# Nurse lead executives: Their relationship to health department performance, health equity work and the public's health

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## Abstract

Nurse lead executives: Their relationship to health department performance, health equity work and the public's health

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**Background:** Strong public health systems are needed to support optimal population health outcomes. Previous research has demonstrated a positive association between the lead executive with a nursing degree and local health department (LHD) performance. However, the reason for this positive association is unknown, as is whether this positive association translates to reduced inequities in the community. The following parallel mixed methods study addresses this gap by providing valuable information regarding the role and contribution of nurse lead executives to LHD performance and health equity in the community.

**Methods:** Using a national county-level data set with information on LHDs linked to health outcome data, **Aim 1** employed a multivariate panel time series design to examine relationships between nurse versus non-nurse lead executives and changes in 15-44-year-old all-cause mortality, infant mortality, and prenatal care in the aggregate as well as Black and White populations (study period 2010-2018, n=626). **Aim 2** used multivariate logistic regression and

count data analyses to compare nurse and non-nurse lead executives' engagement in organizational factors important to performance and health equity work (study period 2019, n=1447). **Aim 3** used critical thematic analysis of one-on-one semi-structured interviews to explore the specific strategies used by nurse lead executives in LHDs to impact performance and advance health equity (n=13).

**Results:** The first paper found that the nurse lead executive is significantly associated with reduced mortality in the 15-44-year-old Black population (-5.2%, $p<0.05$), a reduction in the Black-White mortality ratio (-6%, $p<0.05$) and a reduction in the percent of the population with late or no entry to prenatal care. The second paper suggests that the nurse lead executive, as compared to the non-nurse, is more likely to engage in assessment and planning processes and to emphasize policy activities which are focused on the social determinants of health. Finally, the third paper demonstrates that the nurse lead executive possesses specific skills and competencies, such as capably navigating the political side of their role and approaching their work with an other-focused lens, which support their capacity to achieve success in their leadership role.

**Conclusions:** The results presented here provide a comprehensive understanding of the nursing approach to public health leadership and the importance of that leadership to population health. It demonstrates a distinctive constellation of skills, competencies, and activities which reflect the interprofessional nature of public health nursing practice, demonstrating a specialized approach which may set nurse leaders apart from other types of public health leaders. It also suggests that nurse leaders are associated with health improvements in line with addressing health inequities, further emphasizing the importance of their leadership in work to facilitate health equity.

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# CHAPTER 1

# INTRODUCTION

## 1.1 BACKGROUND

Strong public health systems are needed to support optimal population health outcomes; the following mixed methods study addresses a critical need for evidence by providing valuable information regarding the role and contribution of nurse lead executives to such a system.

The Institute of Medicine, in discussing public health strategies to improve health, cited the need for improved data collection and measurement systems as well as policies that are in line with current population health concerns. To achieve this, local health departments (LHDs) need to "be empowered and organized to do their job [of] improving the health of their communities".[1] Assurance, policy development, and assessment are the major ways LHDs accomplish this work. This is mainly done through delivery of the 10 Essential Public Health Services (EPHS), with higher performing LHDs successfully delivering a greater number of these services.[2-4] Recently, the EPHS have been re-examined and updated to bring attention to the need for LHDs to focus on and emphasize work to advance health equity. [5]

Historic underfunding of public health has restricted capacity to perform these services and additionally highlights a need for research to provide guidance for LHDs as well as to strengthen the argument for more and stable public health funding.[6,7] The COVID-19 pandemic provides an example of how an underfunded and under-equipped public health system has significantly hindered public health's capacity to respond.[8] Since 2008, the proportion of US health expenditures allocated to public health has progressively declined.[9,10] Existing funding is siloed, with specific funding given for certain programs and services, impeding system flexibility and adaptability.[11] Thus, it is necessary for LHDs to understand factors which are influential in

supporting positive performance to enable them to effectively use limited resources to address and improve the community's health, as well as to advocate for resources that support high performance and health equity.

Public health systems and services researchers have identified the local health department's top ("lead") executive to be an important factor in a strong and high-performing public health system; the recent EPHS changes further emphasize the critical role leaders play in the overall direction and focus of the LHD, particularly with respect to doing work to address inequities.[2,12-14] Two studies found that the lead executive with a nursing degree was a strong predictor of performance both overall and of individual essential services, including developing policies and plans, enforcing health laws and regulations, linking people to needed health services, ensuring a competent workforce, and conducting research on solutions.[2,15] This same research found that directors with a medical degree or public health degree were negatively associated with performance of certain services.[2,15] An additional study found that nurse lead executives were strongly and positively associated with an LHD's provision of population-based prevention activities versus other types of activities.[16] Each of these investigators stressed that further exploration of the relationship between the nurse-trained director and performance was needed.[2,15,16] However, this exploration has not occurred and thus the reason for the positive association between nurse lead executives and LHD performance remains unknown. Neither has it been examined if this positive association translates to improved health outcomes in the community. Further, while literature has highlighted the importance of the LHD being a leader in health equity work, very few studies have explored which factors represent LHD work to advance health equity and current measurements of LHD performance lack explicit focus in this area.[13,17,18]

Beyond a need to understand why the nurse might be influential for LHD performance, it is equally, if not more, important to understand if such a relationship improves health. Very few research studies focused on LHD performance have explored how better performance might improve health, with only one examining the role of leadership.[19] This prior study did find that clinician lead executives – either a physician or a nurse – were associated with reduced Black-White mortality disparities. This focus on disparities, however, highlights an additional gap in public health performance literature – most examine health outcomes at the total population level and thus fail to examine whether the work of the health department is effectively addressing health inequities. This is concerning, as inequities are significant across multiple health outcomes. For example, within maternal and child health outcomes, Black and Indigenous infants have higher rates of infant mortality than White infants; this is similar with respect to pregnancy-related deaths, as the pregnancy-related mortality ratio among Black and Indigenous pregnant individuals is 2.5 to 3 times higher than among White pregnant people. LHDs need to be doing work which addresses the root causes of these inequities and thus research measuring the effects of this work must assess health outcome improvements beyond the total population to ensure that those experiencing the greatest inequities are also experiencing the greatest improvements.

Research is also urgently needed which demonstrates the value of public health nurses and nurse leaders. While public health nurses comprise a large portion of the overall public health workforce, the overall number of nurses in public health is decreasing.[20] Nurses are on the front line of public health's work in caring for vulnerable populations, ensuring delivery of services and programs which target health disparities.[21] Indeed, they have been vital to public health's response during the COVID-19 pandemi.[22] Thus, continued reduction of the size of the public health nurse workforce has potentially detrimental effects on LHD capacity to deliver services as well as on

population health.[21,23] Such a decline may also lead to decreased representation of nurses in public health leadership positions.

## 1.2 OBJECTIVES

As illustrated above, multiple research gaps exist with respect to public health nurses, LHD performance, and how such pieces fit together to improve population health and advance equity. The following study addresses each of these gaps by exploring the relationship between nurse lead executives, factors which support health department performance and health equity work, and community health. It answers the overarching question: Why is there a positive relationship between the nurse lead executive and LHD performance and does it matter for the population's health?

In Chapter 2, **Aim 1** examines the association between changes in LHD leadership type (nurse and non-nurse) and changes in Black-White disparities (all-cause infant mortality, 15-44-all-cause mortality, percent with late or no prenatal care) between 2010-2018. It is a retrospective longitudinal secondary analysis using data from the 2010, 2013 and 2016 National Profile of Local Health Departments surveys ("National Profile"), 2010-2018 health outcome data from the CDC WONDER database and 2010-2018 county-level demographic variables from the Area Health Resources File.[24-27]

In Chapter 3, **Aim 2** compares implementation of certain LHD organizational factors (partnerships, accreditation, completion of a community health assessment and community health improvement plan, presence of a strategic plan, presence of a policy-making board

of health, and policy-making activities) between nurse and non-nurse lead executives in order to provide insight into the nurse leader's relationship with improved LHD performance and work to promote health equity. It is a retrospective cross-sectional analysis using the 2019 National Profile survey linked with 2018 community demographic variables.

In Chapter 4, **Aim 3** explores the leadership strategies used by nurse lead executives in order to identify what nurses uniquely bring to positions as public health directors and how that might be connected to evidence regarding their relationship with LHD performance. One-on-one semi-structured interviews were conducted with nurse public health directors for this study; themes were developed using critical thematic analysis.

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# CHAPTER 2

# ADDRESSING HEALTH DISPARITIES: THE NURSE LEAD EXECUTIVE'S RELATIONSHIP TO IMPROVED COMMUNITY HEALTH

## 2.1 ABSTRACT

**Background** The nurse-trained LHD lead executive has been shown to be positively associated with LHD performance; however, no other research has explored if this association translates to improved community health. This study addresses this gap by investigating the relationship between the type of LHD leadership – whether or not the lead executive is a nurse - and changes in health outcomes. **Methods** This study used a multivariate panel time series design to examine relationships between nurse versus non-nurse lead executives and changes in 15-44-year-old all-cause mortality, infant mortality, and prenatal care in the aggregate as well as Black and White populations. A national, county-level dataset was compiled containing pertinent variables for the years 2010-2018. Each model was estimated as a pooled time series and using time and unit fixed effects, with a one-year lag used for all covariates and the main predictor. **Results** In models with combined time and unit fixed effects, a statistical relationship exists between an LHD with a nurse lead executive and reduced mortality in the 15-44-year-old Black population (-5.2%, $p<0.05$) and a reduction in the Black-White mortality ratio (-6%, $p<0.05$). In addition, there is a relationship between the nurse-led LHD and a reduction in the percent of the population with late or no entry to prenatal care. **Conclusions** The evidence presented here helps to connect the known positive association between nurse lead executives and LHD performance to improvements in community health. It suggests that nurse leaders are associated with health improvements in line with addressing health inequities.

## 2.2 INTRODUCTION

Local health departments (LHDs) serve a vital and important role in supporting health equity and population health improvements. LHDs fulfill this role mostly by assuring that appropriate and effective services are available to those who are most underserved, engaging in policy work to address public health issues, and implementing programs targeted toward promoting population health.[1,2] Several studies have demonstrated that the LHD top or lead executive with a nursing degree is positively associated with an LHD's performance of this role; however, no other research has explored why this association exists and if such an association translates to improved health outcomes in the community. Further, decreased public health funding and revenues have impacted LHD capacity during a time when health inequities are worsening.[3-6] Thus, to effectively use limited resources - and to build a case for more - a better understanding of factors which might be influential in supporting the population's health is needed. This study seeks to address this need by investigating the relationship between the type of LHD lead executive (nurse or non-nurse) and changes in health outcomes in the community.

The public health director sets the vision, strategy and approach for the LHD in serving its community. Much of this is informed by the 10 Essential Public Health Services, or, more recently, through voluntary public health agency accreditation.[7,8] Such frameworks give way to specific activities such as partnership development and collaboration, policy-making activities, and completion of a community health assessment and community health improvement plan.[9] Each of these can be leveraged by the lead executive to better serve the community and facilitate equitable health improvements.

A small number of research studies have explored the relationship between such activities and community health. A majority of these studies have focused on the relationship between public

health spending and health outcomes,[10-17] with a smaller number examining other predictors such as partnerships,[18,19] staffing,[20] a local board of health with policy-making authority,[21,22] and service provision.[23-25] Only one, conducted by Bekemeier et al.,[26] focused on the impact of leadership. This study found that the presence of a clinician lead executive, either a nurse or a physician, was positively associated with reductions in Black-White mortality disparities. This study was also unique in its examination of disparities. Most studies have focused on changes in health outcomes in the overall population which has resulted in a fundamental and persistent gap in understanding whether the documented health improvements are experienced equitably across various populations.

Further, no investigations have specifically examined the influence of nurse lead executives on public health outcomes, despite 24% of LHDs reporting that they had a nurse lead executive in 2019.[27] Nurse leaders have been shown to possess transformational leadership styles among their staff that include modeling ethical behavior, articulating and carrying out an inspirational vision, creating an environment which supports staff in achieving their goals, and engaging in intellectual stimulation.[28,29] Such leadership qualities are associated with improved LHD capacity to address health disparities and improved health equity.[30-34] A study on the public health nurse workforce highlighted nurses' ability to be a "bridger"; this, along with additional research, illustrates nurses' knowledge and skill with respect to partnerships and collaboration.[19,32,35] Other evidence demonstrates that nurses possess a diverse set of skills needed to serve vulnerable populations.[30,36] Taken together, evidence suggests that nurse leaders employ strategies that effectively address problems in public health.[36-38]

Concerns related to the underfunding of public health persist, with an ongoing reduction in the public health workforce. The current COVID-19 pandemic provides an example of how an

underfunded and under-equipped public health system has significantly hindered the nation's public health response.[39] After the 2008 recession, public health funding was significantly reduced and continues to be grossly insufficient.[40,41] Recent reports show that public health's total share of the US health expenditures has declined since 2008.[41] Over the past decade, LHDs have eliminated 56,360 jobs; in 2019, approximately 19% of LHDs indicated that they expected future budget cuts.[42] As a result, services to address disparities in health continue to be reduced or cut, placing public health nurse positions and programs that reduce health disparities at risk as nurses deliver many of these services.[43,44]

Continued increases in health disparities, particularly related to maternal and child health, underscore the need to understand which public health strategies improve population health and how leadership can influence these outcomes.[43,45] For example, infant mortality in the Black population is 10.8 per 1,000 live births as compared to 4.6 per 1,000 live births in the White population. Such disparities are also present in outcomes such as maternal mortality, maternal morbidities and breastfeeding.[5,46-50] The gap in mortality disparities between Black and White populations has narrowed somewhat over time, but continues to persist, particularly in rural areas.[51] Past research found that nurses are more likely to focus on prevention and maternal and child health services and thus likely to target these disparities in their work.[52]

Research supports the fact that nurse public health directors are associated with improved LHD performance; this study builds on that evidence in exploring whether that association translates to improvements in population health outcomes. While this study cannot fully address equitable community health improvement, it takes a systems approach through a focus on leadership, understanding that effective leadership is a "pre-requisite" which is needed to support better health outcomes.[53] Public health leaders are called to serve as "Chief Health Strategists" and

must leverage resources to address "the full range of factors that influence a person's overall health and well-being."[53] Nurse lead executives are trained in this responsibility, as the nursing model of care centers on social justice and is focused on addressing structures which negatively affect well-being.[54,55] Thus, in an effort to generate further evidence to grow our understanding of public health system factors which are important for community health, this study examined the relationship between the type of public health leadership - whether or not the director is a nurse - and changes in 15-44-year-old all-cause mortality, infant mortality, and percent of the population with late or no entry into prenatal care.

