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"Accreditation Preparedness and Health IT Infrastructure & Utilization:
An Assessment of U.S. Local Health Departments"

By

Aisha L. Flores
Degree to be awarded: M.P.H.
Applied Public Health Informatics

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"Accreditation Preparedness and Health IT Infrastructure & Utilization:
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Abstract

"Accreditation Preparedness and Health IT Infrastructure & Utilization:
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By Aisha L. Flores

The ability to attain and use information is critical to designing, establishing, and implementing public health activities. (NACCHO, 2013) Health information is the lifeblood of an effective and sustainable public health program. The Health Information Technology for Economic and Clinical Health (HITECH) Act of 2009 (ref - consumer) recognized this and allocated billions of dollars to hospitals and health care providers. One of the principal objectives of the HITECH Act is to allow the U.S. Department of Health and Human Services to facilitate and hasten the adoption and use of electronic health records (EHRs) and health information exchanges (HIEs). LHD's are facing challenges related to shrinking budgets and new requirements related to the Affordable Care Act and the HITECH Act. It is also imperative that federal funding is made available to foster the development and utilization of HIT and meaningful use within the nation's local health departments. Partnerships and collaborations with community providers along with funding and technical assistance from federal entities to gain HIT capacity and participate in the national voluntary accreditation process will enable LHDs to utilize health care data effectively, mitigate health disparities and improve population health outcomes. While there is ongoing research and limited examination of the topic of public health informatics (PHI) and the role of PHI in the accreditation preparedness of LHDs, this study investigates whether public health informatics implementations can be associated with accreditation preparedness amongst us local health departments based on the NACCHO 2013 LHD national survey. A correlation analysis of the informatics infrastructure score with accreditation preparedness scores are used to identify any associations. The results are meaningful in both areas of public health informatics and health department accreditation in setting priorities for resource distribution as it relates to local health departments going through the accreditation process.

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With Love & Gratitude,

Aisha Flores

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ACRONYMS

AC Accreditation Coordinator
ADA Americans with Disabilities Act
APEXPH Assessment Protocol for Excellence in Public Health
APHA American Public Health Association
ASTHO Association of State and Territorial Health Officials
BOH – Board of Health

CDC – Centers for Disease Control and Prevention
CHA – Community Health Assessment
CBPR – Community-based Participatory Research
CCO – Coordinated Care Organization
CLIA – Clinical Laboratory Improvement Amendments
DHHS – US Department of Health and Human Services
EPA – Environmental Protection Agency
EMS – Emergency Medical Services
EOP – Emergency Operations Plan
ERP – Emergency Response Plan
GIS – Geographic Information System
HEDIS – Health Effectiveness Data and Information Set
HIPAA – Health Insurance Portability and Accessibility Act
HAN – Health Alert Network
HIE – Health Information Exchange
ICS – Incident Command System
IRB – Institutional Review Board
IT – Information Technology
JIC – Joint Information Center
LHD – Local Health Department
LPHS – Local Public Health System
MU – Meaningful Use
MAPP – Mobilizing for Action through Planning and Partnerships
NPHPS – National Public Health Performance Standards
NEDSS – National Electronic Disease Surveillance System
NIMS – National Incident Management System
NPHPS – National Public Health Performance Standards
NACCHO – National Association of County and City Health Officials
NALBOH – National Association of Local Boards of Health
NNPHI – National Network of Public Health Institutes
OSHA – Occupational Safety and Health Administration
PHAB – Public Health Accreditation Board
PHF – Public Health Foundation
PHI – Public Health Information or Public Health Informatics
PHIN –
PIO – Public Information Officer
PSA – Public Service Announcement
QI – Quality Improvement
RHIO – Regional Health Information Organization
SPHS – State Public Health System
SOI – Statement of Intent
TA – Technical Assistance
USC – United States Code

Chapter I | Introduction

Public Health Informatics in Local Health Departments

The ability to attain and use information is critical to designing, establishing, and implementing public health activities. (NACCHO, 2013) Health information is the lifeblood of an effective and sustainable public health program. The Health Information Technology for Economic and Clinical Health (HITECH) Act of 2009 (Rowe, 2012) recognized this and allocated billions of dollars to hospitals and health care providers. One of the principal objectives of the HITECH Act is to allow the U.S. Department of Health and Human Services to facilitate and hasten the adoption and use of electronic health records (EHRs) and health information exchanges (HIEs). (NACCHO, 2013)

EHRs and HIEs are electronic systems that allow healthcare providers and patients to access electronic health information securely. HIEs specifically provide the capability to move health data electronically among disparate healthcare information systems, while still maintaining the meaning of the information being exchanged (Figure 1). (HIMSS, 2013) The goal of a HIE is to enable access and retrieval of clinical data in a safe, timely, effective, efficient, unbiased and patient-centered manner. (HIMSS, 2013)
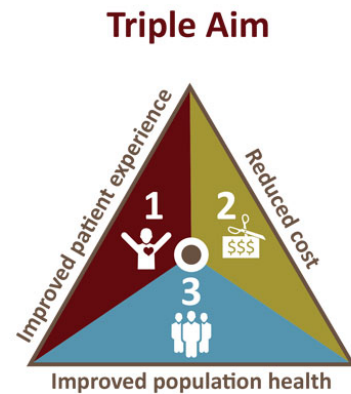
Figure 1 Health Information Exchange Model
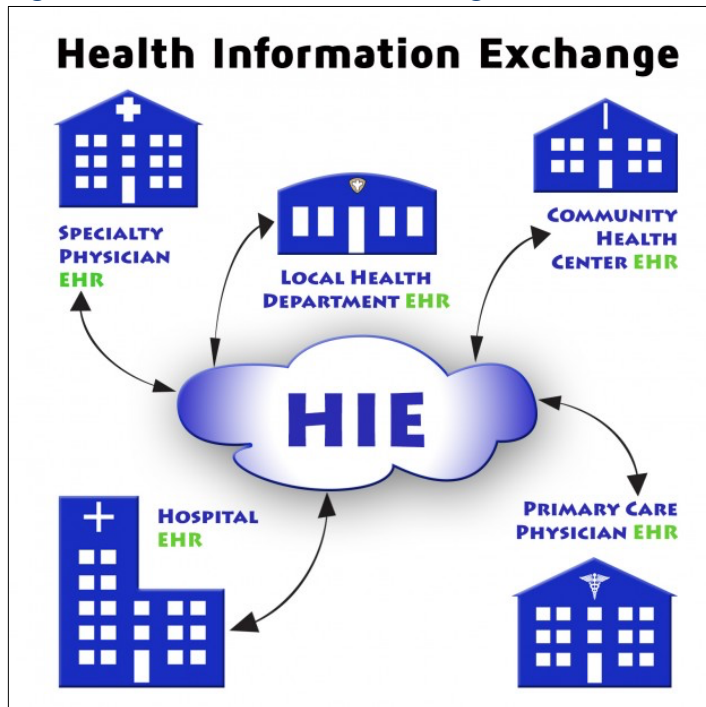
One of the main drivers for the development of HIE's is the Meaningful Use (MU) mandate within the HITECH Act, which provides incentives through CMS to foster the implementation of certified EHR technology by hospitals and other eligible healthcare providers. Many of the Meaningful Use objectives relate directly to the reporting of data to public health agencies. (HealthIT, 2015)

Unfortunately, while many hospital chains in urban centers and other clinical providers realize the benefits of EHRs and HIEs, the same funding has not flowed into many of the nation's 2,800 local health departments (LHDs) to ensure they are also connected to this system of health information technology. As a result, LHDs have taken on significant challenges and financial strain, although they remain an important unit of

analysis for nationwide efforts to boost the adoption and use of health information technology. (NACCHO 2023, Lenert 2012)

Through the use of health information exchanges, LHDs can competently interact with healthcare providers.   Health information exchanges offer promising outcomes by affording LHDs the ability to:

Triple Aim

Source: Institute for Healthcare Improvement

Figure 2

- Effectively interact with healthcare providers

- Observe health trends

- Recognize health hazards

- Administer preventive health services

- Have more competent disaster response and preparedness programs

- Engage in clinical care

The effective use of health information technology (Coffin, 2013) between public health agencies and clinical providers breaks down key barriers in information sharing and allows for better identification and response to toxic exposures and infectious diseases. (Coffin, NACCHO, 2013)

To identify the needs among LHDs, the National Association of County and City Health Officials (NACCHO) surveyed its members to obtain a more accurate picture of health information technology (HIT) needs in local health departments. (NACCHO, 2013)   In 2013, the Centers for Disease Control and Prevention (CDC) and NACCHO produced the NACCHO Informatics Needs Assessment, which is currently the most complete source of data about health information technology and informatics in local health

departments. The results of the survey reveal a need for significant changes in the manner that LHD's access and use technology. (NACCHO, 2013)

National Public Health Accreditation

National public health accreditation sets the standards for the nation's approximately 3,000 state, tribal, local, and territorial public health departments. (CDC, 2015) The Public Health Accreditation Board (PHAB), a nonprofit, para-statal organization, was created to serve as the national public health accrediting body. (CDC, 2015) Established in 2011, PHAB is jointly funded by CDC and the Robert Wood Johnson Foundation. Its priority is to protect and improve public health by advancing the quality and performance of the nation's state, local, tribal, and territorial public health departments. (CDC, 2015) Accreditation by PHAB indicates that a health department is meeting those standards to provide essential public health services in the community. (CDC, PHAB, 2015)

Lack of accreditation can limit funding to an already limited-resource organization, and lack of quality standards can impact health delivery systems. Prior to 2011, there were no nationally recognized standards for public health departments despite the critical role that such standards play in preserving and promoting the health of communities and residents. The accreditation process thus established a mechanism by which LHDs could be evaluated on the effectiveness of their services. (PHAB, 2014; CDPH, 2011) Accreditation of public health agencies thus established a set of benchmarks that LHDs could use to ensure a minimum level of capacity and programming. Accreditation also sought to optimize funding so that local and state public health departments could take

full advantage of monetary and political support for vital programming. LHDs that successfully underwent the accreditation process could yield quality and performance improvements within all public health programs and can become better prepared to react proactively to emerging and reemerging health challenges. (PHAB, 2014)

Benefits of Accreditation

According to a recent evaluation by NORC at the University of Chicago, "health departments accredited for one year agreed that accreditation by PHAB stimulated quality improvement and performance improvement opportunities, encouraged greater accountability and transparency, strengthened management processes, and helped health departments document their capacity to deliver critical public health services to their communities." (RI, 2015)

PHAB Research Agenda | Overarching Questions

The Public Health Accreditation Board (PHAB) is interested in supporting research to cultivate the science base for accreditation and systems change in public health. The research agenda encompasses nine overarching questions, which cover the following areas:

1. Barriers and facilitators to seeking and obtaining accreditation
2. Evaluation and performance of public health departments
3. Metrics for determining the impact of accreditation
4. Benefits and outcomes of public health department accreditation
5. Costs and benefits resulting from accreditation
6. Characteristics of accredited vs. non-accredited health departments
7. Effects of PH accreditation on the public health system at large
8. Impact of accreditation on health outcomes
9. Factors that affect the impact of accreditation vs. the impact of other initiatives

PHAB Current Priorities

These nine areas were prioritized as current or future priorities. The first five areas listed

are current priorities, and the last four areas are listed as future priorities, but are

currently being explored through various initiatives. The areas that influenced our

decision to do this thesis study were an aggregate of these themes:

Barriers and Facilitators

- Incentives for participation in the voluntary accreditation program
- Barriers to participation
- Activities that could improve readiness for accreditation
- Factors that aid in successful accreditation or need for preparation for accreditation
- The direct and indirect impact of dedicated "core" or infrastructure funding on the health department's likelihood to achieve accreditation
- Accreditation standards and measures that are missing
- Impact of grants targeted towards accreditation on health department operations and ability to obtain accreditation (PHAB, 2011)

The following questions are not listed on the previous priorities list, but may be a higher

priority in the future. Due to limited data and the amount of time that the accreditation

program has been in place, the following are not deemed high priority by PHAB

currently:

- What factors are the strongest predictors for being nationally accredited?
- Are jurisdictions that have engaged in broader systems initiatives (e.g. NPHPSP, MAPP, SHIP) better positioned to seek and attain accreditation?
- Are health departments that emphasize emergency preparedness and readiness (e.g., Project Public Health Ready) better positioned to seek and attain accreditation?
- Are health departments with well-developed quality improvement systems better prepared to seek and achieve accreditation?
- Are local health departments more likely to seek accreditation if surrounding health departments are seeking it or have attained it?

