectiveness and cost-effectiveness of federally funded prevention efforts on gonorrhea rates in the United States, 1971-2003, under various assumptions about the impact of prevention funding. *Sex Transm Dis, 33*(10 Suppl), S140-144. doi:10.1097/01.olq.0000194575.79728.72

Chesson, H. W., Harrison, P., Scotton, C. R., & Varghese, B. (2005). Does funding for HIV and sexually transmitted disease prevention matter? Evidence from panel data. *Eval Rev, 29*(1), 3-23. doi:10.1177/0193841x04270613

Collins, C. (2015). Rural health care: redefining access. *N C Med J, 76*(1), 20-23.

Corso, P. S., Ingels, J. B., Taylor, N., & Desai, S. (2014). Linking costs to health outcomes for allocating scarce public health resources. *EGEMS (Wash DC), 2*(4), 1128. doi:10.13063/2327-9214.1128

CSAC. (2013). *California State Association of Counties Reader's Guide to AB 85*. Retrieved from Sacramento:

CSAC (2017, February 24, 2017). [Dismantling the CCI, the County IHSS MOE, and Shifting IHSS Collective

Bargaining to Counties].

Current Status of State Medicaid Expansion Decisions. (2017). *State Health Facts.* Retrieved from http://kff.org/health-reform/slide/current-status-of-the-medicaid-expansion-decision/

de Wit, G. A., Over, E. A., Schmid, B. V., van Bergen, J. E., van den Broek, I. V., van der Sande, M. A., . . . Kretzschmar, M. E. (2015). Chlamydia screening is not cost-effective at low participation rates: evidence from a repeated register-based implementation study in The Netherlands. *Sex Transm Infect, 91*(6), 423-429. doi:10.1136/sextrans-2014-051677

Demeere, N., Stouthuysen, K., & Roodhooft, F. (2009). Time-driven activity-based costing in an outpatient clinic environment: development, relevance and managerial impact. *Health Policy, 92*(2-3), 296-304. doi:10.1016/j.healthpol.2009.05.003

DeVoe, J. E., Krois, L., & Stenger, R. (2009). Do children in rural areas still have different access to health care? Results from a statewide survey of Oregon's food stamp population. *J Rural Health, 25*(1), 1-7. doi:10.1111/j.1748-0361.2009.00192.x

Directors, N. C. o. S. (2016). New CDC Surveillance Shows STDs Surge to 20 Year High [Press release]. Retrieved from http://www.ncsddc.org/who-we-are/press-releases/new-cdc-surveillance-shows-stds-surge-20-year-high

Douthit, N., Kiv, S., Dwolatzky, T., & Biswas, S. (2015). Exposing some important barriers to health care access in the rural USA. *Public Health, 129*(6), 611-620. doi:10.1016/j.puhe.2015.04.001

Ehman, M., Flood, J., & Barry, P. M. (2014). Tuberculosis Treatment Managed by Providers outside the Public Health Department: Lessons for the Affordable Care Act. *PLoS One, 9*(10), e110645. doi:10.1371/journal.pone.0110645

Escaron, A. L., Chang Weir, R., Stanton, P., Vangala, S., Grogan, T. R., & Clarke, R. M. (2016). Testing an Adapted Modified Delphi Method: Synthesizing Multiple Stakeholder Ratings of Health Care Service Effectiveness. *Health Promot Pract, 17*(2), 217-225. doi:10.1177/1524839915614308

Esposito, S., Principi, N., & Cornaglia, G. (2014). Barriers to the vaccination of children and adolescents and possible solutions. *Clin Microbiol Infect, 20 Suppl 5*, 25-31. doi:10.1111/1469-0691.12447

Fairbrother, G., Kuttner, H., Miller, W., Hogan, R., McPhillips, H., Johnson, K. A., & Alexander, E. R. (2000). Findings from case studies of state and local immunization programs. *Am J Prev Med, 19*(3 Suppl), 54-77.

Fronstin, P. (2016). *California's Uninsured: Coverage Expands, but Millions Left Behind*. Retrieved from Oakland, CA:

Garrett, B., & Gangopadhyaya, A. (2016). *ACA Implementation—Monitoring and Tracking: Who Gained Health Insurance Coverage Under the ACA, and Where Do They Live?* Retrieved from http://www.urban.org/sites/default/files/publication/86761/2001041-who-gained-health-insurance-coverage-under-the-aca-and-where-do-they-live.pdf

Gift, T. L., Haderxhanaj, L. T., Torrone, E. A., Behl, A. S., Romaguera, R. A., & Leichliter, J. S. (2015). Estimating the Size and Cost of the STD Prevention Services Safety Net. *Public Health Rep, 130*(6), 602-609.

Golden, M. R., & Kerndt, P. R. (2015). What is the role of sexually transmitted disease clinics? *Sex Transm Dis, 42*(5), 294-296. doi:10.1097/olq.0000000000000271

Gore, P., Madhavan, S., Curry, D., McClung, G., Castiglia, M., Rosenbluth, S. A., & Smego, R. A. (1999). Predictors of childhood immunization completion in a rural population. *Soc Sci Med, 48*(8), 1011-1027.

Groom, H., Kolasa, M., Wooten, K., Ching, P., & Shefer, A. (2007). Childhood immunization coverage by provider type. *J Public Health Manag Pract, 13*(6), 584-589. doi:10.1097/01.PHH.0000296134.70014.b0

Hale, N. L., Klaiman, T., Beatty, K. E., & Meit, M. B. (2016). Local Health Departments as Clinical Safety Net in Rural Communities. *Am J Prev Med*. doi:10.1016/j.amepre.2016.05.012

Hartley, D. (2004). Rural health disparities, population health, and rural culture. *Am J Public Health, 94*(10), 1675-1678.

Health, T. f. A. s. (2013). *Investing In America's Health: A State-by-State Look at Public Health Funding and Key Health Facts*. Retrieved from http://healthyamericans.org/assets/files/TFAH2013InvstgAmrcsHlth05%20FINAL.pdf

Hogben, M., Chesson, H., & Aral, S. O. (2010). Sexuality education policies and sexually transmitted disease rates in the United States of America. *Int J STD AIDS, 21*(4), 293-297. doi:10.1258/ijsa.2010.009589

Hoover, K. W., Parsell, B. W., Leichliter, J. S., Habel, M. A., Tao, G., Pearson, W. S., & Gift, T. L. (2015). Continuing Need for Sexually Transmitted Disease Clinics After the Affordable Care Act. *Am J Public Health, 105 Suppl 5*, S690-695. doi:10.2105/ajph.2015.302839

HRSA. (2012). *The Affordable Care Act and Health Centers*.