## 2.3 METHODS

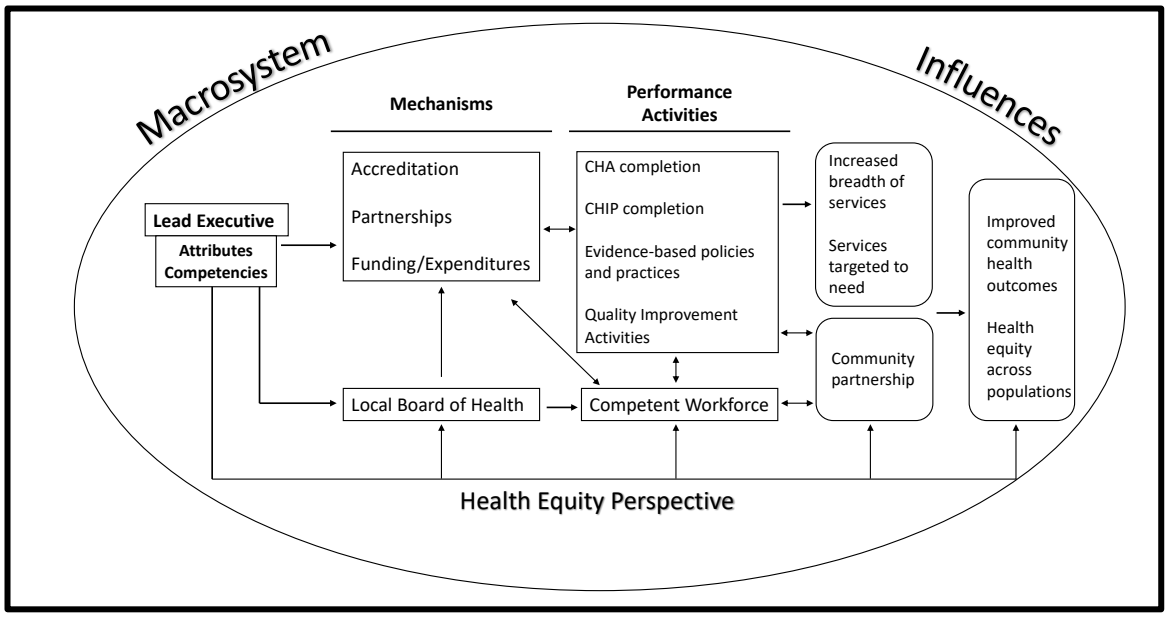
This study used a multivariate panel time series design to examine relationships between nurse versus non-nurse public health directors and changes in health outcomes in the population as a whole, as well as within Black and White sub-populations.

### Conceptual Framework

A conceptual framework was developed for this study to illustrate the process by which the nurse lead executive can support equitable community health outcomes (Figure 1). It is largely based on a model developed by Hajat and colleagues which is focused on the local public health system; however, it also utilizes concepts present in the Social-Ecological Model as well as the System of Prevention framework.[56-58] Each of these utilizes a systems perspective. In using this conceptual framework, this study aligns with the perspective of the nurse lead executive and is grounded in a health equity approach.

In this framework, the lead executive, with specified attributes and competencies such as a transformational leadership style and commitment to social justice, is shown to operate directly through four major mechanisms: the local board of health, partnerships, accreditation and funding/expenditures. Effective leveraging of these mechanisms results in improved LHD performance as evidenced by a competent workforce,[59-61] completion of a community health assessment,[9,62,63] the presence of evidence-based practices,[64,65] and policies and engagement in quality improvement activities.[8,66] This leads to an increased breadth of services targeted to the community's needs as well as community engagement, which supports improved outcomes in the community.[1,23,67,68] This set of factors will most successfully lead to equitable improvements in community health when the leader operates from a health equity perspective, which acknowledges that health outcomes are the result of multiple injustices ingrained in current structures and systems, such as systemic racism, poverty, and gender inequality. It is critical that this perspective starts with the lead executive, but to be most effective, this perspective must be integrated throughout the LHD, reflected by factors such as a workforce competent in the social determinants of health (SDOH), community partnerships focused on the SDOH, and policy advocacy activities.[33,69,70] Finally, this model acknowledges that the LHD operates amid many systemic factors which must be taken into consideration: public policy, corporations, characteristics of the community and issues such as systemic racism and gender inequality, all of which influence community health and affect health disparities.[71-75]

Figure 1: Pathway to Community Health




Data and variable selection

A national, county-level dataset was compiled using three separate sources of data in order to capture variables pertaining to the LHD, community demographics, and health outcomes as reflected in the conceptual framework (Figure 1). This study received an exemption from the University of Washington's Institutional Review Board.

Data pertaining to LHD leadership and other organizational variables comes from the 2010, 2013, and 2016 National Profile of Local Health Departments (*Profile*) surveys. This dataset contains information on individual-level LHDs with variables pertaining to the organization, infrastructure, workforce, and practice of the LHD, including information on the "top" (lead) executive, as well as types of activities performed. The 2010-2018 health outcomes selected as dependent variables come from the CDC WONDER database. The 2010-2018 county-level demographic variables were retrieved from the Area Health Resource File. [76-78] In order to link these three datasets together, the LHD identification codes in the *Profile* dataset needed to be linked to their corresponding county-level FIPS codes. This was necessary as the other two sources

of data used the county-level FIPS codes as identifiers. At this point, all three sources contained one common element – the county-level FIPS codes – which was used to link all the data together to create the final dataset for analysis.

Dependent variables were chosen based on ability to show changes over a shorter period of time in addition to previous research demonstrating a relationship between such outcomes and LHD factors such as type of leadership.[10,20,24,26,79] The dependent variables include the all-cause mortality rate among 15-44 year olds, the infant mortality rate, and the percent late or no entry to prenatal care for pregnant peoplein a county. Late entry to prenatal care was defined as beginning prenatal care after the 6$^{th}$ month of gestation. All were measured at the total population level as well as in Black and White populations. This analysis specifically examined outcomes in Black and White populations as data sources did not provide outcome data for other racial groups at the LHD or county level. Fifteen-to-forty-four-year-old mortality rates were measured per 100,000 population. Infant mortality rates were measured per 1000 live births and were constructed using three-year smoothed rates, due to small numbers in some counties (2009/2010/2011 – 2017/2018). The last smoothed rates were measured over two years, due to the lack of 2019 data available at the time. Data for counties with less than 20 annual deaths (either for 15-44-year-olds or infants) were excluded due to measurement unreliability. In addition, CDC WONDER suppresses infant mortality outcome data for counties with less than 250,000 population. Together these two restrictions on data access resulted in mainly reducing the number of rural counties represented in the data (see Appendix, Table 1). Finally, from 2007-2015, prenatal care entry data from states using the 1989 version of the birth certificate (as opposed to the 2003 revised version) was coded as "excluded" in the CDC WONDER database and therefore, was not available for analysis for this study (see Appendix, Table 2).

*Leadership Measures*

The main independent variable in this study was measured using *Profile* data, indicating whether the LHD was "nurse-led" (lead executive has an ASN, BSN, MSN and/or DNP degree) or "Not nurse-led" in 2010, 2013 and/or 2016. Other lead executive covariates – fulltime FTE and a tenure of less than five years – were considered for the model, based on prior research showing that such characteristics are positively predictive of the LHD delivering services to address health disparities. [80,81] However, these were not included due to each variable being a near constant in the sample (90% fulltime and 95% tenure <5 years).

*Other Measures*

Two other sets of covariates were included in this study which are associated with health outcomes in the community, as illustrated in Figure 1. The first set of covariates represents community demographics, community need and health resources available, and were taken from the Area Health Resource File: % non-Hispanic Black, % Hispanic, % uninsured, % of the population 19 years or younger, % of the population 65 years or older, the number of providers (MD, DO and nurse practitioners) per 1,000 population and rural/urban designation.[11,15,22,82-84] LHDs were characterized as metropolitan (urban), micropolitan or rural based on the 2010 Rural-Urban Commuting Area Codes.[85] In addition, a disadvantage index representing community disadvantage was compiled by summing the z-scores for the following variables: % poverty, % unemployed and % with less than a high school diploma. This was modeled after past research with a similar focus.[24,86] As the reasons for health disparities are complex and multifaceted, these chosen variables relate specifically to more upstream factors such as socioeconomic status and

educational attainment which are known to affect health outcomes. [74,87] All variables were time-variant except for % Black, % Hispanic and rural/urban designation, which were removed for fixed effects models.

The second was a set of LHD organizational variables taken from the *Profile* survey. The number of FTEs are clearly documented in the literature as being indicative of an LHD's capacity to deliver services as well as being connected with better community health.[20] Similarly, the presence of a local board of health with policy-making authority as well as completion of both a community health assessment and a community health improvement plan are associated better health outcomes in the community.[1,21,22] Finally, increased breadth of service provision has been found to be associated with reduced disparities in health outcomes and is represented here by a total count of services provided in each of 10 service domains: maternal and child health (MCH), immunizations, treatment, screening, health services, epidemiology, population health, regulation, environmental health and other services.[25,26,88]

Sample

This dataset was restricted to those county LHDs that responded to all three *Profile* survey years studied, as well as the participating jurisdictions that had one or fewer missing outcome variables during the study time period. In addition, 5 LHDs were removed due to missing data in the nurse-led variable for >1 survey period. This resulted in a total of 626 LHDs. Most LHDs in the sample served county-level jurisdictions (87%, n=543 areas). Eleven percent (n=69) served multiple counties and so data were combined into multi-county jurisdictions. The remaining 2% (n=11) were considered city- or municipal-level LHDs – these were aggregated up to the county level, similar to past studies.[23,24] As the final statistical model (described below) used the first lag

of the independent variable as well as additional covariates, observations for 2010 were dropped in the analysis, yielding data from 2011-2018 and a total of 5008 observations.

Analysis

Variables were screened for outliers and descriptive statistics were computed for LHD leadership characteristics, other LHD factors, health outcomes, and community characteristics of the sample from 2010-2018. Correlations were examined across covariates. Time series of the primary outcome variables were inspected for potential autocorrelation; non-stationarity was assessed using the Im-Pesaran-Shin test for unit roots.[89] The null hypothesis was able to be rejected for both the unit-specific and trend-specific unit root tests, meaning no evidence of non-stationarity ($p<0.05$).

A pooled model using ordinary least squares (OLS) regression analysis was first estimated for comparison purposes, although it is acknowledged that this is unlikely an appropriate way to model these data as it is subjected to omitted variable bias. Next, in keeping with Bekemeier et al.'s[26] analysis as well as other longitudinal studies focused on LHD factors,[13,20] this model was estimated using time as well as unit and time fixed effects, represented by the following equation:

$$Outcome_{it} = \beta_0 + Outcome_{it-1} + Nurse_{it-1}\beta_1 + X_{it-1}\beta_2 + \alpha_i + \delta t + \varepsilon_{it}$$

where $Outcome_{it}$ is the dependent variable measured at time $t$ in the county for LHD $i$. The natural log transformation was used for the mortality outcomes and has been commonly adopted in previous studies.[11,12,25] It can be interpreted as a percent change in the outcome for every one-unit change in the predictor. $Outcome_{it-1}$ is the first lag of the dependent variable based on the strong

likelihood that past values of each dependent variable are related to current values. $Nurse_{it-1}\beta_1$ represents the nurse/non-nurse leader and is a one-year lag to allow a period of time to elapse between the leader presence and expected health benefits. $X_{it-1}\beta_2$ represents a one-year lagged matrix of covariates and their coefficients, $\alpha_i$ represents a unit fixed effect to account for time-invariant omitted variables (such as regional differences) and $\delta_t$ represents time fixed effects to account for trends. Three models were estimated for comparison for each outcome: the bivariate model, a second model including covariates representing the community context, and a third full model which added LHD organizational characteristics. The second model provided information regarding the direct relationship between the nurse leader and the outcomes when accounting for the social, economic, and health factors present in the community. The third model then adjusted for certain organizational factors

Table 1: Descriptives, N=626

| Parameters | N (%) | Mean | SD | Range |
|---|---|---|---|---|
| **Leader Characteristics** | | | | |
| LHD Nurse Lead Executive | 222 (35) | | | |
| Fulltime FTE | 619 (99) | | | |
| Tenure <5 years | 597 (95) | | | |
| Female | 420 (67) | | | |
| Race other than White | 45 (7) | | | |
| Masters Degree or Higher | 552 (88) | | | |
| **LHD Characteristics** | | | | |
| Completed CHA | 568 (90) | | | |
| Policy-making BOH | 385 (61) | | | |
| Completed CHIP | 528 (84) | | | |
| FTEs | | 134.8 | 333.8 | 0.25-6,070 |
| **Services** | | | | |
| MCH | | 3.8 | 2.09 | 0-12 |
| Immunizations | | 1.99 | 0.51 | 0-4 |
| Screening | | 5.64 | 2.42 | 0-18 |
| Treatment | | 2.36 | 0.94 | 0-6 |
| Health Services | | 1.3 | 1.36 | 0-8 |
| Epi | | 4.64 | 2.04 | 0-12 |
| Population | | 4.97 | 2.82 | 0-18 |
| Environmental Health | | 3.88 | 2.85 | 0-15 |
| Regulation | | 9.5 | 4.22 | 0-26 |
| Other | | 3.69 | 2.33 | 0-16 |
| **Community Characteristics** | | | | |
| Population, 1,000's | | 304.5 | 621.3 | 12.6-10,170 |
| Median Household Income, 1,000's | | 51.15 | 14.1 | 25.5-136.2 |
| % Poverty | | 15.75 | 5.41 | 3-39.2 |
| % <65 uninsured | | 14 | 5.44 | 3-37.6 |
| % on SNAP benefits | | 15.5 | 6.38 | 1.8-41.4 |
| % Black | | 10.55 | 12.8 | 0.2-69.4 |
| % Hispanic | | 9.58 | 12.1 | 0.5-95.7 |
| % under 19y | | 23.9 | 3.01 | 11.62-37.3 |
| % over 65y | | 15.35 | 4.12 | 5.7-39.4 |
| Providers per 1,000 population | | 3.25 | 2.46 | 0.26-31.7 |
| **Rural Urban Classification** | | | | |
| Metropolitan | 443 (71) | | | |
| Micropolitan | 147 (23) | | | |
| Rural/Small Town | 36 (6) | | | |
| **Outcome Variables** | | | | |
| 15-44 Mortality | | 151.3 | 57.2 | 44.4-562.1 |
| Black 15-44 Mortality | | 198.5 | 73.1 | 58-680.3 |
| White 15-44 Mortality | | 145.7 | 53.1 | 31.8-453.3 |
| Infant Mortality | | 6.7 | 2.22 | 2.2-43 |
| Black Infant Mortality | | 12.32 | 4.2 | 3.17-56.3 |
| White Infant Mortality | | 5.85 | 1.99 | 1.96-21.0 |

through which the nurse leader might operate, illustrating how such factors might change the leader-outcome relationship. Thus, the second and third models are presented here. All models used Arellano's heteroskedastic and autocorrelation consistent variance-covariance matrix for robust standard errors.[90] Analysis was done using R 4.0.2.