- Are health departments that collaborate with schools of public health (e.g., Academic Health Department programs) more likely to achieve accreditation or meet certain standards?
- Does accreditation result in improved performance of health departments undertaking accreditation, or extend to all health departments in general?
- Does the adoption of national standards for accreditation result in funding changes for public health? Does this depend on where the accreditation bar is set?
- To what extent does accreditation have value for federal programmatic initiatives? (PHAB, 2011)

Looking at these various overarching questions and sub-questions on PHAB's research agenda, led us to consider accreditation through an informatics lens. We decided to look at accreditation from the perspective of informatics infrastructure with the available data in these respective areas.

LHD's are facing challenges related to shrinking budgets and new requirements related to the Affordable Care Act and the HITECH Act. It is also imperative that federal funding is made available to foster the development and utilization of HIT and meaningful use within the nation's local health departments. Partnerships and collaborations with community providers along with funding and technical assistance from federal entities to gain HIT capacity and participate in the national voluntary accreditation process will enable LHDs to utilize health care data effectively, mitigate health disparities and improve population health outcomes. ***

Chapter 2 | Literature Review

PHABs National Accreditation Program

Public health department accreditation is defined as "the development of a set of standards, a process to measure health department performance against those standards, and reward or recognition for those health departments who meet the standards." (PHAB, 2012) To accomplish accreditation, a health department must undergo a thorough, multidimensional, peer-reviewed evaluation to assure it reaches or surpasses a well-defined set of quality standards and measures. This evaluation provides valuable and measurable feedback to health departments detailing their strengths and opportunities for improvement. The Standards and Measures document addresses 12 domains (Figure 3) of performance and encompasses activities such as community health assessment, surveillance, investigation, health education, workforce development, quality improvement, enforcement, policy development, emergency response planning, and health department management and administration. (CDC, 2012) The Domains are based on the ten essential functions of public health with the additions of administration and governance. (PHAB, 2013)

Figure 3 - The 10 Essential Public Health Services (CDC, 2014)
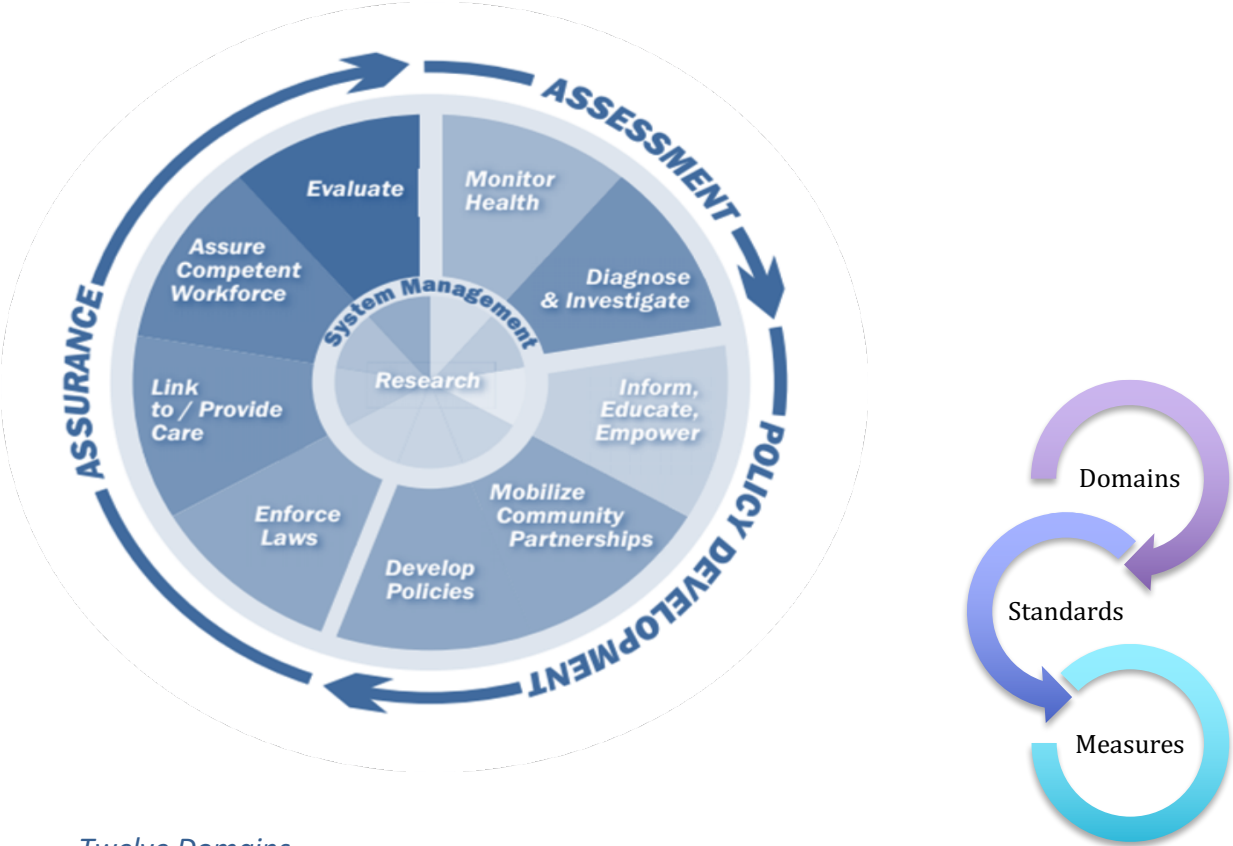
Twelve Domains

The PHAB process outlines 12 domains (Figure 4), which are broken down into a group of standards that pertain to public health services. The first ten domains directly relate to and address the 10 Essential Public Health Services (Figure 3). The health department must satisfy the standards to achieve accreditation. Local health departments meet the standards by demonstrating the measures. For each measure, there are purpose and significance statements which detail what capacity or function is the measure assessing and why the measure is relevant for inclusion in the standards (PHAB, 2013) Each measure also lists the documentation needed to demonstrate conformity, or to meet, the requirements.

All public health departments that apply for accreditation are evaluated based on their submitted documentation that should adhere to the PHAB Standards and Measures Version 1.5. These

serve as the official standards, measures, required documentation, and guidance blueprint for

PHAB national public health department accreditation.

Figure 4. The Twelve PHAB Domains V1.5

Domain 1:	Conduct and Disseminate Assessments Focused on Population Health Status and Public Health Issues Facing the Community
Domain 2:	Investigate Health Problems and Environmental Public Health Hazards to Protect the Community
Domain 3:	Inform and Educate about Public Health Issues and Functions
Domain 4:	Engage with the Community to Identify and Address Health Problem
Domain 5:	Develop Public Health Policies and Plans
Domain 6:	Enforce Public Health Laws
Domain 7:	Promote Strategies to Improve Access to Health Care
Domain 8:	Maintain a Competent Public Health Workforce
Domain 9:	Evaluate and Continuously Improve Processes, Programs, and Interventions
Domain 10:	Contribute to and Apply the Evidence Base of Public Health
Domain 11:	Maintain Administrative and Management Capacity
Domain 12:	Maintain capacity to engage the public health governing entity

source: PHAB Version 1.5 Standards and Measures Document

All of the PHAB domains and measures are relative to this research, but the following specific domains, broken down in Figure 5, were used as our primary focus for developing this thesis.

Figure 5. Relevant PHAB Domains

ASSESS

DOMAIN 1:	Conduct and disseminate assessments focused on population health status and public health issues facing the community
Standard 1.1:	Participate in or Lead a Collaborative Process Resulting in a Comprehensive Community Health Assessment
Standard 1.2:	Collect and Maintain Reliable, Comparable, and Valid Data that Provide Information on Conditions of Public Health Importance and On the Health Status of the Population
Standard 1.3:	Analyze Public Health Data to Identify Trends in Health Problems, Environmental Public Health Hazards, and Social and Economic Factors that Affect the Public's Health
Standard 1.4:	Provide and Use the Results of Health Data Analysis to Develop Recommendations Regarding Public Health Policy, Processes, Programs, or Interventions

INFORM & EDUCATE

DOMAIN 3:	Inform and educate about public health issues and functions
Standard 3.1:	Provide Health Education and Health Promotion Policies, Programs, Processes, and Interventions to Support Prevention and Wellness
Standard 3.2:	Provide Information on Public Health Issues and Public Health Functions Through Multiple Methods to a Variety of Audiences

POLICIES & PLANS

DOMAIN 5:	Develop public health policies and plans
Standard 5.1:	Serve as a Primary and Expert Resource for Establishing and Maintaining Public Health Policies, Practices, and Capacity
Standard 5.2:	Conduct a Comprehensive Planning Process Resulting in a Tribal/State/Community Health Improvement Plan
Standard 5.3:	Develop and Implement a Health Department Organizational Strategic Plan
Standard 5.4:	Maintain an All Hazards Emergency Operations Plan

QUALITY IMPROVMENT

DOMAIN 9:	Evaluate and continuously improve processes, programs, and interventions
Standard 9.1:	Use a Performance Management System to Monitor Achievement of Organizational Objectives
Standard 9.2:	Develop and Implement Quality Improvement Processes Integrated Into Organizational Practice, Programs, Processes, and Interventions

ADMINSTRATION & MANAGEMENT

DOMAIN 11:	Maintain administrative and management capacity
Standard 11.1:	Develop and Maintain an Operational Infrastructure to Support the Performance of Public Health Functions
Standard 11.2:	Establish Effective Financial Management Systems

Source: PHAB Version 1.5 Standards and Measures Document

Accreditation Prerequisites

There are Seven Steps of Public Health Department Accreditation, including 1. Pre-application 2. Application 3. Document Selection and Submission 4. Site Visit 5. Accreditation Decision 6. Reports 7. Reaccreditation. (PHAB, 2015)

Each local health department must complete three agency-wide prerequisites before applying for national accreditation and must submit these three documents (Figure 3) with their application: 1. Community health improvement plan (CHIP) 2. Community health assessment (CHA), and 3. an Agency-Wide Strategic Plan. (CDC, PHAB, 2014) These documents lay the groundwork for health department programs, policies, and interventions, and the remainder of the review for accreditation. (PHAB, 2012).