Hsiao, W. C., Braun, P., Dunn, D., & Becker, E. R. (1988). Resource-based relative values. An overview. *JAMA, 260*(16), 2347-2353.

Hsuan, C., & Rodriguez, H. P. (2014). The adoption and discontinuation of clinical services by local health departments. *Am J Public Health, 104*(1), 124-133. doi:10.2105/ajph.2013.301426

Jones, K. B., Spain, C., Wright, H., & Gren, L. H. (2015). Improving Immunizations in Children: A Clinical Break-even Analysis. *Clinical Medicine & Research, 13*(2), 51-57. doi:10.3121/cmr.2014.1234

Kent, J. (2017). *Summary and Preliminary Fiscal Analysis of the Medicaid Provisions in the Federal American Health Care Act*. Sacramento.

Kimball, A. M., Lafferty, W. E., Kassler, W. J., Hundt, A., MacCornack, R., & Bolan, G. (1997). The impact of health care market changes on local decision making and STD care: experience in three counties. *Am J Prev Med, 13*(6 Suppl), 75-84.

Kimmel, S. R., Burns, I. T., Wolfe, R. M., & Zimmerman, R. K. (2007). Addressing immunization barriers, benefits, and risks. *J Fam Pract, 56*(2 Suppl Vaccines), S61-69.

Leider, J. P., Castrucci, B. C., Russo, P., & Hearne, S. (2015). Perceived impacts of health care reform on large urban health departments. *J Public Health Manag Pract, 21 Suppl 1*, S66-75. doi:10.1097/phh.0000000000000145

Liu, T. C., Chen, C. S., & Chen, L. M. (2002). The impact of National Health Insurance on neonatal care use and childhood vaccination in Taiwan. *Health Policy Plan, 17*(4), 384-392.

Lucia, L., Jacobs, K., Graham-Squire, D., Watson, G., Roby, D., Pourat, N., & Kominski, G. (2015). *A Little Investment Goes a Long Way: Modest Cost to Expand Preventive and Routine Health Services to All Low-Income Californians.* Retrieved from

Manangan, L. P., Moore, M., Macaraig, M., MacNeil, J., Shevick, G., Northrup, J., . . . Qualls, N. (2006). Health Department Costs of Managing Persons With Suspected and Noncounted Tuberculosis in New York City, Three Texas Counties, and Massachusetts. *Journal of Public Health Management and Practice, 12*(3), 248-253.

Mays, G. P. (2014). *Estimating the Costs of Foundational Public Health Capabilities: A Recommended Methodology*

Lexington, KY.

Mays, G. P., McHugh, M. C., Shim, K., Perry, N., Lenaway, D., Halverson, P. K., & Moonesinghe, R. (2006). Institutional and economic determinants of public health system performance. *Am J Public Health, 96*(3), 523-531. doi:10.2105/ajph.2005.064253

Mays, G. P., Scutchfield, F. D., Bhandari, M. W., & Smith, S. A. (2010). Understanding the organization of public health delivery systems: an empirical typology. *Milbank Q, 88*(1), 81-111. doi:10.1111/j.1468-0009.2010.00590.x

Morgan, J. R., Drainoni, M. L., Sequeira, S., Sullivan, M., & Hsu, K. K. (2016). Getting What You Pay For: The Economics of Quality Care for Sexually Transmitted Infections. *Sex Transm Dis, 43*(1), 18-22. doi:10.1097/olq.0000000000000377

NACCHO. (2013). Local health department job losses and program cuts: findings from the 2013 Profile Study. Retrieved from www.naccho.org/topics/infrastructure/lhdbudget/upload/Survey-Findings-Brief-8-13-13-3.pdf

NACCHO. (2014). *2013 National Profile of Local Health Departments*. Retrieved from Washington, DC:

http://www.naccho.org/topics/infrastructure/profile/upload/2013-National-Profile-of-Local-Health-Departments-report.pdf

NACCHO. (2016). *2016 National Profile of Local Health Departments*. Retrieved from

Ortiz, J., Meemon, N., Zhou, Y., & Wan, T. T. (2013). Trends in rural health Clinics and needs during U.S. health care reform. *Prim Health Care Res Dev, 14*(4), 360-366. doi:10.1017/s1463423612000503

Ozer, E. M., Adams, S. H., Lustig, J. L., Gee, S., Garber, A. K., Gardner, L. R., . . . Irwin, C. E., Jr. (2005). Increasing the screening and counseling of adolescents for risky health behaviors: a primary care intervention. *Pediatrics, 115*(4), 960-968. doi:10.1542/peds.2004-0520

Ransom, J., Schaff, K., & Kan, L. (2012). Is there an association between local health department organizational and administrative factors and childhood immunization coverage rates? *J Health Hum Serv Adm, 34*(4), 418-455.

Rodriguez, H. P., Chen, J., Owusu-Edusei, K., Suh, A., & Bekemeier, B. (2012). Local public health systems and the incidence of sexually transmitted diseases. *Am J Public Health, 102*(9), 1773-1781. doi:10.2105/ajph.2011.300497

Rodriguez, H. P., McCullough, J. M., & Hsuan, C. (2014). Local Health Department Collaborative Capacity to Improve Population Health. *Front Public Health Serv Syst Res, 3*(4), 7.

Schulman, K., Burke, J., Drummond, M., Davies, L., Carlsson, P., Gruger, J., . . . Glick, H. (1998). Resource costing for multinational neurologic clinical trials: methods and results. *Health Econ, 7*(7), 629-638.

Shah GH, L. H., Sotnikov S. . (2014). Public Health Services Commonly Provided by Local Health Departments in the United States. *Frontiers in Public Health Services & Systems Research, 3(1): Article 2.*

Shen, A. K., O'Grady, M. J., McDevitt, R. D., Pickreign, J. D., Laudenberger, L. K., Esber, A., & Shortridge, E. F. (2014). How might immunization rates change if cost sharing is eliminated? *Public Health Rep, 129*(1), 39-46.