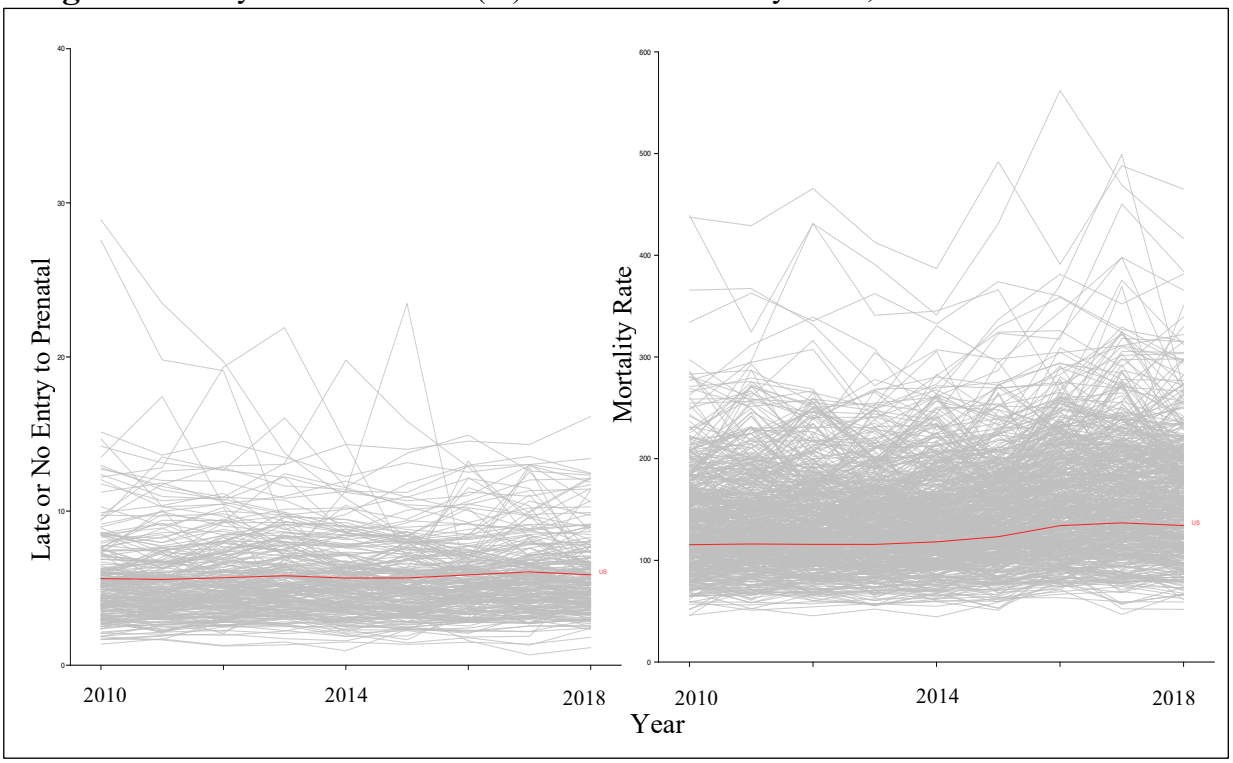
While time and unit fixed effects help address major issues in the model, we did take a precautionary measure and estimated a series of Generalized Method of Moments (GMM) models. These models were estimated using lags of potentially endogenous variables to account for additional bias due to correlation between the lagged dependent variable and the error term. Results are largely the same and are available in the Appendix.

## 2.4 RESULTS

Most of the lead executives in this sample were fulltime, had a tenure of less than five years, were White, and held a Master's degree or higher (Table 1). Looking specifically at the *Profile* years in this study, the proportion of health departments which were female-led increased from 48% in 2010 to 53% in 2016, with approximately two-thirds having a female lead executive for some period of time over the course of the study. With respect to the main predictor, 35% had a nurse leader at some point over the course of the study period. Of those LHDs with a nurse leader, 73% changed type of leadership during the study period (n=162), either to or from a nurse lead executive.

In examining the chosen population health outcomes, very little variability exists overall in the total population, although total 15-44 mortality increased slightly from 2010-2018 (Figures 2 & 3). In addition, variation among some individual LHD jurisdictions is clear, particularly with regard to entry to prenatal care and 15-44 mortality. Age 15-44 mortality in the Black population

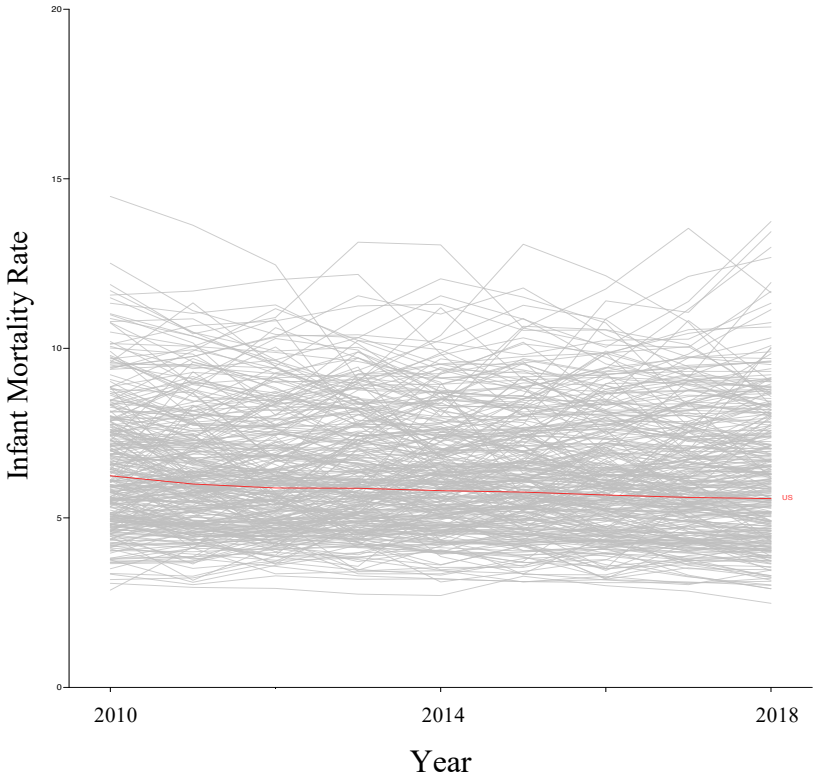
**Figure 2**. Entry to Prenatal Care (%) and 15-44 Mortality Rates, 2010-2018




increased over time as well, from an average of 178 per 100,000 population to an average of 211.5. This outcome also worsened in the White population, although the change was less significant (not shown). This is different when examining the other outcomes – Black and White infant mortality rates, as well as the percent in the White population with late or no entry to prenatal care, changed very little from 2010-2018. Further, the percent in the Black population with late or no entry to prenatal care improved, decreasing slightly from 9.2% to 8.8%.

Table 2 provides regression results for age 15-44-year-old mortality, demonstrating a significant relationship between nurse-led LHDs and reduced 15-44-year-old mortality in the Black population, as well as a reduced Black-White mortality ratio. With regard to the Black population, a significant and negative relationship exists in the pooled analysis -- this relationship holds and is strengthened as combined fixed effects are added to the model, showing that the presence of a nurse leader is associated with a 5.2% lower 15-44-year-old mortality rate in the

**Figure 3.** Infant Mortality Rate, 2010-2018




Black population. This is similar when examining the Black-White mortality ratio, which is significant with the addition of unit and time fixed effects. While a significant relationship was found in the simple bivariate OLS pooled model for total 15-44 mortality (not shown), this relationship did not hold when first adjusting for community factors, then adjusting for organizational covariates and combined fixed effects. For the White population, a significant relationship is only found in the pooled models – this relationship slightly weakens when accounting for the organizational structure through which the nurse operates and disappears completely when accounting for time and unit fixed effects.

Several other relationships are interesting to note. Previous research found a significant and positive relationship between screening services and Black-White disparities in 15-44 mortality.[24,26] We see that in this set of analyses (Table 2), screening is also positively and

significantly associated with disparities in Black-White 15-44 mortality in the pooled models, but this relationship is no longer significant when unit fixed effects are included. In addition, in the combined fixed effects model for both 15-44-year-old Black mortality and the Black-White mortality ratio, a completed health improvement plan is associated unexpectedly with an increase in each of these outcomes. This may represent an endogenous relationship, as worsening health outcomes in the community could motivate completion of the health improvement plan. When examining the relationship between changes in leadership and infant mortality, a significant relationship was found for the total population in the pooled analysis when community covariates were accounted for; however, this relationship did not hold with the addition of organizational covariates and fixed effects to the model (Table 3).

Significant relationships exist between whether or not an LHD had a nurse lead executive and reductions in the percent of the population with late or no entry to prenatal care (Table 4). This significant relationship also exists when looking specifically at the White population but was not found in the Black population. It is useful to note that while no significant relationship was found in the analysis for the Black population, the coefficient size was similar to that of the White population (Black population = -0.192 $\pm$ 0.287 versus White population = -0.173$\pm$ 0.097). Thus, the effect size is similar, but due to a smaller sample size for this specific analysis and the resulting larger standard errors, it is more difficult to establish a statistically significant relationship. As with 15-44-year-old mortality, this relationship holds as organizational covariates are added to the model and with the addition of unit and year fixed effects. When examining the combined fixed effects model, it should be noted that the strength of the effect slightly decreases when organizational covariates are added. Results presented here include those LHDs with only one or no missing outcome variable over the course of the study period; subsetting the sample

Table 2. Relationship between nurse-led local health department and 15-44 mortality

| Variables | *ln* (15-44 Mortality) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total (n=626) | | | | Black (n=142) | | | | White (n=556) | | | | Mortality Ratio (n=142) | | | |
| | Pooled | | Time and Unit Fixed | | Pooled | | Time and Unit Fixed | | Pooled | | Time and Unit Fixed | | Pooled | | Time and Unit Fixed | |
| | Community | Full | Community | Full | Community | Full | Community | Full | Community | Full | Community | Full | Community | Full | Community | Full |
| **Lead Executive Characteristics** | | | | | | | | | | | | | | | | |
| Nurse | -0.007 | -0.008 | 0.008 | 0.011 | -0.019 | -0.031** | -0.037* | -0.052** | -0.013** | -0.012** | 0.005 | 0.010 | -0.016 | -0.020 | -0.044* | -0.060** |
| **Community Characteristics** | | | | | | | | | | | | | | | | |
| Disadvantage index | 0.014*** | 0.015*** | -0.009 | -0.009 | 0.018*** | 0.021*** | -0.032* | -0.039** | 0.014*** | 0.014*** | -0.017** | -0.017** | 0.021*** | 0.029*** | 0.005 | -0.003 |
| % 19 and under | 0.003** | 0.002 | -0.011* | -0.011** | 0.004 | 0.001 | -0.000 | 0.004 | 0.003* | 0.002 | -0.016*** | -0.016*** | -0.006 | -0.007 | 0.018 | 0.024 |
| % 65 and older | 0.010*** | 0.010*** | 0.009 | 0.012* | 0.010*** | 0.011*** | -0.009 | -0.001 | 0.010*** | 0.010*** | -0.001 | 0.000 | -0.007** | -0.007*** | -0.023 | -0.018 |
| % ≤65y, uninsured | -0.002*** | -0.003*** | 0.003 | 0.004 | -0.004*** | -0.005*** | 0.012*** | 0.015*** | -0.003*** | -0.003*** | 0.005** | 0.006** | -0.001 | -0.003* | -0.001 | 0.001 |
| *ln*(Providers per 1,000 population) | -0.021*** | -0.02*** | 0.019 | 0.001 | 0.031* | 0.035** | 0.094 | -0.049 | -0.032*** | -0.031*** | 0.052 | 0.026 | 0.094*** | 0.119*** | 0.046 | -0.142 |
| % Black | 0.001*** | 0.001*** | x | x | 0.001*** | 0.001*** | x | x | 0.001*** | 0.001*** | x | x | 0.000 | 0.000 | x | x |
| % Hispanic | -0.001*** | -0.001*** | x | x | -0.001** | -0.000 | x | x | -0.001*** | -0.001*** | x | x | 0.001 | 0.001 | x | x |
| Metropolitan | Reference | Reference | Reference | Reference | Reference | Reference | Reference | Reference | Reference | Reference | Reference | Reference | Reference | Reference | Reference | Reference |
| Micropolitan | 0.013** | 0.010 | x | x | 0.070*** | 0.073*** | x | x | 0.017** | 0.016** | x | x | 0.027 | 0.069 | x | x |
| Rural | 0.054*** | 0.054*** | x | x | 0.148 | 0.178* | x | x | 0.052*** | 0.053*** | x | x | 0.081 | 0.165 | x | x |
| **LHD Characteristics** | | | | | | | | | | | | | | | | |
| Presence of Policy-making BOH | | -0.006 | | 0.012 | | 0.030** | | 0.052* | | -0.002 | | 0.003 | | 0.003 | | 0.044 |
| Total FTEs | | 0.000*** | | -0.000 | | -0.000** | | -0.000* | | -0.000* | | -0.000 | | -0.000 | | -0.000 |
| Completion of CHIP | | -0.009* | | -0.010 | | 0.013 | | 0.060*** | | -0.012** | | -0.013* | | 0.025* | | 0.072*** |
| Completion of CHA | | 0.003 | | 0.014* | | -0.007 | | -0.013 | | 0.009 | | 0.017** | | -0.016 | | -0.010 |
| Services Provided | | | | | | | | | | | | | | | | |
| MCH | | -0.003** | | -0.002 | | -0.001 | | 0.001 | | -0.004*** | | -0.005 | | -0.002 | | -0.008 |
| Immunizations | | -0.006 | | 0.006 | | -0.003 | | 0.002 | | -0.006 | | 0.007 | | -0.002 | | 0.006 |
| Screening | | 0.003** | | -0.003 | | 0.005* | | 0.001 | | 0.002 | | -0.003 | | 0.010*** | | 0.006 |
| Treatment | | 0.003 | | 0.000 | | 0.001 | | 0.005 | | 0.005 | | 0.005 | | -0.008 | | -0.014 |
| Health Services | | -0.003 | | 0.008* | | -0.008** | | -0.002 | | -0.002 | | 0.007* | | -0.005 | | -0.010 |
| Epidemiology | | -0.002 | | -0.002 | | -0.001 | | 0.003 | | -0.003* | | -0.002 | | -0.005 | | 0.010** |
| Population Health | | -0.001 | | 0.002 | | -0.000 | | -0.000 | | -0.001 | | 0.003* | | 0.000 | | -0.001 |
| Regulation | | 0.001 | | -0.001 | | -0.000 | | -0.004 | | 0.003*** | | -0.000 | | -0.006** | | -0.004 |
| Environmental Health | | -0.002** | | 0.000 | | -0.002 | | -0.001 | | -0.003*** | | -0.001 | | -0.003 | | -0.001 |
| Other | | -0.001 | | -0.001 | | -0.003 | | 0.001 | | -0.002 | | -0.00 | | 0.003 | | -0.000 |
| Dependent variable lag | 0.756*** | 0.740*** | 0.004 | -0.0158 | 0.737*** | 0.710*** | -0.015 | -0.040 | 0.741*** | 0.731*** | 0.017 | -0.004 | 0.587*** | 0.544*** | -0.017 | -0.029 |