More than two-thirds of local health departments (LHDs) have completed a CHA within the past five years, and 56 % of LHDs have completed a CHIP (NACCHO, 2013). CHAs and CHIPs can promote a model cycle of identification, analysis, and prioritization of community needs, leading to the implementation of shared goals for health improvement within a community. According to an article by McCullough, there is evidence from studies done in Washington state and Wisconsin that show collaboration with community partners can be a key indicator for successful health assessment and planning processes. Also, performing a CHA can cultivate new and strengthened relationships amongst health departments and partner organizations. (McCullough, Cohen, 2015)

Figure 6. PHAB Prerequisites

Accreditation Prerequisite Definitions according to the Public Health Accreditation Board

Community Health Assessment

Community Health Assessment is defined as regularly and systematically collecting, analyzing, and making available information on the health of a community, including statistics on health status, community health needs, epidemiologic and other studies of health problems, and an analysis of community strengths and resources. (PHAB, 2015)

Community Health Improvement Plan

A Community Health Improvement Plan can be defined as a long-term, systematic effort to address health problems. This plan is used by health and other government education and human service agencies, in collaboration with community partners, to set priorities and coordinate and target resources. (PHAB, 2015)

Agency-wide Strategic Plan

The health department strategic plan is internal to the health department, although may have been developed with input from partners. It shapes and guides what the health department does and why it does it; it sets forth the department's vision, mission, guiding principles and values, and strategic priorities; and describes measurable and time-framed goals and objectives. The strategic plan should include steps to implement portions of the community health improvement plan as well as other strategic issues for the department. (PHAB, 2015)

The first health departments to become nationally accredited by PHAB were announced in February of 2013. As of 2015, health departments that met PHAB's national standards serve approximately 45 percent of the U.S. population (nearly 139 million people). (CDC, PHAB, 2015) There are currently 96 PHAB-accredited health departments, with at least one PHAB-accredited health department in 33 states (including the District of Columbia). (NACCHO, 2015)

PHAB works in close collaboration with several national organizations that represent the public health departments and structures across the country. Some of the partners include: The National Association of County and City Health Officials (NACCHO), the American Public Health Association (APHA), the National Network of Public Health Institutes (NNPHI), the Association of State and Territorial Health Officials (ASTHO), the National Association of Local Boards of Health (NALBOH), the National Indian Health Board (NIHB), and the Public Health Foundation National partner organizations. These partnerships provide technical assistance to health departments to meet the needs and requests of their citizens. (PHAB, 2015)

Chapter 3 | Methods

Conceptual Framework

Socio-technical systems theory and systems thinking practice have evolved over the past sixty years into an overarching philosophy that embraces the joint design and optimization of organizational systems while incorporating both social and technical elements. (Davis, MC, 2014) The primary constructs of the socio-technical model advocate consideration of both social and technological influences while organizational change is being promoted or introduced, whether the catalyst is technical or related to general organizational improvement. (Davis, MC, 2014)

Figure 2 illustrates the 8-dimensional Socio-Technical Model introduced by Sittig and Singh (2010) specifically designed to address the socio-technical challenges involved in the design, development, implementation, use, and evaluation of Health IT within complex adaptive healthcare systems. The eight dimensions are interdependent and interrelated concepts similar to compositions of other complex adaptive healthcare systems. (Sittig, Singh, 2010)

Figure 2. The Eight Dimensions of the Socio-Technical Model (2010)
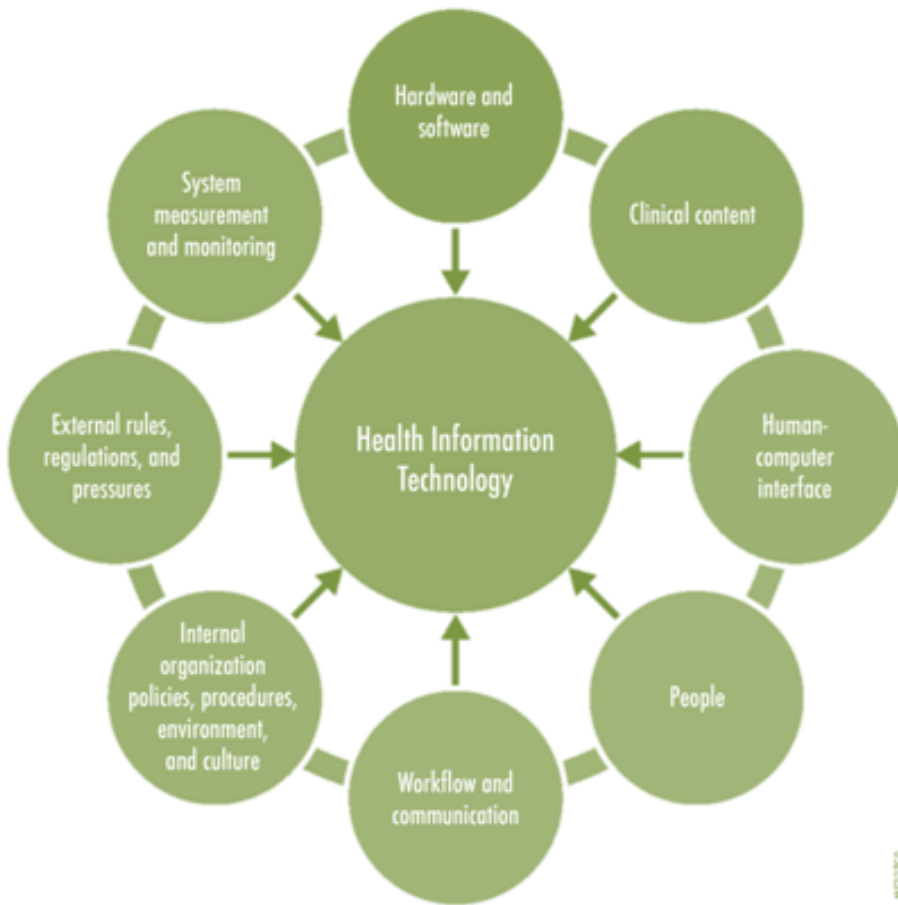
In the Public health domain organizations consist of complex interdependent parts that require thoughtful attention and collaboration when change is introduced. The principles of the socio-technical philosophy have been applied successfully in many other relative domains, most notably concerning the design of new technologies and the restructuring of work roles. (Davis, MC, 2014)

This model addresses the areas of collaboration, informatics infrastructure, and quality improvement as they relate to the meaningful use of technology within the public health delivery system and its utility within the constructs of accreditation.

Figure 3. Socio-Technical Model - Example (2010)
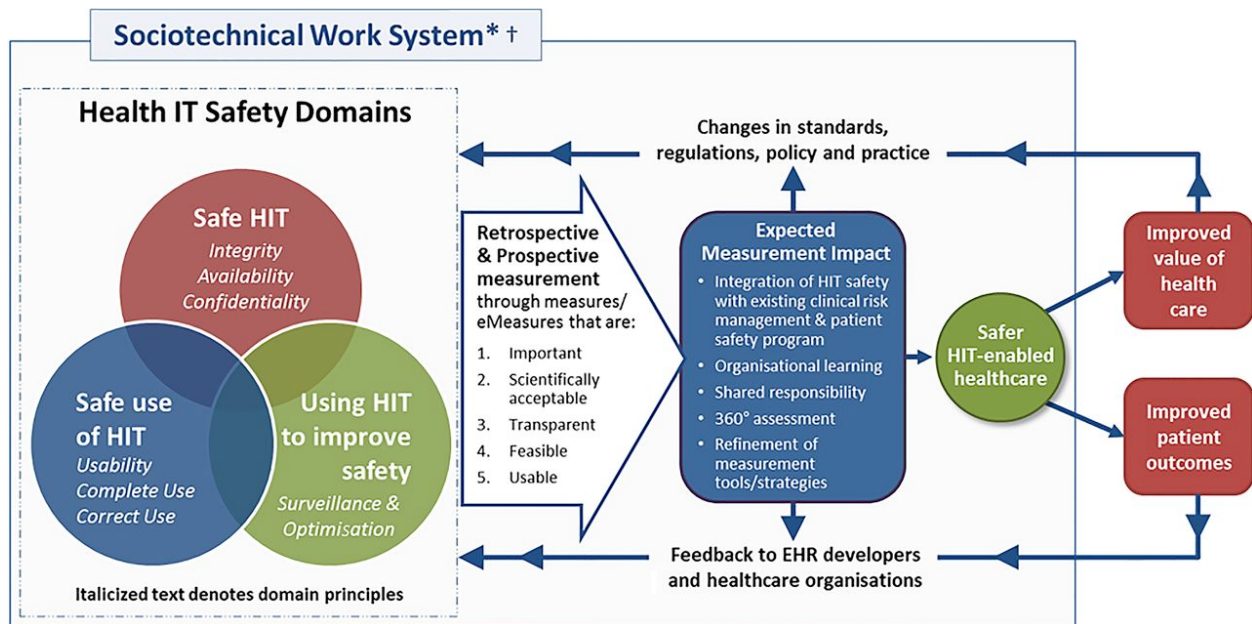
Figure 8

Source: (Sittig, Singh, 2010)

This thesis utilizes socio-technical principles throughout the analysis and exploration of the intersection of HIT utilization and the process of preparedness for national public health accreditation. Davis states that this model should be used in this fashion to extend the conceptualization and application of socio-technical thinking into new domains to solve a wider range of complex challenges. (Davis, MC, 2014)***

Dataset and Population Sample

The National Association of County and City Health Officials (NACCHO) conducts two surveys to assess local health department infrastructure and activities over time. LHDs are surveyed that meet NACCHO's definition of a local health department: "an administrative or service unit of local or state government, concerned with health, and carrying some responsibility for the health of a jurisdiction smaller than the state". (NACCHO, 2013) The purpose of the survey of LHDs is to "advance and support the development of a database for LHDs to describe and understand their structure, function, and capacities". (Wilhoit, 2013)

We used data from The National Profile of Local Health Departments, 2013 survey conducted by NACCHO. A data use agreement was attained to receive the public-use data from the Inter-University Consortium for Political and Social Research (ICPSR). ICPSR generated all of the data files from the original STATA data file provided by the principal investigator. (Wilhoit, 2013)

The profile survey was completed by each local health department online and could be completed in multiple sittings and by different stakeholders at each LHD. Data from this Profile was analyzed and published by NACCHO and some summary statistics, and highlights of key findings are provided from their analysis. (Wilhoit, 2013; NACCHO, 2013)

The profile survey included three modules: a core module, which was sent to the entire cohort, and either Module 1 or Module 2. LHDs received one of the two randomly assigned modules of supplemental questions. The core survey questions covered LHD

activities, community health assessment, and health improvement planning, use of the Community Guide to Preventive Services, governance, funding, workforce, and policy-making and advocacy. (Wilhoit,2013)