Smith, K. (2015). *The Immunization Status of Young Children in California*. Retrieved from Sacramento, CA:

Stewart, A. M., Richardson, O. L., Cox, M. A., Hayes, K. J., & Rosenbaum, S. J. (2010). The Affordable Care Act: US vaccine policy and practice.

Talbot, J. A., Coburn, A., Croll, Z., & Ziller, E. (2013). Rural considerations in establishing network adequacy standards for qualified health plans in state and regional health insurance exchanges. *J Rural Health, 29*(3), 327-335. doi:10.1111/jrh.12012

Tan, L. (Producer). (2011, December 15, 2012). Impact of the Affordable Care Act on immunization. Retrieved from http://www.ama-assn.org/resources/doc/public-health/immunization101-tan2.pdf

Thomas, T. L., DiClemente, R., & Snell, S. (2014). Overcoming the triad of rural health disparities: How local culture, lack of economic opportunity, and geographic location instigate health disparities. *Health Educ J, 73*(3), 285-294. doi:10.1177/0017896912471049

West, T. D., Balas, E. A., & West, D. A. (1996). Contrasting RCC, RVU, and ABC for managed care decisions. A case study compares three widely used costing methods and finds one superior. *Healthc Financ Manage, 50*(8), 54-61.

Willis, E., Sabnis, S., Hamilton, C., Xiong, F., Coleman, K., Dellinger, M., . . . Simpson, P. (2016). Improving Immunization Rates Through Community-Based Participatory Research: Community Health Improvement for Milwaukee's Children Program. *Prog Community Health Partnersh, 10*(1), 19-30. doi:10.1353/cpr.2016.0009

Wilson, T. (2000). Factors influencing the immunization status of children in a rural setting. *J Pediatr Health Care, 14*(3), 117-121.

Wright, B., Damiano, P. C., & Bentler, S. E. (2015). Implementation of the Affordable Care Act and rural health clinic capacity in Iowa. *J Prim Care Community Health, 6*(1), 61-65. doi:10.1177/2150131914542613

Wright, B., & Nice, A. J. (2015). Variation in local health department primary care services as a function of health center availability. *J Public Health Manag Pract, 21*(1), E1-9. doi:10.1097/phh.0000000000000112

Zhou, F. S., A.; Wenger, J.; Messonnier,M.; Wang,LY.; Lopez, A.; Moore,M.; Murphy,T.V.; Cortese, M.; Rodewald, L. (2014). Economic evaluation of the routine childhood immunization program in the United States, 2009. *Pediatrics, 2014 Apr*(133(4)), 577-585. doi: 510.1542/peds.2013-0698.

## 5. Conclusion

Local Health Departments are at the crossroads of change. The constant fluctuations in funding and the call to align their operations based on the Ten Essential Services have stimulated Local Health Departments (LHDs) to examine their costs to deliver preventive clinical services. Moreover, the implementation of the ACA has increased the number of people with health care insurance, expanded access to prevention services, and increased the capacity of community health centers to provide care to the underserved. Correspondingly the need and demand for preventive clinical services delivered by LHDs are decreasing. Given these changes, LHDs need to decide to continue to provide these clinical services, outsource these services to community providers, or reallocate their decreasing resources to preventing disease through health education and outreach.

. We engaged directors from Local Health Departments throughout California to partner with us in formulating research questions about the future of local public health departments in delivering preventive clinical services given the constant shift in political and funding landscape. From these conversations, several priority areas were selected for this research because they represent core clinical services offered by Local Health Departments. These priority areas include cost estimations for childhood immunization, tuberculosis, and sexually-transmitted disease clinics. In particular, Local Health Departments in rural areas were concerned about barriers to achieving optimal immunization coverage rates and the need to preserve their clinical services, even though more community members were insured. These rural jurisdictions face an increase in demand for clinical services from lack of timely access to care. We sought to answer these research questions using three different studies.

The first study in this dissertation attempted to provide cost estimation of childhood immunization services using information about revenues and expenses reported by the LHDs. We stratified the results from our state-wide survey by rural and non-rural counties. Based on revenues and expenses reported by LHDs, we estimated the mean annual cost to immunize a child as $256 for rural jurisdictions, compared to $151 for their non-rural counterparts. These results are comparatively less than $1,086 per child noted in a study of two urban family medicine residency clinics in Salt Lake City (Jones et al., 2015).

We also sought to build a predictive model for achieving optimal childhood immunization rates through an analysis of variations and barriers identified by Local Health Departments. The Affordable Care Act has increased the number of children covered by public or private health insurance. However, previous studies noted that achieving acceptable childhood immunization rates is a challenge for children in rural areas (Gore et al., 1999) and access disparities between rural and urban low-income children persist, even after adjusting for health insurance (DeVoe et al., 2009). Our study confirms that disparities in kindergarten rates may be partly due to differences between rural and non-rural local health departments. The key informant interviews and survey results indicate that LHDs in rural counties may experience more barriers in delivering childhood immunization services than their non-rural counterparts. These geographic

variations include more rural LHDs reporting lower immunization coverage rates; barriers such as lack of timely appointments, high cost to provide immunizations, anti-vaccination concerns; and lack of reimbursement for services from both public and private health insurance providers.

Regardless of the limited reimbursement and funding for immunization services, both rural and non-rural LHDs are committed to maintaining or increasing their childhood immunization services. LHDs in rural areas are less likely to discontinue services when residents lack access to care (Hale et al., 2016). Rural LHDs are committed to providing childhood immunizations to maintain or improve immunization rates, especially to underserved populations. As demonstrated in our predictive model, several practices have positive impact on kindergarten immunization rates. These practices are referring to private providers, contracting with private insurance, engaging in collaborative relationships with external agencies, and offering immunization services to privately insured children. The results show some differences in immunization rates for rural versus non-rural as measured by CMSP membership. Further work should focus on what drives the differences. For example, rural counties were less likely to engage in collaborative behavior; but collaboration was found to be statistically significant in raising immunization rates in rural counties by an average of 12.7%.