BOH - board of health; CHIP - community health improvement plan; CHA - community health assessment; MCH - maternal and child health

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

Table 3. Relationship between nurse-led local health department and infant mortality

| | *ln* (Infant Mortality) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Variables | Total (n=328) | | | | Black (n=116) | | | | White (n=254) | | | | Mortality Ratio (n=113) | | | |
| | Pooled | | Time and Unit Fixed | | Pooled | | Time and Unit Fixed | | Pooled | | Time and Unit Fixed | | Pooled | | Time and Unit Fixed | |
| | Community | Full | Community | Full | Community | Full | Community | Full | Community | Full | Community | Full | Community | Full | Community | Full |
| **Lead Executive Characteristics** | | | | | | | | | | | | | | | | |
| Nurse | 0.009* | 0.007 | 0.015 | 0.013 | 0.011 | 0.008 | 0.017 | 0.025 | 0.006 | 0.001 | 0.013 | 0.013 | 0.013 | 0.009 | 0.020 | 0.033 |
| **Community Characteristics** | | | | | | | | | | | | | | | | |
| Disadvantage index | 0.006*** | 0.007*** | -0.010 | -0.008 | 0.007** | 0.010*** | -0.027** | -0.027* | 0.008*** | 0.008*** | -0.013 | -0.013 | 0.004 | 0.006 | -0.013 | -0.014 |
| % 19 and under | 0.002 | 0.002 | 0.002 | 0.002 | 0.001 | 0.000 | 0.006 | 0.005 | 0.003*** | 0.003*** | 0.002 | 0.003 | -0.005** | -0.006*** | 0.007 | 0.006 |
| % 65 and older | 0.002* | 0.002** | 0.007 | 0.004 | 0.001 | 0.002 | -0.007 | -0.012 | 0.002** | 0.002** | 0.004 | 0.001 | -0.002 | -0.001 | -0.022 | -0.033 |
| % ≤65y, uninsured | 0.000 | -0.000 | 0.004 | 0.004 | -0.001 | -0.002* | 0.014*** | 0.016*** | 0.000 | 0.000 | 0.001 | 0.001 | -0.002 | -0.004** | 0.017*** | 0.017** |
| *ln*(Providers per 1,000 population) | -0.005 | -0.003 | 0.077 | 0.061 | 0.011 | 0.008 | 0.006 | 0.046 | -0.024*** | -0.019*** | 0.034 | 0.003 | 0.052*** | 0.044*** | 0.036 | 0.127 |
| % Black | 0.001*** | 0.001*** | x | x | -0.000 | -0.000 | x | x | -0.000 | -0.000 | x | x | -0.001** | -0.001 | x | x |
| % Hispanic | -0.002*** | -0.001*** | x | x | -0.002*** | -0.001 | x | x | -0.001*** | -0.001*** | x | x | -0.001 | 0.000 | x | x |
| Metropolitan | Reference | Reference | Reference | Reference | Reference | Reference | Reference | Reference | Reference | Reference | Reference | Reference | Reference | Reference | Reference | Reference |
| Micropolitan | 0.028** | 0.027** | x | x | 0.062 | 0.009 | x | x | 0.018 | 0.022 | x | x | x | 0.213*** | x | x |
| Rural | -0.011 | -0.009 | x | x | 0.02 | 0.004 | x | x | -0.046** | -0.022 | x | x | x | n/a | x | x |
| **LHD Characteristics** | | | | | | | | | | | | | | | | |
| Presence of Policy-making BOH | | -0.000 | | -0.018 | | 0.026*** | | 0.030 | | -0.001 | | -0.025* | | 0.003** | | 0.013 |
| Total FTEs | | -0.000*** | | -0.000 | | -0.000*** | | 0.000 | | -0.000 | | -0.000 | | -0.000** | | 0.000 |
| Completion of CHIP | | 0.007 | | 0.011 | | 0.019* | | 0.002 | | 0.008 | | 0.011 | | 0.005 | | -0.027 |
| Completion of CHA | | 0.002 | | 0.001 | | -0.001 | | 0.008 | | 0.004 | | 0.009 | | -0.009 | | 0.005 |
| Services Provided | | | | | | | | | | | | | | | | |
| MCH | | 0.001 | | 0.000 | | -0.001 | | -0.009 | | 0.002 | | 0.003 | | -0.002 | | -0.012 |
| Immunizations | | 0.008** | | 0.008 | | -0.001 | | -0.001 | | 0.003 | | 0.002 | | -0.004 | | -0.001 |
| Screening | | -0.002 | | -0.002 | | -0.001 | | 0.001 | | -0.003** | | -0.005* | | 0.003 | | 0.006 |
| Treatment | | -0.002 | | 0.001 | | 0.004 | | 0.001 | | -0.003 | | 0.004 | | 0.011 | | 0.006 |
| Health Services | | -0.000 | | 0.002 | | 0.000 | | 0.000 | | -0.004** | | -0.009** | | 0.003 | | 0.003 |
| Epidemiology | | -0.003** | | -0.001 | | -0.004 | | -0.004 | | -0.000 | | 0.003 | | -0.003 | | -0.003 |
| Population Health | | -0.001 | | -0.001 | | 0.001 | | -0.002 | | -0.001 | | -0.001 | | -0.001 | | -0.003 |
| Regulation | | 0.002** | | -0.001 | | 0.002 | | -0.002 | | 0.002* | | -0.001 | | 0.002 | | -0.001 |
| Environmental Health | | -0.001 | | 0.001 | | -0.001 | | 0.002 | | -0.001 | | 0.003 | | -0.001 | | 0.001 |
| Other | | -0.002* | | -0.002 | | 0.001 | | 0.000 | | -0.000 | | -0.001 | | 0.000 | | 0.002 |
| Dependent variable lag | 0.177*** | 0.851*** | 0.598*** | 0.588 | 0.884*** | 0.860*** | 0.665*** | 0.648*** | 0.860*** | 0.848*** | 0.572*** | 0.576*** | 0.795*** | 0.783 | 0.625*** | 0.624*** |

BOH - board of health; CHIP - community health improvement plan; CHA - community health assessment; MCH - maternal and child health

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

Table 4. Relationship between nurse-led local health department and late or no prenatal care

| Variables | Late or No Prenatal Care (%) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total (n=280) | | | | Black (n=194) | | | | White (n=280) | | | | PNC Ratio (n=194) | | | |
| | Pooled | | Time and Unit Fixed | | Pooled | | Time and Unit Fixed | | Pooled | | Time and Unit Fixed | | Pooled | | Time and Unit Fixed | |
| | Community | Full | Community | Full | Community | Full | Community | Full | Community | Full | Community | Full | Community | Full | Community | Full |
| **Lead Executive Characteristics** | | | | | | | | | | | | | | | | |
| Nurse | -0.139** | -0.110 | -0.193** | -0.207** | -0.165 | -0.163 | -0.276 | -0.192 | -0.134** | -0.116 | -0.179** | -0.173* | 0.038 | 0.032 | 0.040 | 0.074 |
| **Community Characteristics** | | | | | | | | | | | | | | | | |
| Disadvantage index | -0.075*** | -0.087*** | -0.149 | -0.111 | -0.106** | -0.136*** | -0.344** | -0.279 | -0.080*** | -0.091*** | -0.168* | -0.135 | 0.005 | 0.005 | 0.016 | 0.001 |
| % 19 and under | -0.008 | -0.0054 | -0.093 | -0.100* | 0.028 | -0.023 | -0.191* | -0.217* | -0.007 | -0.004 | -0.063 | -0.073 | 0.010 | 0.004 | 0.002 | -0.006 |
| % 65 and older | 0.019** | 0.026*** | 0.063 | 0.057 | 0.000 | 0.014 | -0.134 | -0.156 | 0.022*** | 0.028*** | 0.051 | 0.047 | -0.007 | -0.008** | -0.031 | -0.018 |
| % ≤65y, uninsured | 0.032*** | 0.034*** | -0.020 | -0.037 | 0.048*** | -0.055*** | 0.011 | -0.031 | 0.035*** | 0.037*** | -0.016 | -0.034 | -0.007** | -0.007* | 0.000 | -0.003 |
| *ln*(Providers per 1,000 population) | -0.178*** | -0.171*** | 1.809* | 1.69* | -0.100 | -0.156* | 5.464*** | 5.68** | -0.245*** | -0.235*** | 1.398 | 1.36 | 0.087*** | 0.083*** | -0.046 | 0.143 |
| % Black | 0.032*** | 0.035*** | x | x | 0.0158*** | 0.020*** | x | x | 0.024*** | 0.027*** | x | x | -0.004** | -0.004** | x | x |
| % Hispanic | 0.010*** | 0.014*** | x | x | -0.008* | -0.007 | x | x | 0.011*** | 0.016*** | x | x | -0.006*** | -0.006*** | x | x |
| Metropolitan | Reference | Reference | Reference | Reference | Reference | Reference | Reference | Reference | Reference | Reference | Reference | Reference | Reference | Reference | Reference | Reference |
| Micropolitan | 0.152 | 0.258* | x | x | -0.610 | -0.426 | x | x | 0.188 | 0.301** | x | x | -0.0157*** | -0.155** | x | x |
| Rural | 1.005*** | 1.000*** | x | x | n/a[1] | n/a[1] | x | x | 1.009*** | 1.018*** | x | x | n/a[1] | n/a[1] | x | x |
| **LHD Characteristics** | | | | | | | | | | | | | | | | |
| Presence of Policy-making BOH | | 0.179*** | | 0.042 | | 0.296** | | 0.064 | | 0.169*** | | 0.068 | | 0.011 | | 0.031 |
| Total FTEs | | -0.000 | | -0.000 | | 0.000 | | -0.000 | | -0.000* | | -0.000 | | 0.000 | | -0.000 |
| Completion of CHIP | | -0.025 | | -0.099 | | -0.126 | | -0.428** | | -0.011 | | -0.082 | | 0.032 | | 0.013 |
| Completion of CHA | | 0.012 | | 0.048 | | -0.087 | | -0.015 | | 0.04 | | 0.069 | | -0.090*** | | -0.072 |
| Services Provided | | | | | | | | | | | | | | | | |
| MCH | | -0.020 | | -0.058* | | -0.047 | | -0.105* | | -0.014 | | -0.056* | | -0.002 | | 0.018 |
| Immunizations | | -0.028 | | 0.063 | | -0.059 | | 0.030 | | -0.029 | | 0.059 | | 0.019 | | -0.040 |
| Screening | | -0.010 | | -0.024 | | -0.029 | | -0.021 | | -0.007 | | -0.024 | | -0.003 | | -0.002 |
| Treatment | | 0.052 | | -0.009 | | 0.167** | | 0.163 | | 0.045 | | -0.029 | | 0.021 | | 0.026 |
| Health Services | | 0.025 | | 0.006 | | -0.007 | | -0.048 | | 0.022 | | 0.022 | | -0.013 | | -0.032* |
| Epidemiology | | 0.016 | | 0.011 | | -0.001 | | -0.025 | | 0.023 | | 0.011 | | -0.012 | | -0.003 |
| Population Health | | -0.023* | | -0.012 | | -0.017 | | 0.030 | | -0.021* | | -0.009 | | 0.003 | | 0.009 |
| Regulation | | -0.007 | | -0.010 | | -0.032* | | -0.027 | | -0.005 | | -0.004 | | -0.009* | | -0.006 |
| Environmental Health | | 0.15 | | 0.024 | | 0.036 | | 0.072** | | 0.012 | | 0.018 | | 0.008 | | 0.004 |
| Other | | 0.011 | | 0.024 | | 0.011 | | 0.005 | | 0.006 | | 0.033 | | 0.007 | | 0.003 |
| Dependent variable lag | 0.750*** | 0.741 | 0.437*** | 0.425*** | 0.754*** | 0.742*** | 0.370*** | 0.354*** | 0.742**** | 0.733*** | 0.401*** | 0.386*** | 0.659*** | 0.649*** | 0.097* | 0.088* |

BOH - board of health; CHIP - community health improvement plan; CHA - community health assessment; MCH - maternal and child health

[1]Not present in this sample

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

differently, either with LHDs with no missing outcomes or including LHDs with 2 missing outcomes, did not change the significance of the relationship.