The topics covered in the modules shown in Figure 8 below. The overall response rates for those who received the Core and Module 2 surveys, were 78% and 82% respectively. (NACCHO, 2013)

Figure 9. NACCHO 2013 Profile Questionnaire Topics

Core (Core Only Response Rate = 78%)	Module 1 (Core + Module 1 Response Rate = 79%)	Module 2 (Core + Module 2 Response Rate = 82%)
Jurisdiction & Governance	Quality Improvement	Emergency Preparedness
Funding	Accreditation	Public Health Informatics
LHD Top Executive	Cross-Jurisdictional Sharing of Services	Access to Healthcare Services
Workforce	Human Resources Issues	Health Disparities
Activities	Partnerships and Collaboration	
Community Health Assessment and Planning	Practice-Based Research	
Guide to Community Preventive Services	Health Impact Assessments	
Policy-Making and Advocacy	County Health Rankings Report	
	Public Health Institute	
	Evaluation of Profile	

Source: 2013 National Profile of Local Health Departments

Inclusion/Exclusion Criteria

2,532 of the approximately 2,800 agencies in the United States that met NACHHO's definition of a local health department received the 2013 LHD profile survey. Hawaii and Rhode Island were excluded in the original dataset due to not having any sub-state units under their state health departments governance. Stratified random sampling was used by NACCHO to select LHDs that were assigned one of the two modules of

supplementary questions. The response rate for the profile was approximately 79 percent: 2,000 of the 2,532 LHDs. Overall, 1,288 LHDs received the core questions only (response rate, 78%), 624 received the core questions plus Module 1 (response rate, 79%), and 620 LHDs received the core questions plus Module 2 (response rate, 82%). (NACCHO, 2013)

The accreditation prerequisite questions needed for comparative and correlation analysis resided in the Core Module and the informatics infrastructure questions were in Module 2. We excluded any LHDs that did not receive both the Core and Module 2 surveys. The resulting population was 505 LHDs with consideration of the response rate for these modules. After creating a subset of the data with the target population of LHDs that answered both the informatics and accreditation questions, we further parsed the data to deal with missing data.

Handling of Missing Data

After several comparative analyses of missing observations from the dataset containing only LHDs that received both the core module and also Module 2, we found that the LHDs with missing data were minimal.   Missing data was less than 3% of the entire cohort where both the accreditation questions and/or informatics questions contained missing values.   We decided to exclude LHDs that did not answer any of the accreditation and/or any informatics questions; though they may have responded to other questions in those modules. Applying these exclusion criteria resulted in a

population of 493 LHDs that answered both the accreditation and informatics questions from the core module and module 2, which was then used for analysis.

Research Objectives

The objectives of this thesis are to:

Determine the informatics infrastructure utilization of LHDs in the US

Determine the level of accreditation preparedness of US LHDs

Determine the level of accreditation preparedness of US LHDs

Investigate if there is an association between informatics infrastructure utilization and accreditation preparedness

Offer insights into future research
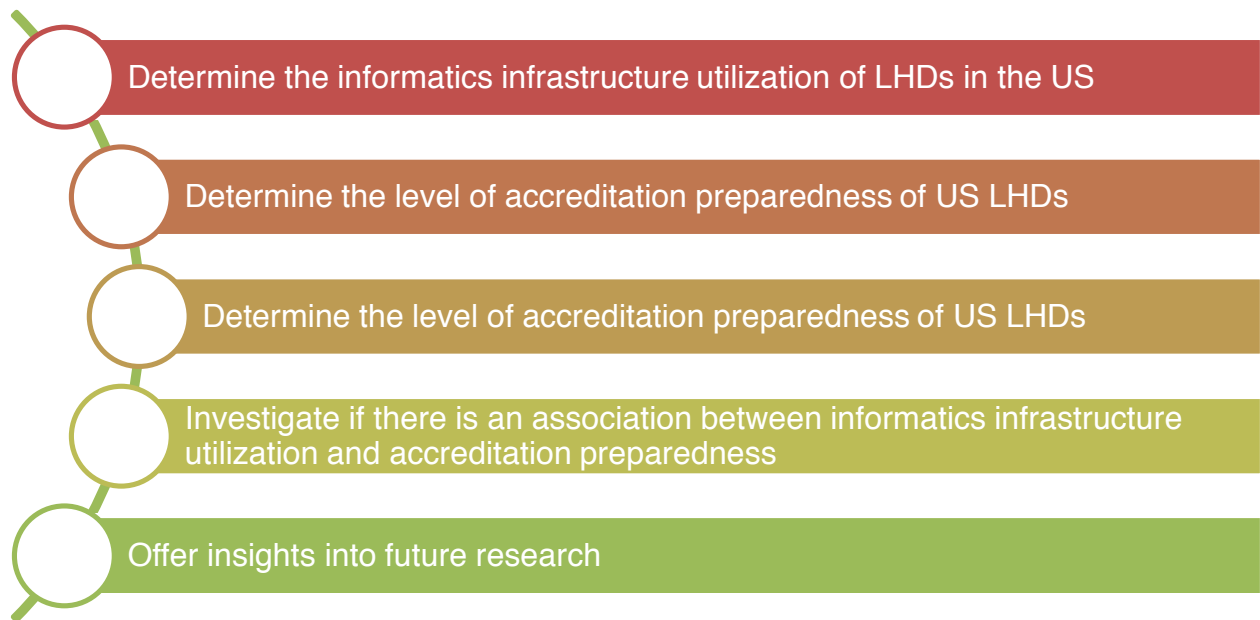
We wondered, as LHDs consistently contend and cope with limited funding and low resources, are local health departments that have implemented and regularly use higher degrees of informatics in their programs and processes more likely to be ready for accreditation? (NACCHO, 2013)

Analysis

The quantitative outcomes of interest were informatics infrastructure utilization (the frequency of informatics tools in use within each organization based on the NACCHO 2013 National Profile Module 2 informatics survey questions relating to informatics). And also accreditation preparedness (the degree to which each health department meets the PHAB prerequisites for applying for accreditation, with most critical

components being the CHA, CHIP, and ASP) (PHAB, 2013; NACCHO, 2013).

Conceptual Diagram

Figure 11. below is a conceptual diagram of how the data in each respective area of accreditation preparedness and public informatics infrastructure were segmented and categorized for analysis.   Survey questions that had multiple options for the same research category were collapsed into a single category.

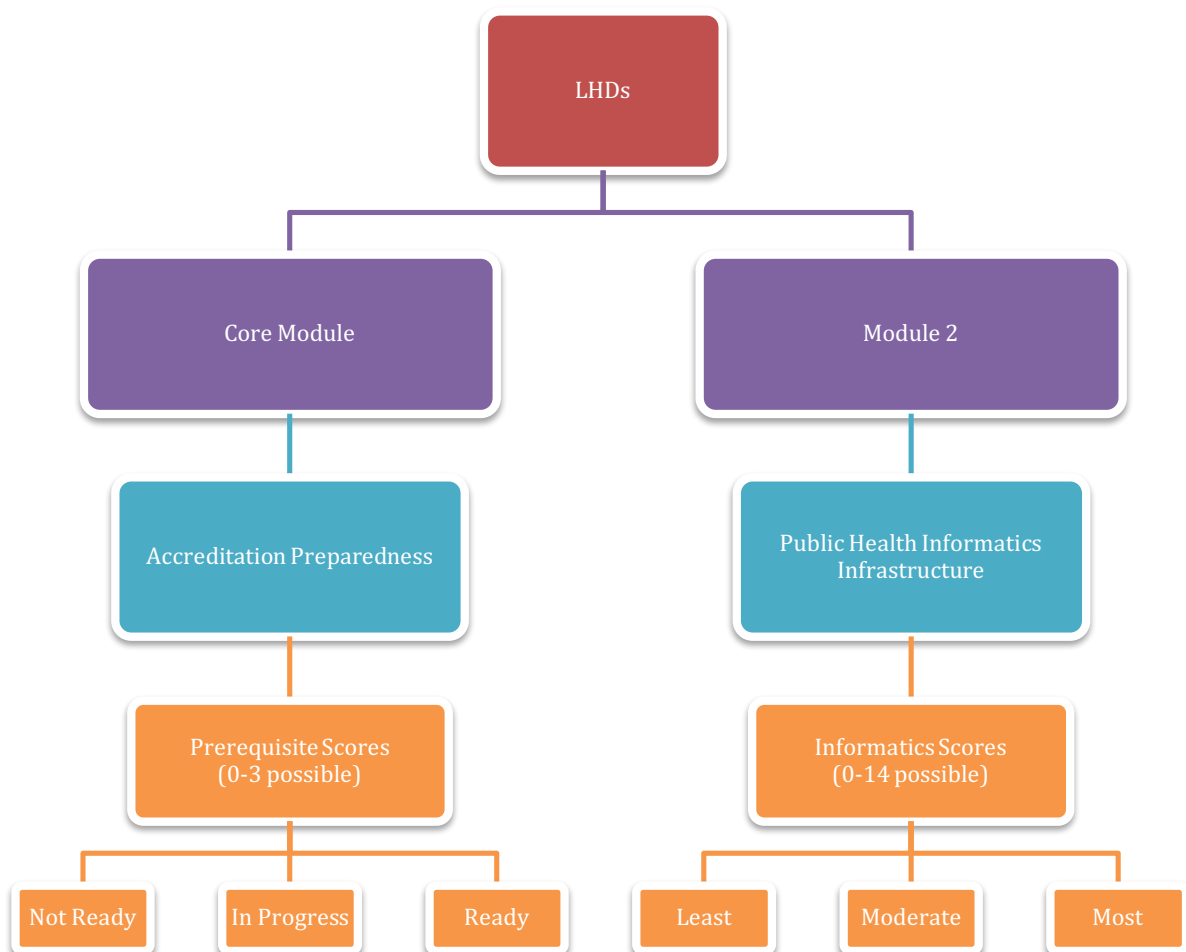Figure 10. Analysis Conceptual Diagram

Figure 12 *(below)* shows the informatics infrastructure breakdown of topics covered in the profile survey Module 2. All variables were converted to dichotomous values (if they were not already). In the communications channel section of the survey, all options that referenced a social media platform, such as Facebook, Twitter, blogs, etc., were aggregated and transformed into one dichotomous variable. The social media variable includes all of the social media platforms as a single variable, and was given the value of "in use" or "not in use". No additional weighting was given if more than one social media platform was in use.

The mobile technology questions were write-in and were not aggregated, but if any form of smartphone, electronic tablet or another mobile tool was indicated, the value was given an "in use" value regardless of the quantity of that specific tool was in use. For example, if more than one type of smartphone was indicated, smartphones were only counted once for having smartphone technology "in use" for public health purposes at that LHD.