The second study is a cost estimation study of childhood immunization and tuberculosis treatment services delivered by three Local Health Departments in the San Joaquin Valley using a resource based cost methodology as a comparison to the reported costs. Unlike the first study where cost estimation for childhood immunization services were based solely on information reported about revenues and expenses, the second study included cost estimations from observing resources consumed during the process of providing the services. Cost estimations using both the Resource Based Costing (RBC) and the Reported Cost (RC) approach showed a wide variance in costs in service provision.

Using the RBC approach, we found that the cost for TB screening and treatment services varied widely across the three Local Health Departments, ranging from $33 per tuberculin skin test to $704; and $1,275 to $23,346 per Latent Tuberculin Infection treatment. This wide variance in cost was reflected in another study with Local Health Departments in three states where the range to treat suspected TB patients was $363 in New York City, $1,108 in Texas counties, and $3,330 in Massachusetts (Manangan et al., 2006). In contrast, the RBC for immunization per child was fairly similar in two counties as $104 and $165. Both the RBC and the RC estimates for childhood immunizations delivered by LHDs were less than the costs incurred in non-LHDs as noted in previous studies. We hypothesize the wide variance in the cost of tuberculosis screening and treatment may be due to the complex needs of clients seeking the services. We noted the higher resources consumed in certain clinics were due to clients who demonstrated other critical health conditions needing intense case management, or needing additional services, such as translation, health insurance, or housing and general assistance

The third study attempted to estimate the costs to provide sexually transmitted disease services in local health departments of different sizes in California, in comparison with a large Alabama jurisdiction. The purpose of the third study was to examine cost variation in STD screening across six different jurisdictions. Similar to the second study,

cost estimations using both the RBC and the RC approach showed a wide variance in costs to provide STD services. Reported Costs varied widely across the five jurisdictions, increasing correspondingly according to the size of the LHD. A comparison of a large Alabama jurisdiction and five various size jurisdictions in California found that the reported cost per client in the STD ranging from $40 per client to $2682. The average cost per client assessed also varied greatly across the LHDs from low $113 to $481. The average cost per assessment reported for a medium county and a large County was $183 and $113 respectively, which is lower than the amount reported in a recent study of a large safety net hospital in Massachusetts, in which the average cost per STD screening was $374 for males and $441 for females (Morgan et al., 2016) . Based on the limited data provided by the participating key informants, the comparison of the reported costs and the estimated costs suggested significant variations. We concluded that the wide variations in the two costing approaches may be due to lack of access to precise data regarding the organization of the STD clinics, including fiscal and client information

The findings from these three studies provide information and process for LHDs to use when deciding whether and how to deliver preventive clinical services to the public. The last two studies are among the first to use a resource based costing approach to estimate the cost for clinical services delivered by local health departments. The methods used here could be adopted by other LHDs seeking to understand the cost of their services. The findings from the last two studies also suggest the urgency for improved information systems that permit LHDs to better assess the cost and productivity of their provision of preventive clinical services. Although the data from our studies indicate that LHDs can provide services at a lower cost than community health centers or private providers, such as childhood immunizations, screening and treatment of tuberculosis and sexually transmitted diseases, only with improved information can the efficiency of their service provision be accurately assessed.

However, in addition to costs, LHDs need to consider the effects to population health in their decision whether to continue providing clinical services.

It remains unclear whether the provider community is prepared to provide services to newly eligible individuals who have been traditionally served by LHDs. These private or community providers may not have the capacity to offer culturally appropriate treatment options or to follow recommended TB treatment protocol for the newly insured individuals

The findings from childhood immunization t study can also provide information to LHDs on barriers to achieving optimal immunization coverage rates in their communities. The inevitable changes in health care policies on the federal and state levels will likely result in diminishing allocations for public health services, and the predictive model in the third study would suggest that concerted efforts are needed by LHDs to examine the organizational structure, administrative processes, and service delivery models to increase childhood immunization coverage rates. The rural LHDs may need to strengthen partnerships with local stakeholders such as providers and health plans to resolve barriers to timely access, since limited access to immunizations may also indicate limited access to other prevention services.

These three studies have a primary noteworthy limitation: lack of precise cost data for specific services. We encountered limited and inconsistent administrative and fiscal

data in the interviews with staff in all three clinics and in the survey responses from Local Health Departments. LHDs often perceived budgeted revenues and expenses as the true cost of services. It was challenging for LHDs to provide accurate information on resources needed to deliver these three services because the staff, services, and supplies were typically blended in the public health clinic. The cost estimates for childhood immunization, tuberculosis, and sexually-transmitted disease clinics were based on the information provided by the LHDs, and thus are dependent upon the accuracy of self-reports of time and staffing. Attempts were made to verify the time estimates using administrative records; however, these were frequently not detailed enough to provide assurance in the reported numbers.

A recent study examining the relationship between immunization expenditures and county-level immunization coverage and pertussis rates also encountered similar data challenges (Bekemeier, B. et al., 2017). The authors also concluded that the data limitations highlighted the gap in consistent, standardized data that can support critically needed evidence regarding immunization rates and disease. Clear delineation of resources consumed will be critical for relevant and accurate cost estimations of services. Small LHDs interested in refining their cost accounting for specific services should consider adopting systems developed in other jurisdiction that can capture detailed revenues, costs, and outcomes for specific clinics. Based on the dissemination of our preliminary results shortly after the studies were completed, one of the LHDs that participated in the first and second study was able to develop a detailed cost accounting system specific to all of their clinical services. This particular county is now able to articulate the cost to deliver a childhood vaccine, different screening tests and treatment for tuberculosis and sexually transmitted diseases. Since this LHD can compare the actual costs to provide services, they are able to make rational decisions about continuing to deliver specific clinical services, outsource them, or utilize the available funding to link clients to other community providers.

Lastly, our findings from our studies on childhood immunization and STDs support previous studies suggesting that in communities that have high childhood immunization coverage rates, and low sexually transmitted infections are in part due to the LHD organizational structure, leadership, and external partnerships providers, policymakers, and health plans (Beatty et al., 2010; Mays, G. P. et al., 2006; Rodriguez et al., 2014; Wright & Nice, 2015) These results suggest that rural counties may need to strategize on how to re-organize their organizational structure and focus to order to achieve optimal health outcomes, especially in an era of limited resources.