## 2.5 DISCUSSION

These findings provide evidence suggesting that the presence of a lead executive with a nursing degree is associated with improved health outcomes in the community. Specifically, while controlling for other factors, nurse lead executives are associated with 5.2% lower mortality in the Black population as well as a 6% lower Black-White mortality ratio among residents that are 15-44 years of age. Nurse lead executives are also associated with a reduction in the percentage of the population with late or no entry to prenatal care. These relationships hold after relevant social, demographic, health resource, and organizational variables are added to the model and after accounting for year and unit fixed effects. Specifically, the relationship to reduced disparities presented here suggests that a nurse leaders' association with improved public health performance can translate into equitable health improvements.

The nurse leader's relationship with earlier entry to prenatal care provides unique information with regard to the role of leadership. Previous public health systems studies which have included this as an outcome have focused on the effect of either LHD program expenditures or availability of services. Only one of these studies found a statistical relationship, which showed that certain types of LHD expenditures were associated with higher percentages of late/no entry to prenatal care.[91,92] In demonstrating the negative relationship between nurse public health directors and late or no entry to prenatal care, this study provides evidence on potential strategies to increase prenatal care utilization. It should be noted that while nurses leaders were overall found to be associated with earlier entry to prenatal care in the aggregate as well as the White population

specifically, no relationship was found between the nurse leader and this outcome in the Black population. This speaks to the importance of disaggregating data when conducting public health systems research, as the improvement at the aggregate level may have more to do with improvements in the White population while not being shared equitably across populations. However, this may also have more to do with data availability, as certain states with large Black populations were excluded from analysis due to variations in the type of birth certificate they used.[93]

This study adds to the public health systems research literature in several additional ways. First, few public health systems studies have examined the role of leadership with respect to community health – this study helps to fill that gap. Second, the longitudinal design of this study is a unique approach to examining the effect of changes in leadership type. While Bekemeier et al. also had a longitudinal design, they examined clinicians as an aggregate and did not examine nurses specifically.[26] Further, their study used a first differences approach with two time periods as opposed to the larger number of time periods used here. Finally, this study is also set apart in its use of additional organizational control variables not previously used, such as completion of a community health assessment and board of health authority.

The association established here is fairly distant – indeed, the small effect on mortality rate and the mortality ratio speak to the multiple systemic and structural factors which influence health in the community. However, the leader of a health department is an important part of addressing such systemic factors and who that leader is, including the values and attributes they hold, appears to matter. The information presented here provides evidence that nurse LHD leaders appear particularly valuable and potentially beneficial to the health of their community. Data from another study led by this author underscores why this might be – in that study, nurses describe an "other-

focused" approach to their work that was grounded in an empathy related to their experiences as a nurse values such as integrity and inclusivity (Kett et al., unpublished). This, along with known nursing strengths such as collaboration, planning, and problem-solving,[35,94] supports the assertion that nurses are important partners in public health work and are likely to be effective in the difficult work of promoting health equity. Continued barriers to establishing the value of public health nurses include limited availability of data regarding their training, work environments, scope of practice, and daily activities. Collecting and including these data would add greatly to future research efforts.

## 2.6 LIMITATIONS

There are several limitations in this study. First, retrieving data from the CDC WONDER database may have influenced our inability to find a relationship between the nurse leader and infant mortality and disaggregated prenatal care outcomes. With this database, we were unable to access county-level infant mortality data for counties with less than 250,000 population. Other studies which have found an association with public health factors and infant outcomes have been state-specific and, thus, used birth certificate data from that state's department of health, allowing for a more complete dataset.[10,11] Gathering individual state datasets was beyond the scope of this study. With regard to prenatal care entry data, certain states' data were excluded due to use of the 1989 version of the birth certificate (see Appendix). Second, the *Profile* survey data used are voluntarily completed by local public health officials in each county and, thus, may contain some inaccuracies. Third, specification of the models was limited by the variables at hand and thus, but there may be additional time-varying factors which play a role. While use of time and unit fixed effects attempted to address omitted variables, this may still have been a potential issue.

## 2.7 CONCLUSION

Strong public health systems are needed to respond to immediate needs in communities. This study provides valuable information regarding the role and contribution of nurse lead executives to such a system. Specifically, the information presented here is an important part of establishing the value nurses bring to public health work and leadership. Future research is needed that is focused on public health strategies to address inequitable health outcomes, as well as how to best employ public health nurses and nurse leaders in supporting this work.

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# Appendix I

Changes in Sample After Removal of Counties with Less Than 20 Deaths

| 15-44 Mortality | | Before* (n) | Final Sample (n) |
|---|---|---|---|
| | LHDs | 862 | 626 |
| | States | 43 | 43 |
| | *LHD classification* | | |
| | Rural | 90 | 36 |
| | Micro | 277 | 147 |
| | Metro | 495 | 447 |
| **Infant Mortality** | | | |
| | LHDs | 511 | 328 |
| | States | 43 | 42 |
| | *LHD classification* | | |
| | Rural | 16 | 6 |
| | Micro | 96 | 22 |
| | Metro | 399 | 300 |

*Before numbers include only those LHDs which responded to all three surveys and LHDs with one or fewer missing in the outcome variable.

# Appendix II

Changes in Sample Due to Exclusion of States Using the 1989 Version of the Birth Certificate

| % Late or No Prenatal Care | Before (n)* | Final Sample (n)** |
|---|---|---|
| LHDs | 1315 | 280 |
| States | 43 | 33 |
| *LHD Classification* | | |
| Rural | 369 | |
| Micropolitan | 404 | |
| Metropolitan | 588 | |

*Before includes only those LHDs which responded to all 3 *Profile* surveys

**The following states were excluded from analysis due to use of the 1989 version of the birth certificate for 2 or more years of the study time period: Alabama, Arkansas, Arizona, Maine, and West Virginia, as 1989 birth certificate data was coded as "excluded" in the CDC WONDER database.

# Appendix III

System GMM Estimation Results for Selected Population Health Measures, 2011-2018

| | 15-44 Mortality (*ln*) | | | IMR (*ln*) | | | Entry to Prenatal Care (%) | | |
|---|---|---|---|---|---|---|---|---|---|
| | Aggregate[1] (n=626) | Black[2] (n=142) | White[1] | Total[4] (n=328) | Black[5] (n=116) | White[6] (n254) | Total[7] (n=280) | Black[8] (n=194) | White[9] (n=280) |
| **Lead Executive Characteristics** | | | | | | | | | |
| Nurse | 0.010 | -0.093* | 0.013 | 0.016 | -0.007 | 0.041 | -0.144 | -0.083 | -0.200 |
| **LHD Characteristics** | | | | | | | | | |
| Presence of Policy-making BOH | -0.031 | 0.106** | -0.026 | 0.021 | 0.023* | -0.054 | 0.055 | 0.640*** | 0.077 |
| Total FTEs | -0.000 | -0.000 | -0.000* | -0.000*** | -0.000*** | -0.000 | -0.000 | 0.000 | -0.000 |
| Completion of CHIP | -0.004 | -0.004 | -0.028** | 0.021 | 0.015 | -0.007 | 0.096 | -0.031 | 0.061 |
| Completion of CHA | 0.013 | -0.042 | -0.021 | -0.032 | -0.015 | -0.091*** | -0.072 | -0.174 | -0.032 |
| Services Provided | | | | | | | | | |
| MCH | 0.000 | -0.007 | -0.003 | 0.014* | -0.001 | -0.023 | -0.053* | -0.100* | -0.053* |
| Immunizations | 0.013 | -0.011 | -0.051*** | 0.041** | -0.005 | -0.068** | -0.071 | -0.093 | -0.063 |
| Screening | 0.012** | 0.014* | 0.011*** | -0.000 | 0.000 | 0.011 | -0.020 | -0.060 | -0.027 |
| Treatment | -0.011 | -0.021 | -0.001 | 0.001 | -0.010 | -0.012 | 0.143** | 0.321** | 0.115* |
| Health Services | -0.005 | -0.004 | -0.003 | 0.006 | 0.002 | 0.010 | 0.0833 | 0.005 | 0.073 |
| Epidemiology | -0.004 | -0.003 | -0.008** | -0.013 | -0.011** | 0.001 | -0.002 | -0.004 | 0.016 |
| Population Health | -0.005 | -0.013* | -0.005 | 0.006 | 0.001 | -0.006 | -0.042* | -0.042 | -0.035 |
| Regulation | -0.009* | 0.003 | 0.007*** | 0.003 | 0.008* | 0.004 | -0.032* | -0.06* | -0.036** |
| Environmental Health | -0.015*** | -0.014 | -0.006 | -0.001 | -0.011** | -0.007 | 0.051** | 0.077** | 0.047** |
| Other | -0.002 | -0.006 | -0.003 | -0.005 | 0.008* | 0.006 | 0.038 | 0.007 | 0.039 |
| **Community Characteristics** | | | | | | | | | |
| Disadvantage index | -0.187*** | 0.204*** | 0.059*** | 0.130*** | 0.056** | 0.077*** | 0.020 | -0.212** | -0.007 |
| % 19 and under | -0.048*** | -0.042*** | -0.014** | -0.014** | -0.010** | -0.069*** | -0.025 | 0.056 | -0.012 |
| % 65 and older | -0.002 | -0.009 | 0.015*** | -0.008* | -0.003 | -0.040*** | -0.023 | 0.01 | -0.011 |
| % ≤65y, uninsured | -0.035*** | -0.027*** | -0.005 | -0.016*** | -0.014*** | -0.012* | 0.123*** | 0.117*** | 0.145*** |
| *ln*(Providers per 1,000 population) | -0.545*** | 0.046 | -0.214*** | 0.420*** | -0.024 | -0.172*** | -0.013 | 0.007 | -0.034* |
| Hansen test: *p*-value | 0.067 | 0.424 | 0.192 | 0.055 | 0.944 | 0.287 | 0.072 | 0.178 | 0.149 |
| AR1 test: *p*-value | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 |
| AR2 test: *p*-value | 0.093 | 0.896 | 0.102 | 0.060 | 0.051 | 0.053 | 0.615 | 0.839 | 0.849 |
| Lagged dependent variable | 0.10** | -0.051 | 0.242*** | 0.500*** | 0.449*** | 0.445*** | 0.455*** | 0.447*** | 0.393*** |

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

1. Total 15-44 mortality: Used all possible instruments for 15-44 mortality, nurse leadership, policy-making board of health, epidemiology, population and health services and providers per 1000 population as well as the 3rd-5th lags for disadvantage index.

2. Black 15-44 mortality: Used the 2nd through 5th lags for both nurseled and mortality variables as well as the 3rd-5th lags for the Disadvantage index as instruments.

3. White 15-44 mortality: Used the 2nd-5th lags of the nurse leadership and dependent variable and the 3rd-5th lags for the disadvantage index variable as instruments as well as all possible instruments for the providers per 1,000 population variable.

4. Total IMR: Used the 2nd-5th lags for both the IMR, nurseled, Total FTE, Provider per 1,000 population, and the Disadvantage index variables, as well as all possible instruments for 2 additional variables: FTEs and Epidemiology services.

5. Black IMR: Used the 3rd lag of the nurseled and infant mortality variables as well as all possible instruments starting with the 3rd lag for 3 additional variables: # of FTEs, Disadvantage index, and % 19 and under

6. White IMR: Used the 3rd lag for the White IMR, nurseled and Disadvantage index variables, the 2nd lag for the MCH, Epidemiology, and Environmental Health services variables and all possible instruments for FTEs.

7. Total PNC: Used the 2nd lag for % PNC and nurse leadership variables as instruments.

8. Black PNC: Used the 2nd lag for % PNC and nurse leadership variables as instruments.

9. White PNC: Used the 2nd lag for % PNC and nurse leadership variables as instruments.

# CHAPTER 3

# THE NURSE LEAD EXECUTIVE'S CONNECTION TO ACTIVITIES WHICH SUPPORT HEALTH DEPARTMENT PERFORMANCE AND REFLECT HEALTH EQUITY WORK

## 3.1 ABSTRACT

**Background** Previous research demonstrated a positive association between the public health director with a nursing degree and local health department (LHD) performance. However, specific mechanisms underlying this relationship are unknown. This study explores the relationship between the nurse public health director and certain LHD organizational factors, providing insight into the nurse leader's relationship with LHD performance and health equity work. **Methods** This study used multivariate logistic regression and count data analyses to explore the relationship between nurse versus non-nurse public health directors and engagement in the following organizational factors: community partnerships, community health assessment (CHA) and community health improvement plan (CHIP) completion, and engagement in policy activities related to the social determinants of health (SDOH). A national, county-level dataset was compiled containing LHD and community demographic variables. **Results** Multivariate logistic regression models showed that the odds of having completed a CHA is 1.49 times more likely, and the odds of having completed a CHIP is 1.56 times more likely, when the public health director is a nurse ($p < 0.05$). Count data models predicted the nurse public health director, compared to the non-nurse, to perform 1.18 times more SDOH-related policy activities ($p<0.05$). **Conclusion** The results presented here demonstrate an important constellation of activities – not only does the nurse leader appear to emphasize assessment in their work, but they also are more

likely than non-nurses to engage in policy activities which address the root causes of health inequities and as such, are important partners in work to facilitate health equity.

## 3.2 INTRODUCTION

Significant research has been devoted to exploring factors which drive LHD performance. Factors found to be influential in performance include higher per capita public health expenditures, a more experienced workforce, the presence of a local board of health with policy-making authority, more collaborative partnerships, and completion of a community health assessment (CHA), a community health improvement plan (CHIP), and an agency-wide strategic plan.[1-9] Such factors are important to understand as a high-performing LHD – one which fulfills the core responsibilities of assessment, assurance, and policy-development – has increased capacity to provide needed services to protect and promote the health of their community.[10] Indeed, high-performing LHDs are associated with population health improvements, such as reduced sexually transmitted diseases, reduced low birthweight births, decreased rates of low or no prenatal care as well as improvements in smoking rates and physical inactivity.[11-14]

Engagement in the 10 Essential Public Health Services (EPHS) has traditionally been the standard by which to assess LHD performance of its core responsibilities.[15] The National Public Health Performance Standards (NPHPS) and requirements for voluntary public health accreditation, both used as tools to evaluate performance, are based on the EPHS.[16-18] The EPHS were updated in 2020 to incorporate a greater focus on equity – these changes emphasize the importance of policy, systems, and services which promote health for all people by addressing structural barriers which underlay health inequities.[15] Thus, along with understanding which factors support LHD performance, additional attention is being given to the need for public health

leaders who effectively guide the LHD in prioritizing work focused on equitable improvements in health.[19,20]

Previous public health systems and services studies have found that a public health director with a nursing degree was positively associated with LHD performance of the following EPHS: ensuring a competent workforce, linking people to health services, evaluation of services, and conducting research on solutions.[5,21,22] Research on nurse leaders indicates that they possess a number of attributes and competencies which are important for performance as well as effective health equity work, including a knowledge of public health, an understanding of people, an inclusive lens, a collaborative leadership style, and being partnership oriented.[20,23-27] Nurses' training emphasizes a holistic approach to health and is grounded in social justice, indicating that the nurse leader is likely to commit to supporting the LHD in successfully working toward equitable health improvements in the community.[28,29] However, specific mechanisms regarding the nature of the nurse public health director's relationship to LHD performance are unknown and thus deserve further investigation. In addition, it is important to understand if the activities the nurse emphasizes to support performance are also those which are in line with an equity-oriented approach.