Public Health Informatics Infrastructure

Public Health Informatics Infrastructure points (PHIIPs) - Total of 14 points

Information Technology	Communication Channels	Mobile Technology
Electronic Health Records (EHR)	Email Alert System (EAS)	Smartphones (i.e. iPhone) (SMP)
Electronic Lab Reporting (ELR)	Fax broadcast/Fax blast (FBB)	Electronic Tablets (eg. iPad) (ETD)
Electronic Disease Reporting System (EDRS)	Text Messaging (TMSG)	Other mobile tools (OMT)
Electronic Syndromic Surveillance System (ESSS)	Automated Phone Calling (APC)	
Immunization Registry (IR)	Social Media[1] (SM)	
Health Information Exchange (HIE)		

[1] *Social Media includes Facebook/twitter/YouTube/blogs/LinkedIn/Google+, Tumblr, Instagram, Pinterest and other social media platforms*

Figure 13 below shows the accreditation prerequisite criteria used to score accreditation preparedness. Local Health Departments' must submit the following prerequisites as part of their application to begin the accreditation process: 1. Community Health Assessment (CHA) 2. Community Health Improvement Plan (CHIP) 3. Agency-wide Strategic Plan (ASP). These documents lay the groundwork for the local health department's programs, policies, and interventions, and the remainder of the review for accreditation. (PHAB, 2014).

Figure 13. Public Health Accreditation Preparedness Topics l NACCHO 2013 Profile

Public Health Accreditation Board
Accreditation Preparedness Prerequisites

Accreditation preparedness (AP) - Total of 3 points
All health departments who intend to apply for PHAB accreditation must complete three agency-wide processes before applying for national accreditation.

1. Community Health Assessment (CHA)	**Community Health Assessment** can be defined as regularly and systematically collecting, analyzing, and making available information on the health of a community, including statistics on health status, community health needs, epidemiologic and other studies of health problems, and an analysis of community strengths and resources
2. Community Health Improvement Plan (CHIP)	A **Community Health Improvement Plan** can be defined as a long-term, systematic effort to address health problems. This plan is used by health and other government education and human service agencies, in collaboration with community partners, to set priorities and coordinate and target resources
3. Agency-Wide Strategic Plan (SP)	The **health department strategic plan** is internal to the health department, although may have been developed with input from partners. It shapes and guides what the health department does and why it does it; it sets forth the department's vision, mission, guiding principles and values, and strategic priorities; and describes measurable and time-framed goals and objectives. The strategic plan should include steps to implement portions of the community health improvement plan as well as other strategic issues for the department.

source: (PHAB, 2011)

Scoring

Public Health Informatics - Technology Infrastructure Points (TIPs)

There were 14 informatics infrastructure variables (Figure 12) obtained from the 2013 National Profile from the LHD target population. Each variable was given a value of one or zero and then tallied. Each LHD received a cumulative TIPs score and was put into one of the following categories below (Figure 14) based on the quantity of technology in use at that LHD: least, moderate, and most.

Figure 13. Technology Infrastructure Scoring Categories

Technology Infrastructure Point (TIP) Categories

Least
- Has 0 to 4 technology infrastructure points

Moderate
- Has 5 to 9 technology infrastructure points

Most
- Has 10+ technology infrastructure points
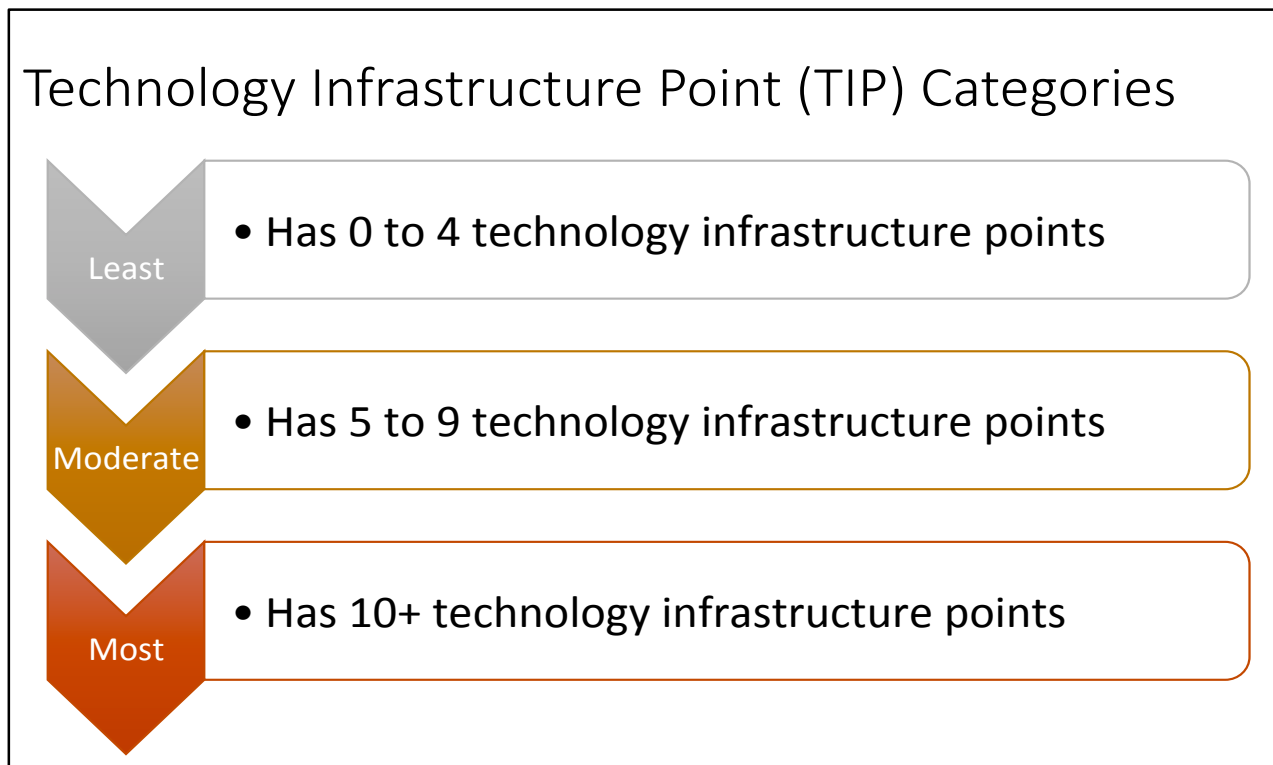
Public Health Accreditation - Accreditation Preparedness Points (APPs)

There were three accreditation preparedness variables obtained from the 2013 National Profile from the LHD target population. Each accreditation-related variable was given a value of one or zero and then tallied. Each LHD received cumulative APPs score and was put into the categories below (Figure 15) based on the level of accreditation preparedness, having zero or more of the prerequisites: not ready, in progress, and ready.

Figure 14. Accreditation Preparedness Scoring Categories
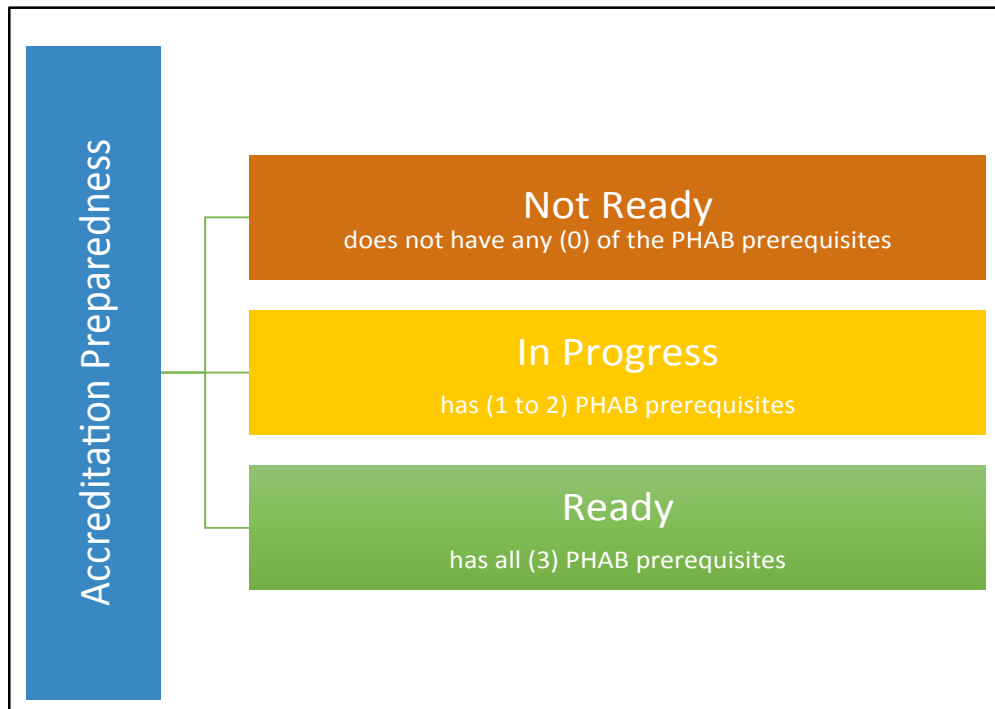
Research Design

After the data was cleaned and LHDs were placed into the accreditation and informatics categories, frequency distributions, contingency tables and correlation matrices were created to analyze and compare the interrelationships among these variables. Statistical analysis was performed using the Fisher's exact test. The [output/code/data analysis] for this paper was generated using SAS software, version 9.4. Copyright © [2002-2012] SAS Institute Inc. Scores were calculated for all LHDs that met the inclusion/exclusion criteria for analysis. (SAS, 2016)

Chapter 4 | Findings

Local Health Department Cohort Summary

Table 1. Summary of LHD Characteristics		
	N	%
All LHDs in Cohort	493	100
By Jurisdiction		
City	56	11.4
County	371	75.3
Multi-City	21	4.3
Multi-County	45	9.1
By Governance		
1 - State	98	19.9
2 - Local	354	71.8
3 – Both State/Local	41	8.3

In Table 1, we see that most of the LHDs serve county-level jurisdictions (75.3%) and are governed locally (71.8%). Although our cohort did not include all of the LHDs in the US, we can see from figure# below, which shows the jurisdiction statistics for all responding LHDs nationally from the 2013 Profile, our cohort is representative and close to the national breakdown of local health departments. Figure 16 - Geographic Jurisdictions Served by LHDs jurisdictions with 68% being county-level jurisdictions and 79% locally governed.
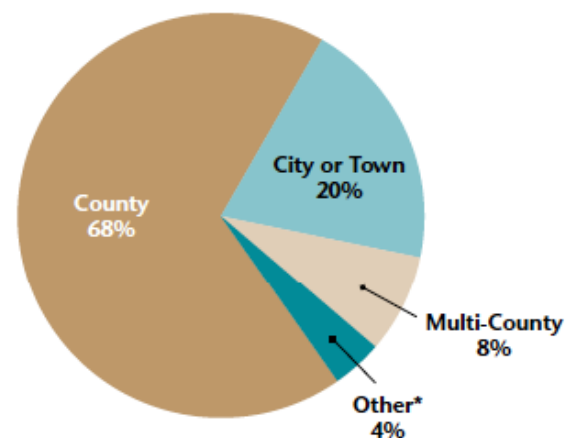
Figure 15 – Geographic Jurisdictions Served by LHDs
Source: 2013 National Profile

Table 2. Frequency of each PHAB Accreditation Prerequisite		
	N	%
All LHDs in Cohort	493	100
Community Health Assessment (CHA)	399	80.9
Community Health Improvement Planning (CHIP)	303	61.5
Agency-wide Strategic Planning (ASP)	265	53.8

Table 2 shows the frequency in which local health departments completed each of the PHAB accreditation prerequisites. Table 2 combines all "yes" responses into a single statistic. Once again, you can see that our cohort is comparable to the national percentages in each respective area in Figure 17. Approximately 81% of our cohort completed the CHA and 62% completed the CHIP and 54% completed the ASP.