Based on the results and implications of this dissertation, future research should further explore the efficiency of different LHDs in delivering core clinical services by standardizing a cost accounting tool to capture resources consumed by specific clinical service. Additional studies should also engage additional jurisdictions to compare the effects to population health when LHDs maintain core clinical services, outsource them, or reallocate the limited allocation towards health education and outreach. Lastly, additional studies are needed to explore the role and capacity of LHDs to ensure that vulnerable population have timely access to preventive clinical services offered by other safety net providers.

It is likely that LHDs will continue to be faced with the decision whether to deliver services, either because of legal mandates or gaps in the public health system. While the ACA is expanding the number of people eligible for health care coverage via Medicaid, it remains unclear how un individuals will receive access to preventive health care services. In addition, the free preventive care as a provision in the current ACA may be eliminated in the future, thereby potentially more people will seek these services from LHDs. These two pressing conditions may be exacerbated in rural areas, where health care coverage may not guarantee timely access to needed services. The cost information for three core clinical services and the predictive variables for decreasing barriers to these services will hopefully assist LHDs, especially those in rural areas, to make the decision on whether to maintain their preventive clinical services in this changing landscape.

# References

Beatty, K., Harris, J. K., & Barnes, P. A. (2010). The role of interorganizational partnerships in health services provision among rural, suburban, and urban local health departments. *J Rural Health, 26*(3), 248-258. doi:10.1111/j.1748-0361.2010.00285.x

Bekemeier, B., Pantazis, A., Yip, M. P., & Kwan-Gett, T. (2017). Developing the Evidence for Public Health Systems to Battle Vaccine Preventable Disease at the Local Level: Data Challenges and Strategies for Advancing Research. *J Public Health Manag Pract, 23*(2), 131-137. doi:10.1097/phh.0000000000000411

DeVoe, J. E., Krois, L., & Stenger, R. (2009). Do children in rural areas still have different access to health care? Results from a statewide survey of Oregon's food stamp population. *J Rural Health, 25*(1), 1-7. doi:10.1111/j.1748-0361.2009.00192.x

Gore, P., Madhavan, S., Curry, D., McClung, G., Castiglia, M., Rosenbluth, S. A., & Smego, R. A. (1999). Predictors of childhood immunization completion in a rural population. *Soc Sci Med, 48*(8), 1011-1027.

Hale, N. L., Klaiman, T., Beatty, K. E., & Meit, M. B. (2016). Local Health Departments as Clinical Safety Net in Rural Communities. *Am J Prev Med*. doi:10.1016/j.amepre.2016.05.012

Jones, K. B., Spain, C., Wright, H., & Gren, L. H. (2015). Improving Immunizations in Children: A Clinical Break-even Analysis. *Clinical Medicine & Research, 13*(2), 51-57. doi:10.3121/cmr.2014.1234

Manangan, L. P., Moore, M., Macaraig, M., MacNeil, J., Shevick, G., Northrup, J., . . . Qualls, N. (2006). Health Department Costs of Managing Persons With Suspected and Noncounted Tuberculosis in New York City, Three Texas Counties, and Massachusetts. *Journal of Public Health Management and Practice, 12*(3), 248-253.

Mays, G. P., McHugh, M. C., Shim, K., Perry, N., Lenaway, D., Halverson, P. K., & Moonesinghe, R. (2006). Institutional and economic determinants of public health system performance. *Am J Public Health, 96*(3), 523-531. doi:10.2105/ajph.2005.064253

Morgan, J. R., Drainoni, M. L., Sequeira, S., Sullivan, M., & Hsu, K. K. (2016). Getting What You Pay For: The Economics of Quality Care for Sexually Transmitted Infections. *Sex Transm Dis, 43*(1), 18-22. doi:10.1097/olq.0000000000000377

Rodriguez, H. P., McCullough, J. M., & Hsuan, C. (2014). Local Health Department Collaborative Capacity to Improve Population Health. *Front Public Health Serv Syst Res, 3*(4), 7.

Wright, B., & Nice, A. J. (2015). Variation in local health department primary care services as a function of health center availability. *J Public Health Manag Pract, 21*(1), E1-9. doi:10.1097/phh.0000000000000112

## Appendix A
## Study 1 – Variations between Rural and Non-Rural Child Immunization Services in LHDs

### Informed Consent & Child Immunization Survey

Impact of the affordable care act on childhood immunization
Study population: Local Health Departments

### I. Informed consent form

**Purpose and Description of Survey:** The purpose of this survey is to collect information about the effects of the Affordable Care Act on the delivery of childhood immunizations. We are especially interested in the changing role of the local health department in this new era. The information collected through this survey will be used to characterize immunization services available in local health jurisdictions in California. The survey will provide important data to improve childhood immunization coverage in diverse communities. This information is especially critical during shrinking resources and shifting roles in the public health system. The results from this survey will be integrated with other data sources to construct predictive models for childhood immunization services.

**Confidentiality:** Information about local program processes and costs associated with the target services will not be coded, but will be identified by local health jurisdiction. Some of the analysis will include data aggregated according to county size or similar responses. The information to be collected is not confidential or protected by privacy laws. The information will be available to all participants in the study as well as the Robert Wood Johnson Foundation and its agents. Absolute confidentiality cannot be guaranteed, since research documents are not protected from subpoena.

**Right to Refuse or Withdraw:** Participation in this research study is completely voluntary, and will not change the nature of your employment. You have the right to say no. You may change your mind at any time and withdraw your participation. You may choose not to answer specific questions or stop participation at any time. Your decision to participate will have no effect on your employment.

**Benefits and Risk of Participation:** Benefits to your organization may include using research findings, such as the predictive models for childhood immunization services. There are no anticipated risks to your participation in this survey. Your participation is completely voluntary. If you decide to participate, you may withdraw from the survey at any time without penalty. Completing the survey constitutes your consent to participate.

**Contact information:** If you have any questions about this research study, pleas e contact Van Do-Reynoso at 559-416-9489 or via email at vdo-reynoso@ucmerced.edu.