Public health nurses (PHNs) represent the largest group of public health practitioners, but their presence is decreasing, particularly with respect to PHN leaders.[30] Recent data shows that only 24% of lead executives reported a nursing degree in 2019, as opposed to 31% in 2016.[30,31] Research is lacking that demonstrates the value of nurses to public health, particularly public health leadership.[32,33] At a time when a stronger and more effective public health infrastructure is needed, it is imperative to understand how nurse leaders support this system to prevent further decreases

in this important part of the public health workforce and potentially detrimental effects on the public's health.

The following study addresses such a need. It compares engagement of certain LHD organizational factors between nurse and non-nurse lead executives in order to provide insight into the nurse leader's relationship with improved LHD performance as well as their work to promote health equity. This study is unique in its focus on the nurse-trained public health director as the main predictor as well as in its examination of a broad set of organizational factors important in LHD performance and health equity work.

## 3.3 METHODS

This study used a series of multivariate logistic regression and count analyses to explore the relationship between the presence of a nurse-trained public health director and engagement in a range of organizational factors associated with LHD performance.

### Conceptual Framework

A conceptual model was developed to guide the selection of organizational factors being examined (Kett, unpublished). It is largely based on a model developed by Hajat and colleagues, but also utilizes concepts present in the Social-Ecological Model as well as the System of Prevention framework.[3,34,35] This model (Figure 1) illustrates how organizational factors within an LHD are related to and influence each other to support LHD performance and to lead to health equity in the community. In this model, the public health director ("lead executive"), with specified attributes and competencies such as a knowledge of public health and a commitment to social justice, is shown to operate directly through four major mechanisms: the local board of health (LBOH), partnerships, accreditation and funding/expenditures. Each of these mechanisms in turn

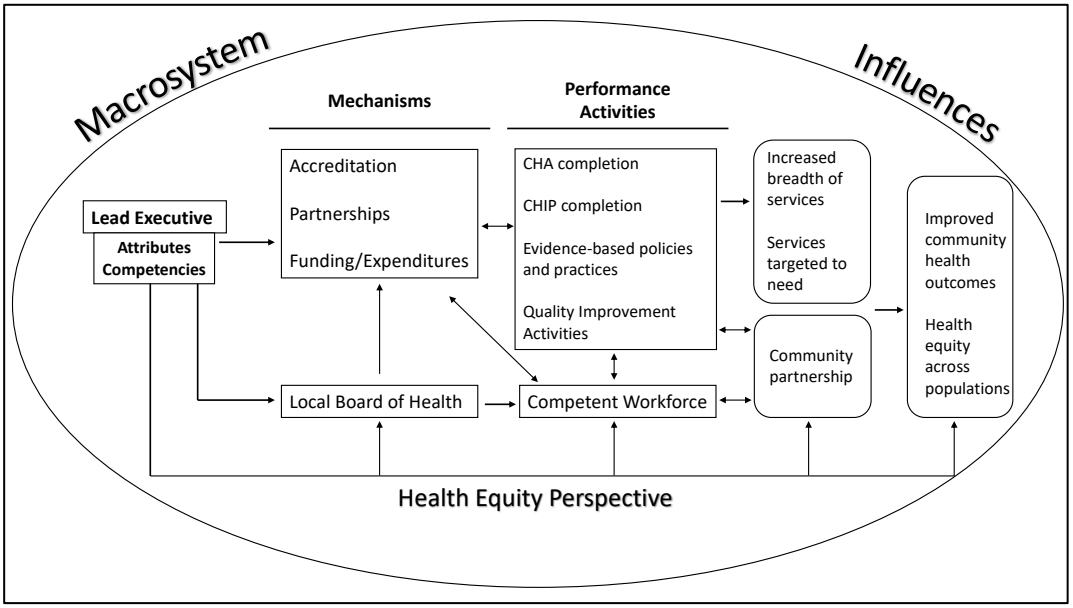


Figure 1. Pathway to Community Health

influence, and are influenced by, activities which reflect performance including completion of a community health assessment, an updated strategic plan, a competent workforce, and engagement in evidence-based policies and practices. These activities both facilitate, and are facilitated by, a strong partnership with the community. When implemented, these measures lead to an increased breadth of services targeted to the community's need, supporting improved health outcomes. This model specifies a leader with a health equity perspective; such a leader is likely to support the types of partnerships, workforce competencies, and activities which are needed for health equity in the community. [36-38] The macrosystem influences show that 1) the LHD operates amid many systemic factors which must be taken into consideration and 2) multiple factors influence community health outcomes.

Data and Variable Selection

A national, county-level dataset was compiled containing variables pertaining to the LHD and community demographics. This study received an exemption from the University of Washington's Institutional Review Board.

Data pertaining to LHD leadership, organizational factors, and infrastructure come from the 2019 National Association of County and City Health Officials Profile of Local Health Departments (*Profile*) survey.[30] This dataset contains information on individual-level LHDs with variables pertaining to the organization, infrastructure, workforce, and practice of the LHD, including information on the public health director as well as types of activities performed. Data pertaining to community demographic variables come from the 2018 Area Health Resource File (AHRF).[39] In order to link these two datasets together, the LHD identification codes in the *Profile* dataset needed to be linked to their corresponding county-level FIPS codes. This was necessary as the AHRF uses the county-level FIPS codes as identifiers. At this point, both data sources contained one common element – the county-level FIPS codes – which was used to link all the data together to create the final dataset for analysis.

*Leadership Measures*

The main independent variable in this study was measured using *Profile* data, indicating whether the LHD was "nurse-led" (lead executive has an Associate Degree in Nursing, Bachelor of Science in Nursing, Master of Science in Nursing, and/or a Doctor of Nursing Practice) or "Not nurse-led." Three other lead executive characteristics were included based on past studies showing these factors are influential in LHD performance.[5,6] They were binary variables indicating whether or not the lead executive (a) possessed a master's degree or higher, (b) had been in their position 5 years or less, or (c) identified as female.

*Outcome variables*

Ten organizational factors, listed in Table 1, were chosen as outcomes due to evidence of their relationship to LHD performance. Several of these outcomes also reflect a commitment to health equity work and are associated with health improvements in the community. Partnerships are frequently cited as a major way for the LHD to effectively provide core public health services and thus represent capacity to address the complex issues inherent in equitably caring for the community's health.[23,37,40-42] Frequent engagement in policy activities reflect an organizational culture which emphasizes policy as an avenue to address underlying health disparities.[43] Accredited LHDs are found to have higher participation in quality improvement, more effective management processes, and to be better positioned to guide the public health system.[5,17,44,45] Accredited LHDs are also associated with reduced smoking rates, physical inactivity, and teen birth rates.[14] The presence of a recently completed strategic plan, CHA, and CHIP also reflect agencies with greater engagement in quality improvement; in addition, when implemented, these

**Table 1.** Organizational Variables

| Outcome | Definition |
|---|---|
| Accreditation | Public health accreditation designation in 2019 (yes or no) |
| Community health assessment completion | Community health assessment completion within the past three years (yes or no) |
| Community health improvement plan completed | Community health improvement plan completed within the past three years (yes or no) |
| Total policy activities | Total number of policy-making and/or advocacy activities in the past two years |
| SDOH policy activities | Total number of policy-making and/or advocacy activities focused on the social determinants of health in the past two years[1] |
| Total partnerships | Total number of partnerships |
| Formal Partnerships | Total number of partnerships with a written agreement |
| Informal Partnerships | Total number of partnerships which involve regular meetings or information sharing only, but do not have a written agreement |
| Presence of a strategic plan | Completion of a strategic plan within the past three years (yes or no) |
| Presence of a board of health with policy-making authority | Board of health has final authority to determine public health regulations, impose taxes, set and impose fees and/or set policies, goals, and priorities for LHD (yes or no) |

[1]SDOH Policy-making and advocacy activities include: climate change, emergency preparedness and response, funding for local public health, injury and violence prevention, land use planning, safe and healthy housing, waste, water, or sanitation, other environmental health, and occupational health and safety.

activities facilitate development of programs and services targeted to community need.[1,46,47] Services targeted to need often have greater breadth to provide more population-based services centered on prevention and reducing health disparities.[22,48] This is important, as increased breadth of population-based services has been associated with a reduction in infant mortality, Black-White mortality disparities and mortality related to stroke.[22,48,49] Finally, the LBOH with policy-making authority is found to be influential in supporting completion of the CHA and a strategic plan, particularly when the LBOH is contributing to the development of policies focused on improving the public's health.[50,51]

Partnerships were examined in total, as well as transformed into two groups – formal and informal partnerships. This was done given hypotheses that nurses, due to their emphasis on relationships in their practice, may be more likely to have informal, rather than formal, partnerships. [26,27] Policy activities were also examined in total, as well as transformed into a variable representing only those policy activities that focused on the social determinants of health (SDOH). This was done as organizations committed to health equity are more likely to be involved in activities which address root causes of health disparities.[52,53] SDOH policy activities were those pertaining to: climate change, emergency preparedness and response, funding for local public health, injury and violence prevention, land use planning, safe and healthy housing, waste, water, or sanitation, other environmental health, and occupational health and safety. While LHD expenditures are noted to be an important influence in performance as well as to have a known relationship with community health, they were not selected as an outcome variable due to a significant amount of missing data pertaining to expenditures (52%).[12,54]

*Other measures*

Two sets of covariates were included in this study due to their known association with LHD performance as well as community health. The first set of covariates were LHD organizational variables, several of which were also included as outcome variables. These were accreditation status, a completed CHA, the presence of an LBOH with policy-making authority, and an updated strategic plan. Each was excluded as a covariate in the model where they were examined as the outcome. Two additional LHD covariates were total FTEs, representing LHD capacity, as well as a service classification scheme. The classification scheme, developed in prior research, identified three classes of LHDs based on responses to personal and population health service activity questions in the *Profile* survey.[55] These classes illustrate the breadth of activities provided by the LHD: limited, core, and core-plus. Those LHDs in the core-plus class are more likely to provide an increased range of population-focused services than those in the core and limited classes.

The second set of covariates represented contextual factors in the community which may influence LHD engagement in the organizational factors examined. These included the number of hospitals in the county as well as the rural/urban designation.[8,56-58] LHDs were characterized as metropolitan (urban), micropolitan or rural based on the 2010 Rural-Urban Commuting Area Codes.[59]

This study specifically focuses on the mechanisms and activities which can be leveraged and implemented by the nurse leader and as such, only includes elements at the organizational and community levels which could impact engagement in these factors. Elements of the community context which are connected to health outcomes, such as level of education, percent at or below poverty, and employment status, were not included as they are less likely to significantly influence engagement in the chosen organizational factors. In addition, population size was not included as

a covariate as it generally is used as a proxy to represent the size and capacity of the LHD; this aspect of the LHD is accounted for through the variables representing the number of FTE's as well as rural/urban designation.

*Sample*

The 2019 *Profile* survey was sent out to 2,459 LHDs in the United States with a response rate of 61% (n=1496).[30] The data set was further restricted for this study by removing LHDs with missing data pertaining to the education of the lead executive, resulting in a final sample of 1447 LHDs. The variables pertaining to partnerships were part of a supplemental module sent to a randomly selected subset of LHDs.[30] A total of 374 respondents completed this module; this was then also restricted to respondents that had education data pertaining to the lead executive, resulting in a total of 367 LHDs in the analysis concerning partnerships.

Analysis

Variables were screened for outliers and descriptive statistics were computed for LHD leadership characteristics, organizational factors, other LHD characteristics and community characteristics of both the large and small samples. Percent missing was calculated for all covariates and outcomes – no variable had greater than 2% missing except for rural-urban classification. 251 LHDs did not have an associated rural-urban classification as they did not have FIPS which could be utilized to link this information. Models were analyzed with and without these LHDs included; results were not substantially different and so these LHDs were retained in the sample. Multivariate logistic regression analysis was used in models with binary outcome variables to assess the odds of the nurse-led LHD completing the CHA and the CHIP, having an updated strategic plan, being accredited, and having an LBOH with policy-making authority.

Count data analysis using the negative binomial distribution was used in models pertaining to partnerships and policy activities. Analyses were completed to determine the best probability distribution for each count data variable – the negative binomial was chosen due to having the lowest AIC and BIC. In addition, a plot of each count variable demonstrated a right skew, further confirming that the negative binomial distribution was the appropriate choice to model the data. Models were constructed in a stepwise fashion, starting with the bivariate analysis and then adjusting for LHD leader factors, additional organizational factors, and community characteristics. The bivariate and full models are presented here. All analyses are displayed in exponentiated form.

Following logistic regression and count data analysis, a predicted probability was estimated to assess the effect of the type of leader on LHD engagement in policy activities given a range of number of FTEs employed by the LHD. This was done as well for policy activities focused on SDOH. Values for LHD characteristics were set to represent two LHDs with the same resources which were either "nurse led" or "not nurse led". FTEs were set to represent a range from 5 to 4000 based on a majority of LHDs in the sample. Results were plotted to demonstrate the differences in policy activity involvement per leader type.