Figure 16 - LHD Participation in Community Health Assessment, Community Health Improvement Planning, and Strategic Planning (2013 National Profile)
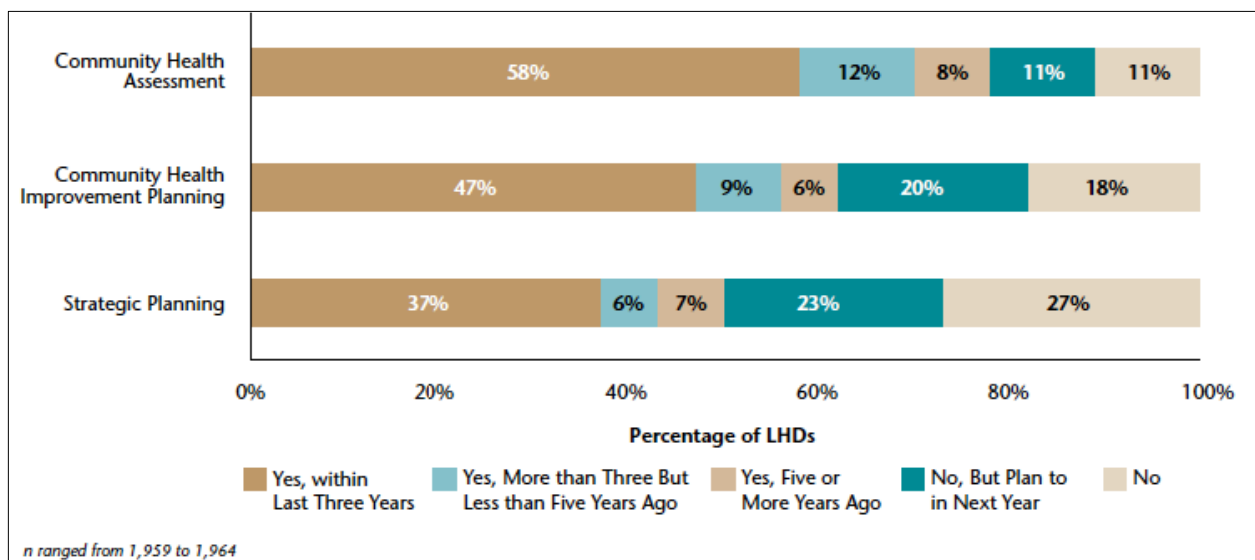
Accreditation Preparedness

Table 3 and Figure 18, show the level of accreditation preparedness based on an LHDs level of completion of the PHAB accreditation prerequisites. Table 3 shows that almost half (47%) of the cohort is in the "In Progress" category of preparedness, having 1 to 2 of the possible three requirements. Only 12% of LHDs had not completed any of the prerequisite documents.

Table 3. Accreditation Preparedness		
	N	Percent
Not Ready *LHDs that did not complete any (0) of the PHAB prerequisites*	59	11.9%
In Progress *LHDs that completed (1-2) of the PHAB prerequisites*	239	48.5%
Ready *LHDs that completed all (3) of the PHAB prerequisites*	195	39.6%
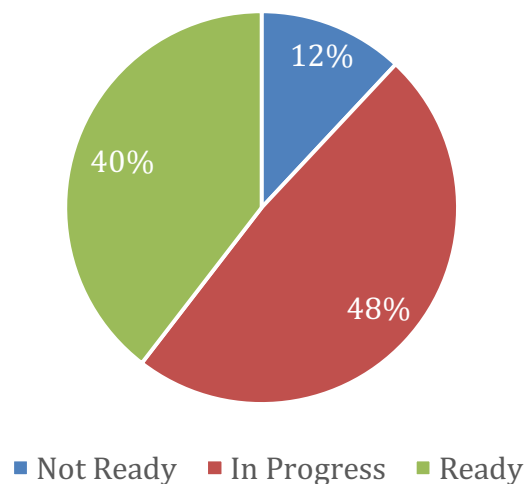
Figure 17

Figure # shows a comparison of the accreditation preparedness rates between 2010 and 2013 according to the 2010 and 2013 National Profiles.
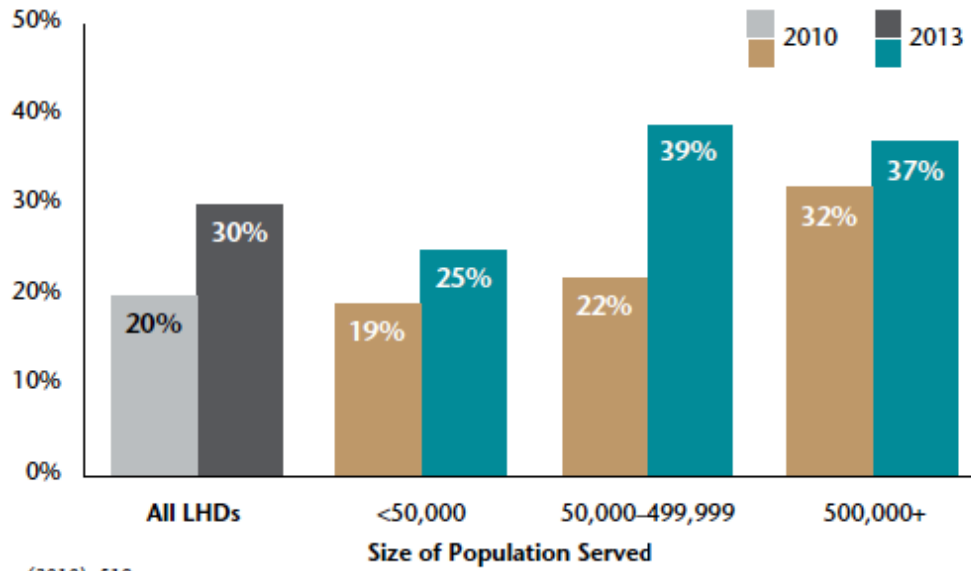
Technology Infrastructure Usage

Category		
IT	Information Technology	
CC	Communications Channel	
MT	Mobile Technology	

Technology	Value
OTHER MOBILE TOOLS (OMT)	36
HEALTH INFORMATION EXCHANGE (HIE)	69
ELECTRONIC HEALTH RECORDS (EHR)	122
ELECTRONIC TABLETS (EG. IPAD) (ETD)	215
ELECTRONIC LAB REPORTING (ELR)	245
TEXT MESSAGING (TMSG)	248
AUTOMATED PHONE CALLING (APC)	255
FAX BROADCAST/FAX BLAST (FBB)	287
ELECTRONIC SYNDROMIC SURVEILLANCE SYSTEM (ESSS)	317
EMAIL ALERT SYSTEM (EAS)	341
ELECTRONIC DISEASE REPORTING SYSTEM (EDRS)	368
SMARTPHONES (I.E. IPHONE) (SMP)	387
IMMUNIZATION REGISTRY (IR)	416
SOCIAL MEDIA1 (SM)	475

40
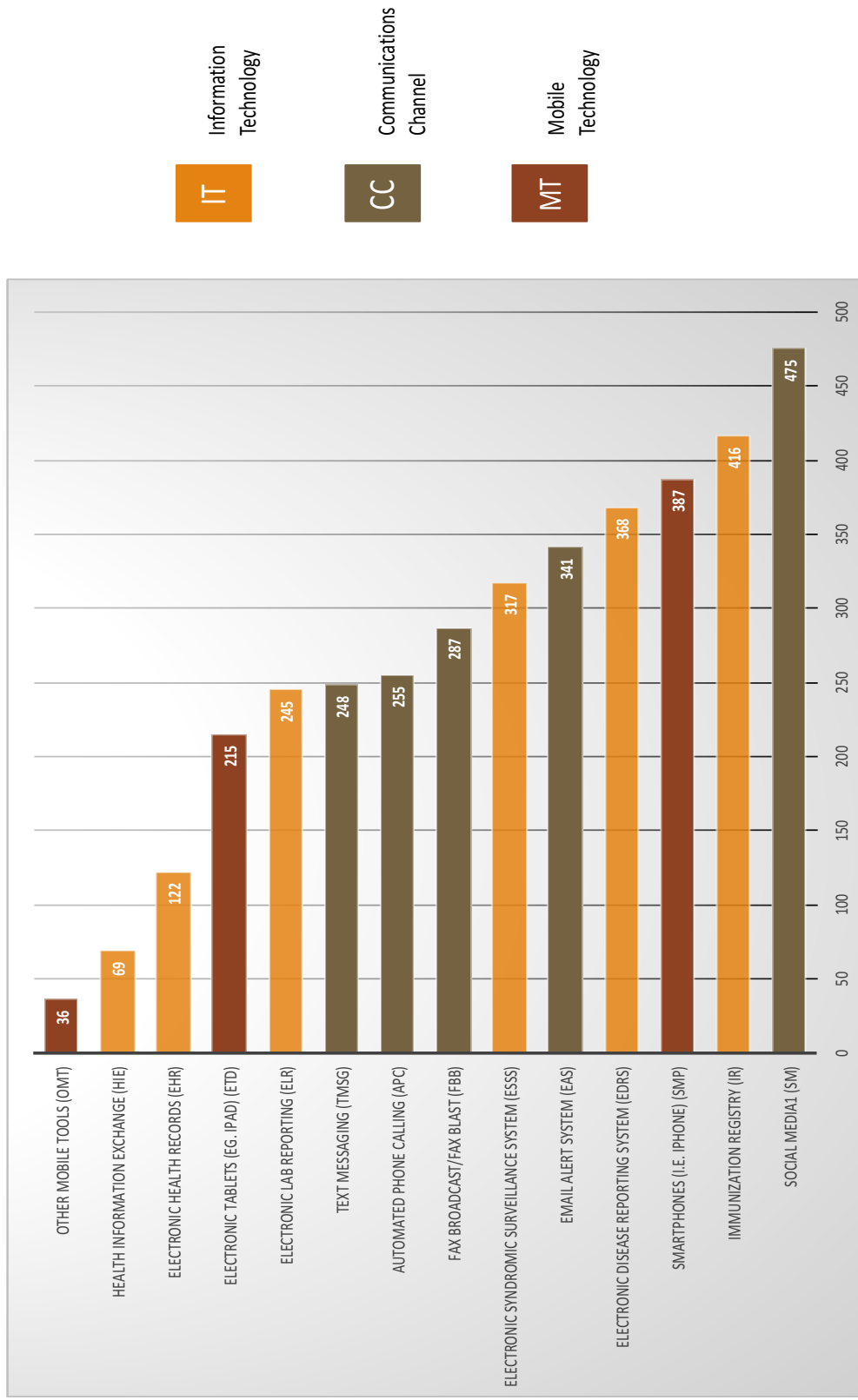
HIEs were amongst the lowest used information technology system overall with only 69 (14%) of LHDs reporting the use of HIEs for our cohort, but represents less than 7% of all US LHDs.