For questions about your rights while taking part in this study call the Office of Research at (209) 383 8655 or write to the Officeof Research,5200 North Lake Rd, UC Merced, Merced, CA 95343. The Office of Research will inform the Institutional Review Board, which is a group of people who review the research to protect your rights.
If you have any complaints or concerns about this study, you may address them to Ramesh Balasubramaniam, Chair of the IRB, at (209) 383-8655
or IRBChair@ucmerced.edu.

We anticipate this will take approximately 20 minutes to complete. Only one respondent from each local health jurisdiction should submit this survey. We appreciate you taking the time to complete this survey!

**II. Questionnaires**

**Q1. Structure and organization of the local health department.**

Please tell us about yourself:

- ❑ Full Name _____
- ❑ Title _____
- ❑ Agency/Program _____
- ❑ Email _____
- ❑ Telephone _____

**Q2. Please select your jurisdiction.**

- ❍ Alameda County
- ❍ Alpine County
- ❍ Amador County
- ❍ Berkeley
- ❍ Butte County
- ❍ Calaveras County
- ❍ Colusa County
- ❍ Contra Costa County
- ❍ Del Norte County
- ❍ El Dorado County
- ❍ Fresno County

- Glenn County
- Humboldt County
- Imperial County
- Inyo County
- Kern County
- Kings County
- Lake County
- Lassen County
- Long Beach
- Los Angeles County
- Madera County
- Marin County
- Mariposa County
- Mendocino County
- Merced County
- Modoc County
- Mono County
- Monterey County
- Napa County
- Nevada County
- Orange County
- Pasadena
- Placer County
- Plumas County
- Riverside County
- Sacramento County
- San Benito County
- San Bernardino County
- San Diego County
- San Francisco County

- ❍ San Joaquin County
- ❍ San Luis Obispo County
- ❍ San Mateo County
- ❍ Santa Barbara County
- ❍ Santa Clara County
- ❍ Santa Cruz County
- ❍ Shasta County
- ❍ Sierra County
- ❍ Siskiyou County
- ❍ Solano County
- ❍ Sonoma County
- ❍ Stanislaus County
- ❍ Sutter County
- ❍ Tehama County
- ❍ Trinity County
- ❍ Tulare County
- ❍ Tuolumne County
- ❍ Ventura County
- ❍ Yolo County
- ❍ Yuba County
- ❍ Other: _____

**Q3. Please select the best description for your local health department.**

| | With a primary care clinic | Without a primary care clinic |
|---|---|---|
| A. A stand-alone health department | ❍ | ❍ |
| B. A health department in a health services agency | ❍ | ❍ |

| | | |
|---|---|---|
| C. A health department in a health & human services agency | ❍ | ❍ |

**Q4. Does your health department offer immunization services to children? (Check all that apply).**

| | Yes | No |
|---|---|---|
| A. With private insurance | ❍ | ❍ |
| B. With Medi-Cal | ❍ | ❍ |
| C. With no health insurance | ❍ | ❍ |

**Q5. Of all the children receiving immunization services from your health department in fiscal year 2014-15, what is the approximate percentage covered by the following?** (Click anywhere on the bar and drag the tab).

_____ A. Percent with private insurance
_____ B. Percent with Medi-Cal
_____ C. Percent who paid cash because they did not have insurance coverage
_____ D. Percent who requested a fee waiver because they did not have insurance coverage and cannot pay cash

**Q6. Do you refer families seeking childhood immunization services to Federally Qualified Health Centers for any of the following reasons?** (Check all that apply)

| | Yes | No |
|---|---|---|
| A. Child has private insurance | ❍ | ❍ |
| B. Child is publicly insured, like Medi-Cal | ❍ | ❍ |
| C. Child has no insurance coverage | ❍ | ❍ |
| D. The referral site is the child's medical home | ❍ | ❍ |
| E. Not applicable –no referrals sent | ❍ | ❍ |

**Q7. Do you refer families seeking childhood immunization services to Rural Health Centers for any of the following reasons?** (Check all that apply)

| | Yes | No |
|---|---|---|
| A. Child has private insurance | ❍ | ❍ |
| B. Child has public insurance, like Medi-Cal | ❍ | ❍ |
| C. Child has no insurance coverage | ❍ | ❍ |
| D. The referral site is the child's medical home | ❍ | ❍ |
| E. Not applicable –no referrals sent | ❍ | ❍ |

**Q8. Do you refer families seeking childhood immunization services to school-based clinics for any of the following reasons?** (check all that apply)

| | Yes | No |
|---|---|---|
| A. Child has private insurance | ❍ | ❍ |
| B. Child is publicly insured, like Medi-Cal | ❍ | ❍ |
| C. Child has no insurance coverage | ❍ | ❍ |
| D. The referral site is the child's medical home | ❍ | ❍ |
| E. Not applicable –no referrals sent | ❍ | ❍ |

**Q9. Do you refer families seeking childhood immunization services to private medical providers for any of the following reasons?** (Check all that apply)

| | Yes | No |
|---|---|---|
| A. Child has private insurance | ❍ | ❍ |
| B. Child is publicly insured, like Medi-Cal | ❍ | ❍ |
| C. Child has no insurance coverage | ❍ | ❍ |
| D. The referral site is the child's medical home | ❍ | ❍ |
| E. Not applicable –no referrals sent | ❍ | ❍ |

**Q10. In addition to the Federally Qualified Health Centers, Rural Health Centers, school-based clinics, and private medical providers, where else do you refer children:**

- ❑ Who have private insurance? _____
- ❑ Who are publicly insured, like Medi-Cal? _____
- ❑ Who have no insurance coverage? _____
- ❑ Who already have a medical home? _____

**Q11. Do you receive referrals for childhood immunizations services from the following organizations?** (Check all that apply)

| | Yes | No |
|---|---|---|
| A. Federally Qualified Health Centers | ❍ | ❍ |

| | | |
|---|---|---|
| B. Rural Health Centers | ❍ | ❍ |
| C. Schools or School-based Clinics | ❍ | ❍ |
| D. Private medical providers | ❍ | ❍ |
| E. Hospitals | ❍ | ❍ |
| F. Community-based organizations | ❍ | ❍ |
| G. Other: | ❍ | ❍ |

**Q12. Approximately what percentage of the total immunizations given to children in your county is done by your local health department?** (Click anywhere in boxes and drag the bar)

_____ A. Vaccinations to infants and children

_____ B. Vaccinations to preteens and teen

**Q13. Approximately what percentage of the following activities in your county is done by your local health department?** (Click anywhere in the boxes and drag the bar)

_____ A. Provider education & support

_____ B. Health education & outreach in the community regarding immunizations

_____ C. Coordinating community coalition or work group on immunization

**Q14. Approximately how many children under 18 years of age do you immunize in a fiscal year?** Please do not include numbers served in your seasonal Flu Clinics or Travel Clinic.