## 3.4 RESULTS

Results of the descriptive analyses for the large sample are presented here (n=1447). Descriptive statistics for the smaller sample are available upon request. Approximately one quarter (n=380) of the lead executives in the sample had a nursing degree. In addition, a majority of the lead executives were full-time (93%), were female (65%), had a tenure of less than five years (56%), and possessed a master's degree or higher (63%). With respect to organizational outcomes of interest, 62% of LHDs in the sample had completed a CHA, 51% had an updated strategic plan,

Table 2: Descriptives, N=1447

| Parameters | N (%) | Mean | SD | First quartile | Third quartile |
|---|---|---|---|---|---|
| **Outcome Variables** | | | | | |
| **Org Variables** | | | | | |
| Completed CHA | 893 (62) | | | | |
| Strategic Plan | 740 (51) | | | | |
| Accredited | 362 (25) | | | | |
| Policy-making BOH | 898 (62) | | | | |
| Completed CHIP | 801 (55) | | | | |
| **Partnerships** | | | | | |
| Total | | 31 | 15.4 | 20 | 40 |
| Formal | | 8.6 | 7.9 | 2 | 13 |
| Informal | | 22.7 | 10.1 | 14 | 28 |
| **Policy Activities** | | | | | |
| Total | | 6.1 | 4.0 | 3 | 9 |
| SDOH | | 3 | 2.4 | 1 | 4.25 |
| **Lead Executive Characteristics** | | | | | |
| LHD Nurse Top Executive | 380 (26) | | | | |
| Fulltime FTE | 1355 (93) | | | | |
| Tenure <5 years | 814 (56) | | | | |
| Female | 943 (65) | | | | |
| Non-White | 144 (10) | | | | |
| Masters Degree or Higher | 918 (63) | | | | |
| **LHD Characteristics** | | | | | |
| FTEs | | 62.6 | 239.4 | 7 | 50 |
| **Service Class** | | | | | |
| Limited | 277 (19) | | | | |
| Core | 675 (47) | | | | |
| Core-Plus | 495 (34) | | | | |
| **Community Characteristics** | | | | | |
| Population, in 1,000's | | 53,916 | 121,339 | 20 | 331 |
| Number of Hospitals | | 2.62 | 5.8 | 1 | 2 |
| **Rural Urban Classification** | | | | | |
| Metropolitan | 522 (36) | | | | |
| Micropolitan | 361 (25) | | | | |
| Rural/Small Town | 311 (21) | | | | |

and 55% had completed a CHIP. Only one quarter of the LHDs in the sample were accredited. The average number of total partnerships was 31 and the average number of total policy activities was 6.1. The spread was fairly even with respect to being designated a rural, micropolitan, or metropolitan jurisdiction (Table 2).

Multivariate logistic regression models show a significant positive relationship between the nurse-led LHD and completion of both a CHA and a CHIP (Table 3). Of the two outcomes, only the CHIP shows a significant relationship with the nurse lead executive in the bivariate model. However, in adjusting for additional leadership, organizational, and community characteristics also associated with these factors, the nurse lead executive's relationship with both the CHA and the CHIP increases in strength and is significant. Specifically, in the full model, the odds of having completed a CHA is 1.49 times more likely when the lead executive is a nurse (95% CI = 1.09-2.05). Similarly, the odds of having completed a CHIP is 1.56 times more likely with a nurse-trained lead executive (95% CI = 1.03-2.37). No significant relationship was found between the

Table 3: Logistic Regression of Organizational Factors

| | CHA (n=1447) | | CHIP (n=1447) | | Strategic Plan (n=1447) | | Accredited (n=1447) | | Policy-Making BOH (n=1447) | |
|---|---|---|---|---|---|---|---|---|---|---|
| Parameters | SLR | Full Model | SLR | Full Model | SLR | Full Model | SLR | Full Model | SLR | Full Model |
| **Main Predictor** | | | | | | | | | | |
| Nurse Lead Executive | 1.19 | 1.49** | 1.29** | 1.56** | 0.92 | 1.07 | 0.67*** | 0.99 | 1.18 | 1.28 |
| **Leader Characteristics** | | | | | | | | | | |
| Female | | 0.9 | | 0.74 | | 0.78 | | 0.92 | | 0.69*** |
| Tenure <5y | | 1.10 | | 0.75 | | 1.22 | | 0.76* | | 0.78* |
| Masters Degree or Higher | | 1.22 | | 0.72 | | 1.56** | | 3.42*** | | 0.85 |
| **LHD Characteristics** | | | | | | | | | | |
| Total FTEs | | 1.00 | | 1.00 | | 1.00 | | 1.00 | | 1.00 |
| Policy-making BOH | | 2.05*** | | 1.67*** | | 0.88 | | 1.17 | | |
| Accredited | | 1.52** | | 1.98*** | | 3.28*** | | | | 1.12 |
| Completed CHA within 3yr | | | | 29.5*** | | 2.36*** | | 1.56** | | 2.07*** |
| Strategic Plan | | 2.35*** | | 3.03*** | | | | 3.17*** | | 0.90 |
| **Service Class** | | | | | | | | | | |
| Limited | | Reference | | Reference | | Reference | | Reference | | Reference |
| Core | | 1.18 | | 1.44 | | 2.05*** | | 2.40** | | 0.66** |
| Core-Plus | | 1.77*** | | 1.90** | | 2.31*** | | 4.84*** | | 0.68* |
| **Community Characteristics** | | | | | | | | | | |
| Number of Hospitals | | 1.00 | | 0.96** | | 0.99 | | 1.13*** | | 0.96*** |
| **Rural-Urban Classification** | | | | | | | | | | |
| Rural | | 0.83 | | 0.90 | | 0.77 | | 0.44*** | | 1.13 |
| Micropolitan | | 0.82 | | 0.85 | | 1.09 | | 0.79 | | 1.09 |
| Metropolitan | | Reference | | Reference | | Reference | | Reference | | Reference |
| BIC | 1928.8 | 1487.5 | 1989.8 | 1013.1 | 2010.7 | 1496.9 | 1634.6 | 1132.8 | 1906.5 | 1591.5 |

[1] LHD - local health department; BOH - board of health; CHA - community health assessment; CHIP - community health improvement plan; BIC - Bayesian Information Criterion
[2] * p<0.1; ** p<0.05; *** p<0.01

type of leader and accreditation status, the presence of an updated strategic plan, and/or an LBOH with policy-making authority.

The models for the count data analyses are displayed in Table 4; similar to the logistic analysis, the simple bivariate model and the full model are displayed for each outcome of interest. Here, the nurse lead executive is predicted to perform significantly more policy activities than the non-nurse lead executive. Analyses using the negative binomial distribution can be interpreted as the expected change in the "log count" of the outcome for a unit change in the predictor. This is best understood by exponentiating the regression coefficient, which is interpreted as a multiple of the change in counts. Thus, all results are in their exponentiated form.

The models displaying the bivariate relationship between the nurse lead executive and policy activities illustrated a non-significant relationship where the nurse lead executive is predicted to perform less policy activities than the non-nurse. However, after adjusting for

additional covariates, this relationship became significant and changed in strength, such that the nurse lead executive was then predicted to perform 1.14 times more policy activities (95% CI = 1.03-1.25) and 1.18 times more policy activities focused on SDOH (95% CI = 1.06-1.32) than the non-nurse lead executive. While in the bivariate models the nurse lead executive was related to fewer partnerships, this statistical significance disappeared with the addition of covariates (β=0.92, [95% CI = 0.81-1.05]). Factors found to be associated with a higher number of partnerships include being accredited and having an LBOH with policy-making authority. In both the logistic regression and count data analyses, additional models were constructed and analyzed that excluded any organizational covariates which were used as dependent variables (LBOH with policy-making authority, community health assessment completion, presence of a strategic plan, and accreditation

Table 4: Count Data Analysis

| | All Partnerships (n=367) | | Formal Partnerships (n=367) | | Informal Partnerships (n=367) | | Policy Activities (n=1447) | | SDOH Policy Activities (n=1447) | |
|---|---|---|---|---|---|---|---|---|---|---|
| Parameters | SLR | Full Model | SLR | Full Model | SLR | Full Model | SLR | Full Model | SLR | Full Model |
| **Main Predictor** | | | | | | | | | | |
| Nurse Lead Executive | 0.81*** | 0.92 | 0.71*** | 0.86 | 0.88** | 0.93 | 0.94 | 1.14** | 0.93 | 1.18*** |
| **Leader Characteristics** | | | | | | | | | | |
| Female | | 0.92 | | 0.80** | | 1.00 | | 0.84*** | | 0.80*** |
| Tenure <5y | | 1.06 | | 1.20* | | 1.03 | | 0.96 | | 0.95 |
| Masters Degree or Higher | | 0.98 | | 0.89 | | 0.99 | | 1.06 | | 1.09 |
| **LHD Characteristics** | | | | | | | | | | |
| Total FTEs | | 1.00** | | 1.00** | | 1.00 | | 1.00** | | 1.00*** |
| Policy-making BOH | | 1.11* | | 1.23* | | 1.06 | | 1.22*** | | 1.27*** |
| Accredited | | 1.15** | | 1.10 | | 1.20*** | | 1.21*** | | 1.26*** |
| Completed CHA within 3yr | | 1.09 | | 1.13 | | 1.07 | | 1.13*** | | 1.19*** |
| Strategic Plan | | 1.04 | | 0.99 | | 1.05 | | 1.06 | | 1.06 |
| **Service Class** | | | | | | | | | | |
| Limited | | Reference | | Reference | | Reference | | Reference | | Reference |
| Core | | 1.44*** | | 2.19*** | | 1.19* | | 1.17** | | 1.04 |
| Core-Plus | | 1.74*** | | 3.18*** | | 1.30*** | | 1.39*** | | 1.24*** |
| **Community Characteristics** | | | | | | | | | | |
| Number of Hospitals | | 1.01* | | 1.02** | | 1.00 | | 1.01* | | 1.01** |
| **Rural-Urban Classification** | | | | | | | | | | |
| Rural | | 0.81*** | | 0.96 | | 0.78*** | | 0.98 | | 0.96 |
| Micropolitan | | 0.85** | | 0.72** | | 0.92 | | 0.94 | | 0.93 |
| Metropolitan | | Reference | | Reference | | Reference | | Reference | | Reference |
| BIC | 3056.4 | 2456.1 | 2366 | 1984.6 | 2747.6 | 2272.8 | 7982.4 | 6387.6 | 6251 | 4943.2 |

[1] LHD - local health department; SDOH - social determinants of health; BIC - Bayesian Information Criterion
[2] * p<0.1; ** p<0.05; *** p<0.01
[3] Data for the partnerships analysis was taken from a module in the Profile study to which only a subset of health departments respond and so the number is smaller than for the other analyses.
[4] SDOH policy activities include those focused on climate change, emergency preparedness, funding for access to healthcare, funding for local public health, land use, occupational health and safety, safe and healthy housing, waste, water and sanitation, and other environmental health activities

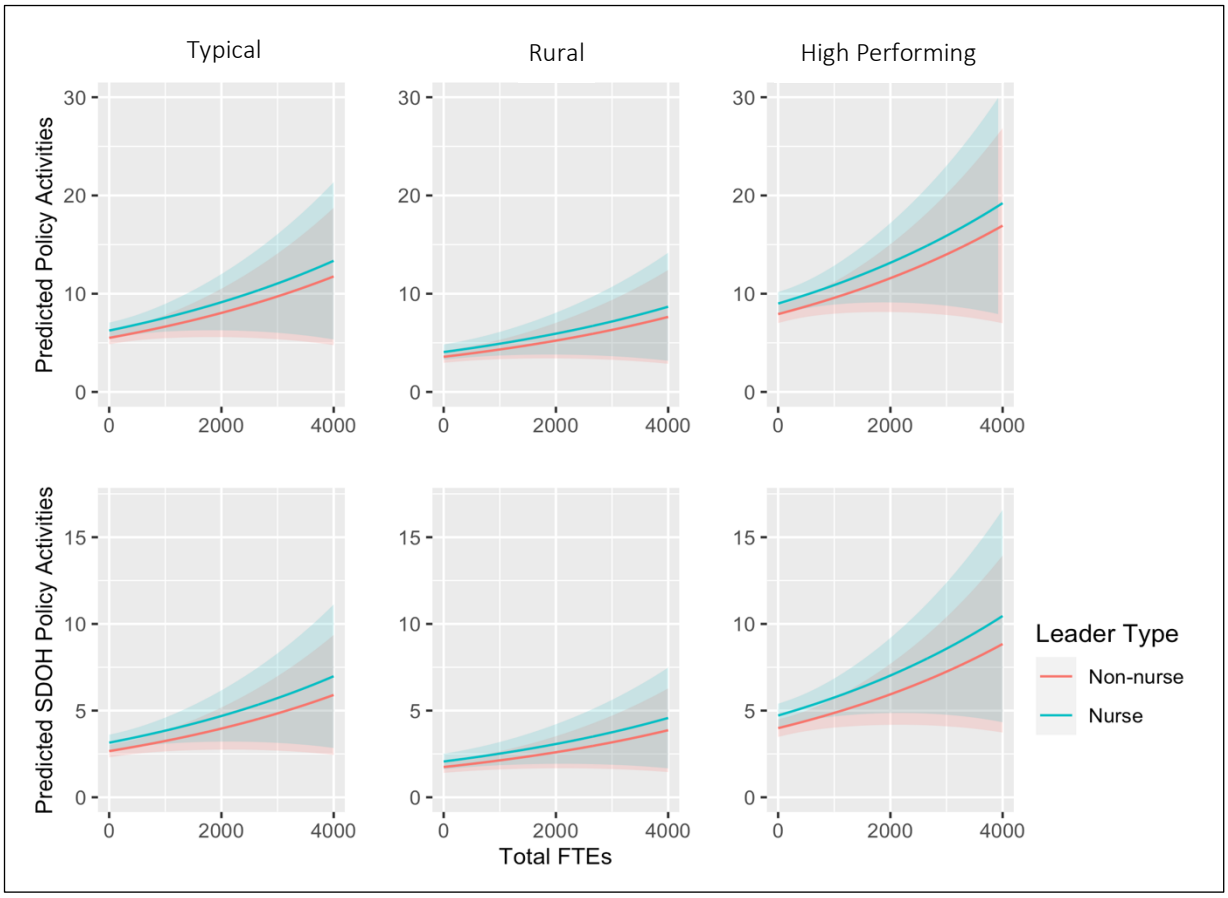


**Figure 2:** Predicted Probability Estimations for Three Types of LHDs per Range of FTEs, Based on Leader Type

status). This resulted in an increase of the effect size of the main predictor but did not change statistical significance (not shown).