Table 5. Informatics Infrastructure Utilization		
	N	**Percent**
Least *LHDs that utilize 0-4 informatics systems*	95	19.3%
Moderate *LHDs that utilize 5 – 9 informatics systems*	346	70.2%
Most *LHDs that utilize 10 or more informatics systems*	52	10.6%

Percentage of LHDs Technology Infrastructure Points
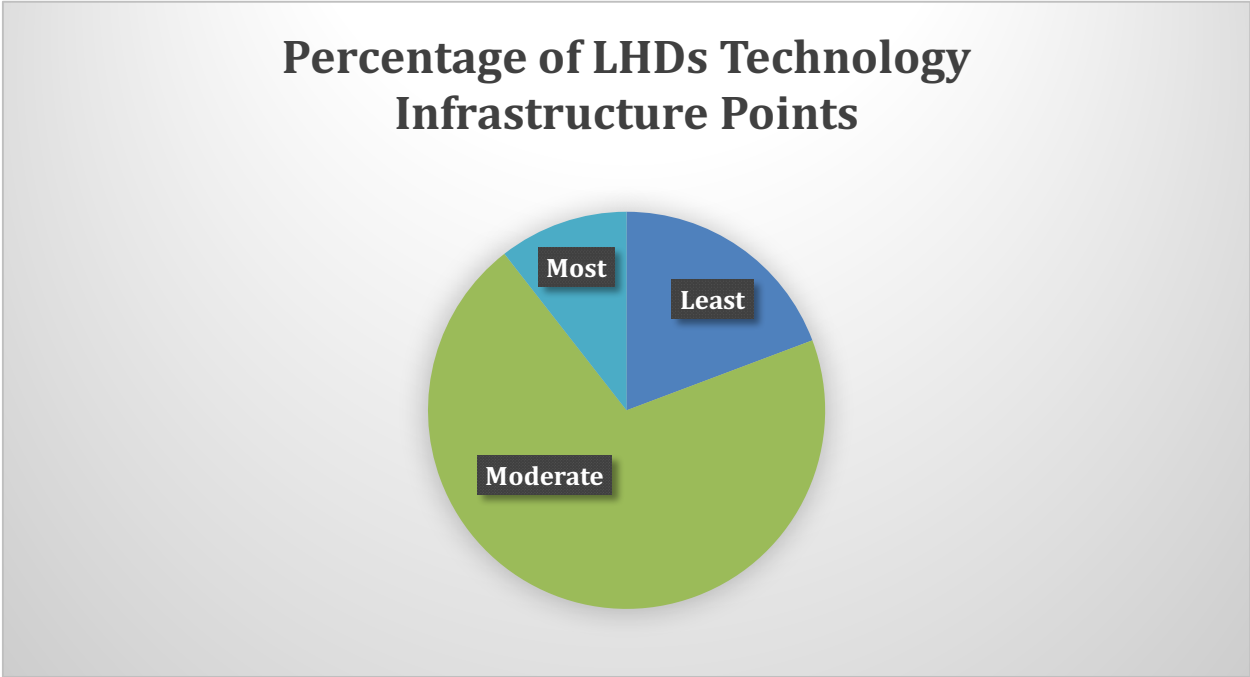
Table 5 is a contingency table of the variables app_score (the accreditation preparedness score) and the tip_score (the informatics infrastructure utilization score). The figure shows that the LHDs with the least informatics are not necessarily the least prepared for accreditation. The data shows that most of the LHDs in the "not ready" for accreditation category, actually have moderate informatics infrastructure utilization. LHDs with moderate informatics utilization, scored the highest in all categories of accreditation preparedness.

Table 5. Simple Cross Tabulation Informatics & Accreditation				
	N = 493			
	Accreditation Preparedness			
Informatics Infrastructure Utilization	Not Ready	In Progress	Ready	Total
Least	19	47	29	95
Moderate	39	162	145	346
Most	1	30	21	52
Total	59	239	195	493

Figure 12

The CORR Procedure

Simple Statistics						
Variable	N	Mean	Std Dev	Median	Minimum	Maximum
app_score	493	1.96146	1.03424	2.00000	0	3.00000
tip_score	493	6.64300	2.39544	7.00000	0	12.0000

Figure 11 is a correlation matrix generated to identify any associations between accreditation preparedness and informatics utilization amongst US local health departments. As the figure shows, no correlation was found. Several correlation procedures were conducted for verification. Correlation matrices were generated with individual informatics types and accreditation prerequisites to further test for unexpected associations. The results still showed no significant associations based on these analyses.

Pearson Correlation Coefficients
Prob > |r| under H0: Rho=0
Number of Observations

	CHAS	CHIPS	ASPS	tip1	tip2	tip3	tip4	tip5	tip6	tip7
CHAS	1.00000	0.53868	0.18152	0.06806	0.03118	0.13493	0.12037	0.09004	0.14111	0.07043
		<.0001	<.0001	0.1353	0.4973	0.0030	0.0081	0.0498	0.0020	0.1249
	493	493	493	483	476	482	483	475	478	476
CHIPS	0.53868	1.00000	0.31037	0.06477	-0.01627	0.08637	0.10456	0.08858	0.06268	0.06957
	<.0001		<.0001	0.1552	0.7233	0.0581	0.0216	0.0537	0.1712	0.1296
	493	493	493	483	476	482	483	475	478	476
ASPS	0.18152	0.31037	1.00000	0.04902	-0.03372	0.03260	0.01232	0.05126	0.01923	0.06467
	<.0001	<.0001		0.2823	0.4629	0.4752	0.7871	0.2649	0.6749	0.1589
	493	493	493	483	476	482	483	475	478	476
tip1	0.06806	0.06477	0.04902	1.00000	0.27384	0.08795	0.04763	0.06260	0.05651	0.02656
	0.1353	0.1552	0.2823		<.0001	0.0547	0.2977	0.1741	0.2204	0.5666
	483	483	483	483	474	478	480	473	472	468
tip2	0.03118	-0.01627	-0.03372	0.27384	1.00000	0.06520	0.14988	0.15602	0.09715	0.00154
	0.4973	0.7233	0.4629	<.0001		0.1573	0.0011	0.0007	0.0358	0.9736
	476	476	476	474	476	472	474	468	467	463
tip3	0.13493	0.08637	0.03260	0.08795	0.06520	1.00000	0.30161	0.25918	0.04248	0.02977
	0.0030	0.0581	0.4752	0.0547	0.1573		<.0001	<.0001	0.3576	0.5205
	482	482	482	478	472	482	480	473	471	468
tip4	0.12037	0.10456	0.01232	0.04763	0.14988	0.30161	1.00000	0.42854	0.27872	0.03024
	0.0081	0.0216	0.7871	0.2977	0.0011	<.0001		<.0001	<.0001	0.5135
	483	483	483	480	474	480	483	475	472	469
tip5	0.09004	0.08858	0.05126	0.06260	0.15602	0.25918	0.42854	1.00000	0.19267	-0.08135
	0.0498	0.0537	0.2649	0.1741	0.0007	<.0001	<.0001		<.0001	0.0810
	475	475	475	473	468	473	475	475	465	461
tip6	0.14111	0.06268	0.01923	0.05651	0.09715	0.04248	0.27872	0.19267	1.00000	0.08712
	0.0020	0.1712	0.6749	0.2204	0.0358	0.3576	<.0001	<.0001		0.0605
	478	478	478	472	467	471	472	465	478	465
tip7	0.07043	0.06957	0.06467	0.02656	0.00154	0.02977	0.03024	-0.08135	0.08712	1.00000
	0.1249	0.1296	0.1589	0.5666	0.9736	0.5205	0.5135	0.0810	0.0605	
	476	476	476	468	463	468	469	461	465	476
tip8	0.01382	-0.01173	-0.02357	-0.02739	0.04018	0.10082	0.06775	-0.04197	0.00555	0.17986
	0.7637	0.7986	0.6079	0.5545	0.3884	0.0292	0.1429	0.3686	0.9049	<.0001
	476	476	476	468	463	468	469	461	465	476
tip9	0.05154	-0.00285	0.06650	-0.00309	0.09986	-0.10718	0.07230	0.10078	0.12098	0.13689
	0.2618	0.9506	0.1474	0.9469	0.0317	0.0204	0.1179	0.0305	0.0090	0.0028
	476	476	476	468	463	468	469	461	465	476
tip10	-0.01337	0.01369	0.04952	0.04687	0.08828	0.03191	-0.03041	-0.01617	0.11886	-0.02001
	0.7711	0.7657	0.2809	0.3117	0.0577	0.4910	0.5112	0.7292	0.0103	0.6633
	476	476	476	468	463	468	469	461	465	476
tip11	0.13916	0.11290	0.04753	0.03807	0.01327	0.16271	0.14199	0.10452	0.12012	0.11759
	0.0023	0.0137	0.3007	0.4113	0.7758	0.0004	0.0021	0.0248	0.0095	0.0102
	476	476	476	468	463	468	469	461	465	476
tip12	-0.07256	-0.00197	-0.05081	-0.07293	0.04146	-0.09256	0.01462	-0.00499	0.04878	0.08335
	0.1401	0.9680	0.3018	0.1414	0.4082	0.0627	0.7689	0.9209	0.3293	0.0939
	415	415	415	408	400	405	406	398	402	405
tip13	0.02754	-0.00041	-0.02894	0.20466	-0.01954	-0.04976	0.07720	0.02476	0.03845	0.17711
	0.5759	0.9934	0.5566	<.0001	0.6969	0.3178	0.1204	0.6224	0.4420	0.0003
	415	415	415	408	400	405	406	398	402	405
tip14	0.08236	0.07583	0.07292	0.07410	-0.00405	0.05228	0.02635	0.03968	-0.03495	-0.15419
	0.0938	0.1230	0.1381	0.1351	0.9356	0.2939	0.5965	0.4298	0.4847	0.0019
	415	415	415	408	400	405	406	398	402	405

Chapter 5 | Discussion

Limitations

The data used in this study were from secondary sources, collected by different agencies, and collected for multiple purposes. Also, the data were self-reported data by LHDs, and missing and data errors decreased the sample size. The dataset was also de-identified and many confounding factors that may have been useful for this study were not available to perform more complex analysis. Future studies should use data either from multiple sources or from the total population of LHDs in the United States to look at differences in factors related to accreditation status. This will require a large enough number of accredited LHDs nationwide to perform analyses.

Conclusion

Though the analysis did not show a clear association between the two areas of accreditation and informatics infrastructure usage, it does illustrate the need for further and deeper research, analysis and data needed in both areas inclusively. Further research is needed in collecting data regarding the informatics needs of LHDs and how those needs and can be incorporated into accreditation standards that can also translate into policy and funding opportunities for LHDs.

Recommendations

Future studies could examine differences in LHDs who are accredited vs non-accredited, differences among LHDs that serve different sizes of populations, benefits experienced as a result of accreditation and how informatics may play a role, or how and factors associated with performance in the public health systems and services literature.