**Q15. Approximately how many adults do you immunize in a year?** Please do not include numbers served in your seasonal Flu Clinics or Travel Clinic.

**Q16. How many full-time equivalents (FTEs) do you have working in your immunization clinic/program?**

❑ Licensed Vocational Nurses _____

❑ Registered Nurses _____

❑ Public Health Nurses _____

- ❑ Medical Assistants (or similar classification) _____
- ❑ Clerical Staff _____
- ❑ Fiscal Staff _____
- ❑ Clinical Supervisors _____
- ❑ Administrative/Management staff _____

**Q17. Are you a contracted provider for childhood immunization services for the following?**

| | Yes | No |
|---|---|---|
| A. Medi-Cal Managed Care | ❍ | ❍ |
| B. Private Insurance | ❍ | ❍ |
| C. Vaccines For Children | ❍ | ❍ |

**Q18. Does your local health department bill Medi-Cal for childhood immunizations?**

- ❍ Yes
- ❍ No

**Q19. Does your local health department bill private insurance for childhood immunizations?**

- ❍ Yes
- ❍ No

**Q20. What is your total annual expenditure to provide immunization services?**

**Q21. Of the total revenues received for immunization services, please approximate the percentage of each source:** (Highlight the tab and drag it)

_____ A. State funding for immunization services

_____ B. Health realignment funding

_____ C. County General Fund

_____ D. Other local funding, such as community or county agencies

_____ E. Reimbursement from private insurance

_____ F. Reimbursement from Medi-Cal

_____ G. Reimbursement from Medicare

_____ H. Fees generated from cash-paying clients

_____ I. Other:

**Q22. Section II: Health insurance coverage for clients seeking immunization services.**

**Q23. How has the number of children with Medi-Cal seeking vaccinations changed in your immunization clinic in the past five years?**

- ❍ Decreased significantly
- ❍ Decreased somewhat
- ❍ Stayed about the same
- ❍ Increased somewhat
- ❍ Increased significantly
- ❍ Don't know

**Q24. How has the number of children without any insurance coverage seeking vaccinations changed in your immunization clinic in the past five years?**

- ❍ Decreased significantly
- ❍ Decreased somewhat
- ❍ Stayed about the same
- ❍ Increased somewhat
- ❍ Increased significantly
- ❍ Don't know

**Q25. How has the number of adults with Medi-Cal seeking vaccinations changed in your immunization clinic in the past five years?**

- ❍ Decreased significantly
- ❍ Decreased somewhat

- ❍ Stayed about the same
- ❍ Increased somewhat
- ❍ Increased significantly
- ❍ Don't know

**Q26. How has the number of adults with private insurance seeking vaccinations changed in your immunization clinic in the past five years?**

- ❍ Decreased significantly
- ❍ Decreased somewhat
- ❍ Stayed about the same
- ❍ Increased somewhat
- ❍ Increased significantly
- ❍ Don't know

**Q27. How has the number of adults without any insurance coverage seeking vaccinations changed in your immunization clinic in the past five years?**

- ❍ Decreased significantly
- ❍ Decreased somewhat
- ❍ Stayed about the same
- ❍ Increased somewhat
- ❍ Increased significantly
- ❍ Don't know

**Q28. Does your health department have a plan related to providing childhood immunization services for the next five years?**

- ❍ We plan to maintain current level of services
- ❍ We plan to decrease current level of services
- ❍ We plan to increase current level of services

**Q29. Does your health department have a plan related to community education and outreach services regarding childhood immunization services for the next five years?**

- ❍ Yes, we have a plan to conduct education and outreach regarding childhood immunization
- ❍ No, we do not have a plan to conduct education and outreach regarding childhood immunization

**Q30. How likely is your health department to convene work groups or coalitions to improve childhood immunization services in the next five years?**

- ❍ Most likely
- ❍ Somewhat likely
- ❍ Neutral
- ❍ Somewhat unlikely
- ❍ Most unlikely

**Q31. Does your local health department have an effective and collaborative partnership with the following agencies to improve the rate of childhood immunization in your county?**

| | Strongly agree | Agree | Neither Agree nor Disagree | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| A. Medical Providers | ❍ | ❍ | ❍ | ❍ | ❍ |
| B. Federally Qualified Centers | ❍ | ❍ | ❍ | ❍ | ❍ |
| C. Rural Health Centers | ❍ | ❍ | ❍ | ❍ | ❍ |
| D. Private Health Insurance Plans | ❍ | ❍ | ❍ | ❍ | ❍ |
| E. Schools | ❍ | ❍ | ❍ | ❍ | ❍ |

| | | | | | |
|---|---|---|---|---|---|
| F. Parent Groups | ❍ | ❍ | ❍ | ❍ | ❍ |
| G. Community Based Organizations | ❍ | ❍ | ❍ | ❍ | ❍ |
| H. Other | ❍ | ❍ | ❍ | ❍ | ❍ |

**Q32. What challenges are you encountering in the delivery of childhood immunization services?**

**Q33. What innovations are you undertaking to maintain or increase childhood immunization services?**

**Q34. What other issues about the delivery of childhood immunization services do you think need to be addressed?**

**Q35. Role of the local health department.** Finally, we would now like to ask you a few questions about the role that you think local health departments should play when it comes to immunizing children. There are no right or wrong answers. We are just interested in hearing your views based on your experiences.

**Q36. Local health department should offer immunization services to children with private insurance.**

❍ Strongly agree

❍ Agree

❍ Neither agree or disagree

❍ Disagree

❍ Strongly Disagree

**Q37. Local health department should offer immunization services to children with public insurance, such as Medi-Cal.**

❍ Strongly agree

❍ Agree

❍ Neither agree or disagree

❍ Disagree

❍ Strongly Disagree

**Q38. Local health department should offer immunization services to children with no insurance coverage.**

❍ Strongly agree

❍ Agree

❍ Neither agree or disagree

❍ Disagree

❍ Strongly Disagree

**Q39. Local health department should refer all children seeking immunizations to Federally Qualified Health Centers, Rural Health Centers, or primary care providers.**

❍ Strongly agree

❍ Agree

❍ Neither agree or disagree

❍ Disagree

❍ Strongly Disagree

**Q40. Local health departments have a role in purchasing and storing vaccines, and then supplying the vaccines to Federally Qualified Health Centers, Rural Health Centers, or primary care providers as needed.**

❍ Strongly agree

❍ Agree

❍ Neither agree or disagree

❍ Disagree

❍ Strongly Disagree

**Q41. If a local health department was to refer all immunizations to Federally Qualified Health Centers, Rural Health Centers, or primary care providers, it would reduce the local health department's ability to respond to outbreaks.**

❍ Strongly agree

❍ Agree

- ❍ Neither agree or disagree
- ❍ Disagree
- ❍ Strongly Disagree

**Q42. Overall, the Affordable Care Act has led to an improvement in childhood immunizations by increasing access to services.**

- ❍ Strongly agree
- ❍ Agree
- ❍ Neither agree or disagree
- ❍ Disagree
- ❍ Strongly Disagree

**Q43. The current state of immunizations in our county is very good or excellent.**

- ❍ Strongly agree
- ❍ Agree
- ❍ Neither agree or disagree
- ❍ Disagree
- ❍ Strongly Disagree

**Q44. Please share any other thoughts you may have regarding childhood immunization services or the role of local health departments in providing this service.**

# Appendix B
## Study 2 - Time Study form for Childhood Immunization Clinic

TIME STUDY **IZ CLINIC**

**NAME OF STAFF:**

**POSITION:**

**DATE:**

**What are you using for timing?**

**(cell phone, clock, etc.)**

| | RECORD MINUTES IT TAKES TO COMPLETE TASKS | | | | | | |
|---|---|---|---|---|---|---|---|
| **Client (Circle N for new; R for returing)** | **Client Registration /Intake** | **Review of forms and Data Entry into CAIR** | **Vax Counseling** | **Vax Preparation** | **Injection** | **# of Vax given** | **Other Services Provided (list)** |
| N R | | | | | | | |
| N R | | | | | | | |
| N R | | | | | | | |
| N R | | | | | | | |
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**DAILY DUTIES**

| | M | Tues | Wed | Thurs | Fri |
|---|---|---|---|---|---|
| Vax pick-up | | | | | |
| Vax Return | | | | | |
| | | | | | |
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**Appendix C**
**Study 2 – Cost Estimation of Child Immunization and TB Services in LHDs**

Sample Time study in TB Clinic

TIME STUDY **FRONT REGISTRATION**

IN MINUTES (How long it takes to complete the activity)

NAME OF STAFF:
POSITION:
DATE:

| Client # | Staff | Type of Service: TST, QFT, Reading, X-ray, Tx initiation, Lab, Meds, Other | Amount of time it takes for Registration | Create medical chart | Check out | Other Tasks (specify) |
|---|---|---|---|---|---|---|
| 1 | | | | | | |
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## Appendix D
## Study 3 - Cost Estimation of Sexually Transmitted Disease Services in Selected LHDs

Interview tool for Cost Estimation of STD Clinics

We are looking to estimate the cost of your STD screening and partner notification efforts using a 'resource based' approach whereby we try to identify the resources that are required for your current efforts and then place cost on those resources. We are collecting similar data from nine other Public Health Departments. This will allow us to aggregate the data and compare them across various clinical sites. However, your information will be private and we will present only aggregated data.

Let's begin. We are looking for two types of information. First, we are looking for information about how your r department delivers STD services. The second type of information we are seeking is related to the number of clients and the types of STD services offered and accepted. We'll use the information to estimate the resources by mapping the activities and processes related to your STD Clinic.

Part 1: The Work Flow for STD clinic

1. This is a basic work flow for a STD clinic at a public health department: Show diagram.
2. What needs to be added or deleted to make this more reflective of your STD clinic?
3. Can you tell me who can perform the major tasks outlined in the workflow?
4. Do you have on-site testing for STDs or do you send out lab work?
5. Do you provide on-site medicine for STDs or does your clinic only write prescriptions for meds?
6. How do clients know about your clinic?
7. About what percentage is referred to you by an external entity such as a provider or non-profit?
8. What are your guidelines for partner notification?
9. What are the methods for how you conduct partner notification? (phone, email, home visit?)
10. What is the average proportion of the types of insurance coverage for STD clients? Public, Private, Uninsured?
11. What are your fees for STD screening, testing, and treatment?

12. How are the STD clinic fees collected?
13. What happens when a client is unable to pay the fees?
14. During this past FY, about how much fees did your STD clinic collect?
15. During this past FY, about how much state funding did you receive for your STD clinic?
16. During this past FY, about how much Health Realignment funding was used by your STD clinic?
17. During this past FY, about how much local General Fund was used by your STD clinic?
18. During this past FY, what other funding was used by your STD clinic?
19. Do you bill MediCal, Medicare, or private insurance?
20. Can you detail the staffing for your STD clinic? (FTEs and classifications)
21. How are revenues and expenses related to STD clinic tracked?
22. Can we get a copy of the budget?
23. Is there any additional information regarding your STD Clinic operations that we haven't covered?

**Part 2. Clients & Services**

| | FY 13-14 | Not Available |
|---|---|---|
| Number of clients visited your STD Clinic during this fiscal period? | | |
| Number of clients who were given risk assessments for STDs? | | |
| Number of clients who were given physical exams based on the risk assessments? | | |
| Number of clients who were given laboratory tests as a result of the risk assessments? | | |
| Number of clients who were treated for STDs | | |
| Number of clients who were referred to an outside agency for treatment? | | |
| Number of partner notifications initiated? | | |
| Number of partner notifications completed? | | |
| Number of partners received treatment?<br>Number of partners declined treatment? | | |
| Number of partners referred for treatment? | | |

Is there additional information regarding clients and services that you feel is important for us to know?