REFERENCES

Accreditation | State Public Health | ASTHO. (2014). Astho.org. Retrieved 2 May 2015, from http://www.astho.org/programs/accreditation-and-performance/accreditation/

Assessing the Status and Prospects of State and Local Health Department Information Technology Infrastructure. (2015). ASPE. Retrieved 2 November 2015, from http://aspe.hhs.gov/basic-report/assessing-status-and-prospects-state-and-local-health-department-information-technology-infrastructure

Building a Comprehensive Research Agenda: Potential Research Questions for Accreditation | PHABOARD.org. (2011). Phaboard.org. Retrieved July 2015, from http://www.phaboard.org/wp-content/uploads/Accreditation-Research-Agenda-and-Logic-Model-5-11.pdf

CDC - Benefits and Impacts of Accreditation - Health Department Accreditation - STLT Gateway. (2016). Cdc.gov. Retrieved 31 July 2015, from https://www.cdc.gov/stltpublichealth/accreditation/benefits.html

CDC - Health Department Accreditation - STLT Gateway. (2016). Cdc.gov. Retrieved 15 July 2016, from http://www.cdc.gov/stltpublichealth/accreditation/index.html

CDC - Public Health System and the 10 Essential Public Health Services - NPHPSP. (2014). Cdc.gov. Retrieved 10 May 2015, from http://www.cdc.gov/nphpsp/essentialservices.html

Chen, L., Nguyen, A., Jacobson, J., Gupta, N., Bekmuratova, S., & Palm, D. (2015). Relationship Between Quality Improvement Implementation and Accreditation Seeking in Local Health Departments. Am J Public Health, 105(S2), S295-S302. http://dx.doi.org/10.2105/ajph.2014.302278

Chudgar, R., Shirey, L., Sznycer-Taub, M., Read, R., Pearson, R., & Erwin, P. (2014). Local Health Department and Academic Institution Linkages for Community Health Assessment and Improvement Processes. Journal Of Public Health Management And Practice, 20(3), 349-355. http://dx.doi.org/10.1097/phh.0b013e31829dc26b

Cilenti, D. (2009). North Carolina Public Health Agency Accreditation and Performance: The Climb From Good to Extraordinary (PhD dissertation). Chapel Hill: University of North Carolina.

Coffin, J., Duffie, C., Wilkins, T., & Hatch, P. (2013). Cultivating Patient Engagement: Bridging
    The Digital Divide Through Active Partnerships And Enhanced Health Information
    Technology.Journal Of Healthcare Information Management, 27(1), 48-67. Retrieved
    from http://www.jhimdigital.org/jhim/winter2013?pg=48#pg48

Davis, M., Bevc, C., & Schenck, A. (2014). Declining Trends in Local Health Department
    Preparedness Capacities. Am J Public Health, 104(11), 2233-2238.
    http://dx.doi.org/10.2105/ajph.2014.302159

Davis, M., Bevc, C., & Schenck, A. (2016). Effects of performance improvement programs on
    preparedness capacities. - PubMed - NCBI. Ncbi.nlm.nih.gov. Retrieved July 2015, from
    http://www.ncbi.nlm.nih.gov/pubmed/25355971

Davis, M., Cannon, M., Stone, D., Wood, B., Reed, J., & Baker, E. (2011). Informing the National
    Public Health Accreditation Movement: Lessons From North Carolina's Accredited
    Local Health Departments. Am J Public Health, 101(9), 1543-1548.
    http://dx.doi.org/10.2105/ajph.2011.300199

Davis, M., Challenger, R., Jayewardene, D., & Clegg, C. (2014). Advancing socio-technical
    systems thinking: A call for bravery. Applied Ergonomics, 45(2), 171-180.
    http://dx.doi.org/10.1016/j.apergo.2013.02.009

For the Public's Health: Revitalizing Law and Policy to Meet New Challenges : Health and
    Medicine Division. (2011). Nationalacademies.org. Retrieved 2 May 2015, from
    http://www.nationalacademies.org/hmd/Reports/2011/For-the-Publics-Health-
    Revitalizing-Law-and-Policy-to-Meet-New-Challenges.aspx

For the Public's Health. (2011). http://dx.doi.org/10.17226/13093

Friedman, C., Faughnan, J., & Wyatt, J. (1997). Evaluation Methods in Medical
    Informatics. BMJ,315(7109), 689-689. http://dx.doi.org/10.1136/bmj.315.7109.689

Hajat, A., Cilenti, D., Harrison, L., MacDonald, P., Pavletic, D., Mays, G., & Baker, E. (2009).
    What Predicts Local Public Health Agency Performance Improvement? A Pilot Study in
    North Carolina.Journal Of Public Health Management And Practice, 15(2), E22-E33.
    http://dx.doi.org/10.1097/01.phh.0000346022.14426.84

Health Communication and Health Information Technology | Healthy People 2020.
    (2016).Healthypeople.gov. Retrieved July 2016, from
    http://www.healthypeople.gov/2020/topicsobjectives2020/overview.aspx?topicid=18

Health Information Exchange (HIE). (2016). HIMSS. Retrieved 18 July 2016, from
        http://www.himss.org/library/health-information-exchange

Health Information Technology and Informatics | NACCHO. (2016). Archived.naccho.org.
        Retrieved July 2016, from
        http://archived.naccho.org/topics/infrastructure/informatics/

Health Information Technology Opportunities for Local Health Departments. (2010) (1st ed.).
        Retrieved from
        *http://archived.naccho.org/topics/infrastructure/informatics/upload/NACCHO_HIT_*
        PolicyHighlight_final.pdf

Health Information Technology Opportunities for Local Health Departments.
        (2016). NACCHO. Retrieved July 2015, from
        *http://archived.naccho.org/topics/infrastructure/informatics/upload/NACCHO_HIT_*
        PolicyHighlight_final.pdf

Ingram, R., Bender, K., Wilcox, R., & Kronstadt, J. (2014). A Consensus-Based Approach to
        National Public Health Accreditation. Journal Of Public Health Management And
        Practice, 20(1), 9-13. http://dx.doi.org/10.1097/phh.0b013e3182a0b8f9

Kronstadt, J., Beitsch, L., & Bender, K. (2013). Marshaling the Evidence: The Prioritized Public
        Health Accreditation Research Agenda. Am J Public Health, 105(S2), S153-S158.
        http://dx.doi.org/10.2105/ajph.2014.302247

Kronstadt, J., Beitsch, L., & Bender, K. (2013). Marshaling the Evidence: The Prioritized Public
        Health Accreditation Research Agenda. Am J Public Health, 105(S2), S153-S158.
        http://dx.doi.org/10.2105/ajph.2014.302247

Lenert, L. & Sundwall, D. (2012). Public Health Surveillance and Meaningful Use Regulations:
        A Crisis of Opportunity. Am J Public Health, 102(3), e1-e7.
        http://dx.doi.org/10.2105/ajph.2011.300542

Local Health Departments and mHealth.. (2012) (1st ed.). Retrieved from
        http://eweb.naccho.org/prd/?NA448PDF.

Luck, J., Chang, C., Brown, E., & Lumpkin, J. (2006). Using Local Health Information To
        Promote Public Health. Health Affairs, 25(4), 979-991.
        http://dx.doi.org/10.1377/hlthaff.25.4.979

McCullough, J., Eisen-Cohen, E., & Salas, S. (2016). Partnership capacity for community health improvement plan implementation: findings from a social network analysis. BMC Public Health,16(1). http://dx.doi.org/10.1186/s12889-016-3194-7

McLeod, S. (2016). Correlation Method in Psychology | Simply Psychology. Simplypsychology.org. Retrieved 31 March 2016, from http://www.simplypsychology.org/correlation.html

National Public Health Department Accreditation Prerequisites. (2016). Retrieved 31 March 2016, from http://www.phaboard.org/wp-content/uploads/PrerequisitesJuly-2012.pdf

Official Information about Health Information Exchange (HIE) | Providers & Professionals | HealthIT.gov. (2015). Healthit.gov. Retrieved 20 September 2015, from https://www.healthit.gov/HIE

Public Health Accreditation Board Awards Five-Year Accreditation to 17 Public Health Departments. (2015). Ri.gov. Retrieved 18 December 2015, from https://www.ri.gov/press/view/26250

Public Health Infrastructure. (2014). Ncsl.org. Retrieved March 2015, from http://www.ncsl.org/research/health/public-health-infrastructure-webpage.aspx

Rowe, J. (2012). Consumer engagement efforts take center stage at ONC Town Hall. MobiHealthNews. Retrieved 2 May 2015, from http://mobihealthnews.com/news/consumer-engagement-efforts-take-center-stage-onc-town-hall

Singh, H. & Sittig, D. (2015). Measuring and improving patient safety through health information technology: The Health IT Safety Framework. BMJ Qual Saf, 25(4), 226-232. http://dx.doi.org/10.1136/bmjqs-2015-004486

Sprague, J. (2015). Twenty Local Health Departments, 46 Million People. Journal Of Public Health Management And Practice, 21, S1-S3. http://dx.doi.org/10.1097/phh.0000000000000174

State Health Department Applies for National Accreditation. (2016). Health.ny.gov. Retrieved 31 July 2015, from https://www.health.ny.gov/press/releases/2013/2013-02-08_nysdoh_applies_for_national_accreditation.htm

Teutsch, S. & Fielding, J. (2013). Rediscovering the Core of Public Health. *Annu. Rev. Public. Health.,34*(1), 287-299. http://dx.doi.org/10.1146/annurev-publhealth-031912-114433

The Seven Steps of Public Heath Department Accreditation | PHABOARD.org. (2016). Phaboard.org. Retrieved 31 March 2016, from http://www.phaboard.org/accreditation-process/seven-steps-of-public-healthaccreditation/

Vest, J., Issel, L., & Lee, S. (2014). Experience of Using Information Systems in Public Health Practice: Findings from a Qualitative Study. *Online Journal Of Public Health Informatics, 5*(3). http://dx.doi.org/10.5210/ojphi.v5i3.4847

What are the Benefits? | PHABOARD.org. (2013). Phaboard.org. Retrieved July 2015, from http://www.phaboard.org/accreditation-overview/what-are-the-benefits/

What is Accreditation? | PHABOARD.org. (2016). Phaboard.org. Retrieved 31 March 2016, from http://www.phaboard.org/accreditation-overview/what-is-accreditation/

White, J. & Goodin, K. (2016). Enhancing Syndromic Surveillance at a Local Public Health Department. *Online Journal Of Public Health Informatics, 8*(1). http://dx.doi.org/10.5210/ojphi.v8i1.6494

Who is Eligible? | PHABOARD.org. (2016). Phaboard.org. Retrieved 31 March 2016, from http://www.phaboard.org/accreditation-overview/who-is-eligible/

Wilhoit, J. (2013). *National Profile of Local Health Departments, 2013.* Icpsr.umich.edu. Retrieved 2 May 2015, from http://doi.org/10.3886/ICPSR34990.v1

Yasnoff, W., O'Carroll, P., Koo, D., Linkins, R., & Kilbourne, E. (2000). Public Health Informatics: Improving and Transforming Public Health in the Information Age. *Journal Of Public Health Management And Practice, 6*(6), 67-75. http://dx.doi.org/10.1097/00124784-200006060-00010