As the results show, nurse leaders were related to increases in policy activities, as well as policy activities specific to SDOH. This model was examined further through displaying predictive probabilities for typical, rural, and high-performing "nurse-led" versus "not nurse-led" LHDs based on varying numbers of FTEs (Figure 2). The total number of FTEs in an agency was used as a proxy to represent the "resources" an LHD had to put toward policy development; the range of FTEs represents a majority of the LHDs in this sample. LHD organizational characteristics were held at a constant representing a "typical" LHD for this sample as well as a rural LHD (often lower-

**Table 5.** LHD Organizational Characteristics for Predictive Probabilities

| | Typical | Rural | High-performing |
|---|---|---|---|
| *Lead Executive Characteristics* | | | |
| Gender Identity | Female | Male | Male |
| Education Level | Master's degree or higher | <Master's degree | Master's degree or higher |
| Tenure | < 5y | <5y | >5y |
| Racial Identity | White | White | White |
| CHA within past three years | Yes | No | Yes |
| Strategic plan within the past three years | Yes | No | Yes |
| LBOH with policy-making authority | Yes | No | Yes |
| Accreditation Status | No | No | Yes |

resourced) and a high-performing LHD (often higher-resourced) (Table 5). [45,60] At all levels of FTEs, the nurse leader was predicted to consistently be involved in more policy-making activities as well as more SDOH-related policy-making activities. Specifically, at agencies with higher numbers of FTEs, the nurse-led LHD was predicted to be involved in up to 2.5 more policy activities than the LHD with a different type of lead executive and up to 1.5 more SDOH-related policy activities.

## 3.5 DISCUSSION

The results presented here provide valuable information regarding where nurse lead executives appear to focus in their work or make specific contributions. Specifically, we see that the nurse lead executive is associated with significantly greater numbers of policy activities than non-nurse led counterparts. Further, this relationship holds when examining those policy activities which are expressly focused on SDOH. Along with increased engagement in policy activities, the LHD with a nurse lead executive is more likely to have recently completed a CHA and a CHIP. This illustrates the value the nurse leader might appear to place on assessment and planning and

aligns with other research by this author which found that public health nurse leaders frequently employ the nursing process (assessment, planning, diagnosis, and evaluation) in their work (Kett, unpublished). Further, it demonstrates an important constellation of activities – not only does the nurse leader appear to emphasize assessment in their work, but they seem to understand the power and importance of policy in addressing identified issues.

This study is the first of its kind known to specifically examine the role of the nurse lead executive with respect to the specified organizational factors, providing insight into where the nurse leader tends to focus their efforts. Community health assessments offer valuable information about needs in the community, organizations which are already working to address these issues, and barriers to achieving equitable health outcomes.[61] In demonstrating that nurse-led LHDs are more likely to have completed a CHA, as well as a CHIP, this study suggests that nurses are leaders who engage in meaningful actions focused on meeting the needs of their community, thus adding to the public health performance and nursing literature. It is interesting to note the lack of a significant relationship between the nurse leader and partnerships. This may be due to the smaller sample size for analysis, making it more difficult to detect a significant difference. It may also be due to the fact that partnerships overall are a necessary part of completing LHD work and responsibilities. Thus, there would not be a significant difference by type of leader, despite knowledge of nurses tending to being partnership-oriented.[26]

This study is also unique in its examination of policy activity involvement, using a national sample. One other study has examined factors associated with LHD policy networks, but this study was limited to 15 large LHDs and did not examine policy activities specifically.[62] Finally, the association between nurse lead executives and greater engagement in SDOH policy activities is notable as it contrasts with recent data showing that LHDs overall are more likely to be involved

in traditional public health policy areas such as tobacco and infectious disease rather than policy areas related to SDOH.[30] The nurse lead executive's relationship with more engagement in policy activities also aligns with recent calls for greater nursing involvement in health policy due to their skills in advocacy, problem-solving, and managing competing demands as well as public respect for their work.[63]

The analysis of predicted probabilities further provides insight into the nurse lead executive's ability to operate in a way that counters expectations. The analysis suggests that a nurse lead executive, as compared to a non-nurse lead executive with the same resources, is engaged in a greater number of policy and SDOH policy activities. This is significant as nurses are more likely to be public health directors of LHDs in smaller, rural areas and small LHDs are less likely to be involved in policy activities overall.[30] Other literature notes that LHDs in rural areas are less likely to have staff with formal training in policy work and to identify policy development as a skill gap.[64,65] However, the models constructed for this study provided a different picture. In accounting for organizational, community, and leadership influences, it seems that the type of leadership, rather than the size of the LHD, may matter more for policy involvement.

This study also provides information on the nurse as a leader in health equity work. It illustrates the emphasis nurse leaders place on work centered on the root causes of health inequities, including policy work to address safe and secure housing, safe working conditions, and a healthy built environment. LHDs with activities which have an SDOH focus demonstrate leader commitment, as well as organizational commitment, to improving the LHD's ability to respond to and address health equity concerns.[37] This commitment persists amidst a complex network of community and organizational influences which were taken into account in this study. The nurse

leader's apparent commitment to SDOH exists in addition to their commitment to the CHA and the CHIP, both of which help to identify where inequities exist and what actions are needed to address them.[66] Such a combination of factors aligns with public health nurses' own rich history of community advocacy which may contribute to their capacity to address the SDOH.[67,68] Even more, in considering recent changes to the EPHS and a need for leaders who emphasize health equity work, the relationships demonstrated here take on even greater significance in that they indicate that nurse leaders are already moving in that direction and are important to have in communities in order for health equity work to thrive.[69,70]

## 3.6 LIMITATIONS

There are limitations to note in this study. As this is a cross-sectional examination, it is not possible to identify a cause-and-effect relationship between the nurse leader and certain LHD activities; future research using longitudinal methodologies would be useful in this regard. Second, this study did not examine engagement in specific policy activities, including adoption of local public health ordinances or regulation adoption within the selected policy areas and so is limited in its understanding of exact policies which are given focus under nurse leadership. However, this study provides an overall understanding of which groups of activities are attended to under such leadership. Third, additional unobserved covariates, such as other community characteristics, may provide a more comprehensive picture of the contextual variables which influence health equity; however, included covariates were intentionally selected based on current literature. Finally, while this study emphasizes factors which are important in health equity work, additional information is needed - such as how priority populations and community partners are involved in program planning and implementation - to fully assess LHD work in this area and the

influence of the lead executive. Future research is also needed to gain more detailed information regarding nursing leadership and policy work to advance health equity, including the specific policies which are given focus, the content and language of the policies, and the nature of community involvement in their development.

## 3.7 CONCLUSION

Previous research has demonstrated a positive relationship between the nurse lead executive and performance of certain essential public health services – this study provides a detailed examination of why this might be. This research demonstrates, as illustrated in the study's conceptual model, specific associations with factors which are important in LHD performance and improved community health. We see in this study that the nurse leader appears to emphasize assessment and planning, as evidenced by their increased likelihood of having completed a CHA and CHIP. Further, the nurse leader is one who engages in policy activities which address the root causes of health inequities. They are already doing what a strong and effective public health system needs and as such, are important partners in work to facilitate equitable health outcomes in the community.

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# CHAPTER 4

# "NOT EVERYBODY APPROACHES IT THAT WAY": NURSE LEAD EXECUTIVES' LEADERSHIP STRATEGIES AND SKILLS IN PUBLIC HEALTH

## 4.1 ABSTRACT

**Background** Evidence points to nurses as possessing particular skills which are important for public health leadership; in particular, investigators have found that an LHD nurse lead executive is strongly associated with positive LHD performance. To better understand this association and to guide effective deployment of nurse leaders, researchers sought to explore the specific leadership strategies used by nurse public health directors. **Methods** One-on-one audio-recorded semi-structured interviews were conducted virtually with 13 nurse public health directors around the country. A critical thematic analysis was used in analyzing all data, developing codes based on recurring patterns in the data and through analyzing connections between interview themes and ideologies, positions of power, and social hierarchies. Codes were then grouped into final themes and sub-themes. **Results** Participants detailed both (1) the strategies they employed to support LHD performance and community health and (2) how they employed these strategies. Major themes focus on the "how" to provide a distinct picture of the *nursing* approach to public health leadership. They were: (a) *approaching their work with an other-focused lens*, (b) *applying theoretical knowledge*, (c) *navigating the political side of their role*, and (d) *leveraging their nursing identity*. **Conclusion** This study articulates a distinctive combination of skills which reflect the interprofessional nature of public health nursing practice, demonstrating a specialized approach which may set nurse leaders apart from other types of public health leaders.

As such, it brings deeper clarity to the relationship between the nursing leader's practice, LHD performance, and a healthy population.

## 4.2 INTRODUCTION

The COVID-19 pandemic has highlighted the need for a responsive and effective public health system; strong public health leadership is an essential part of this. Public health workforce literature points to the particular need for leaders who possess skills in policy development, persuasive communication, systems thinking and coalition-building.[1,2] The local public health director is an important part of this leadership, responsible for setting the vision and strategy of a local health department (LHD) as well as ensuring availability of needed resources to carry out the vision and strategy.[3] As evidence increasingly points to the need to address factors perpetuating health inequities, the LHD director is also a critical part of ensuring priorities shift toward health equity work.[4,5] The recently updated 10 Essential Public Health Services have placed equity now at the center, further emphasizing this focus.[6] This emphasis demands a leader who approaches their work holistically and operates through a health equity lens, who can work effectively across disciplines, and who understands their role within the context of the larger public health system.[2,7,8] Experts note that failure to develop and identify leaders with these skills will undermine public health's ability to address and achieve desired population health outcomes.[1,2]

Evidence points to nurses as having been trained in and possessing particular skills which are important for public health leadership including collaboration and partnership development, a transformational leadership style, and a broad knowledge base with respect to different populations and communities.[9-12] Literature focused on hospital nurse executives describes these nurses' excellent communication skills, as well as an ability to hold a "total organization view."[13,14] In

addition, several studies have found that a LHD lead executive with a nursing degree is strongly associated with positive LHD performance.[15-17]

Despite evidence pointing to nurse leaders as being important partners in public health work, the percentage of public health directors with nursing degrees has decreased by 11% since 2010.[3] This comes amidst a larger decline in the public health nurse workforce overall. Since 2008, the estimated number of public health nurses (PHN) has decreased by 36%.[3] Such a decline is concerning, as nurses provide a wide range of services in public health which will be limited as their employment is reduced.[10,12] Yet, due to a lack of clarity regarding what comprises the various roles of PHNs, including public health nurse leaders, and the value they bring to public health, this decline has been predicted to continue.[18,19]

The small number of studies focused on nurse public health directors have been quantitative in their approach and lack depth in providing a clear understanding of how such directors approach their work.[15,17] Only one qualitative study was identified that explored the practice and experience of nurse leaders in public health; that study limited its focus to directors of nursing in LHDs, not public health directors.[9] The director of nursing role has a different scope of practice and set of responsibilities than the public health director as it is explicitly focused on the practice of the nurses in the health department. A deeper examination of the broad oversight expected of the public health director and how nurses approach those responsibilities has not been addressed.

The need for skilled and effective leaders in public health is clear; such leadership can be found among nurses. Evidence demonstrates public health nurse leaders are positively associated with public health performance, but very little is known regarding their practice and approach in this leadership role.[15,16] To better understand this association and to guide effective deployment of

nurse leaders, researchers sought to explore the specific strategies used by nurse public health directors in order to identify what nurses uniquely bring to positions as public health directors and how that might that be connected to evidence regarding their apparent influence on LHD performance and community health improvement.

## 4.3 METHODS

The assumptions held at the onset of the study were that: (1) nurses see the world and do their work in a unique way due to their training and experience, (2) public health nurse leaders work within a rigid and authoritative system which is influenced by a biomedical lens and face additional challenges due to gender inequities, and (3) nurses' work can be influenced through operating in spaces where they are not the group with the most power. The study was conducted mainly by the lead investigator with a background in qualitative research and expertise in public health systems. Three others served in an advisory capacity throughout the study period. These individuals collectively had a background in public health, organizational theory, and interpretive methodologies using a critical lens. Data were collected between July and September 2020.

Participants were recruited via a snowball sampling approach, with initial contacts made either to public health directors known to the lead investigator or through well-connected public health practitioners. These interviewees in turn recommended others for the study. Inclusion criteria were as follows: (a) current position as a public health director in an LHD, (b) possession of an active nursing license and (c) at least 3 years of experience as a nurse public health director in an LHD. The final sample was comprised of 13 nurse public health directors who agreed to participate.

One-on-one audio-recorded semi-structured interviews were conducted virtually with nurse public health directors around the country who were recognized by fellow public health directors as having a significant breadth of knowledge regarding public health performance. Interview questions focused on the nurse's experience as a public health director, strategies used to accomplish their work (including strategies to support public health performance and health equity in the community), how their training as a nurse influenced these strategies and any challenges they faced as nurse leaders (Table 1). Interviews were conducted in a conversational fashion, giving space for participants to focus on areas of greatest importance to them.[20] Care was taken to establish a non-hierarchical environment, ensuring interviewees understood there were no expected answers and that they could decline to answer at any time.[20,21] All interviews were audio and video recorded with permission and audio recordings were transcribed verbatim. The lead researcher utilized the video recordings to clarify wording if the audio recording was unclear. Consent to participate was given verbally prior to the interview. This study was considered exempt from Human Subjects by the University of Washington IRB and data were managed in accordance with

**Table 1.** Interview Guide

- What has your experience been like as a public health director?
- What are your top responsibilities as the public health director?
- How would you define "positive performance" with respect to the health department?
- Would you describe health equity work as a priority of your health department? If so, what are some specific ways you use your training and experience as a nurse to support this work? If not, could you talk more about why this is?
- What are some specific ways you use your training and experience as a nurse to support the positive performance of your health department?
- Where do you believe nurse lead executives are more effective than other types of lead executives? Why?

  OR In what ways might nurse lead executives operate differently than other types of lead executives? Where might they be more effective?
- What are some challenges you face? How do you address those challenges?
- Is there anything else you would like to share that I did not ask?

**If time allows:**

Has the current COVID-19 pandemic changed your approach or perspective on what an LHD needs to be successful?

**For Recruitment:**

Are there one or two other persons with particular expertise and a national perspective related to local public health practice that you would recommend that we also talk to and that you could refer me to?

a. If I choose to contact this person(s), may I say that you referred me to her/him?
b. If I choose to contact this person(s), might you be willing to initiate the contact?

**Demographic questions:**

a. How long have you worked at an LHD?
b. What is your highest educational degree attained?
c. What is your race/ethnicity?
d. What is your gender identity?

University of Washington privacy and security standards.

A critical thematic analysis was used in analyzing all data—a process informed by both Braun and Clarke and Lawless and Chen.[22,23] This methodology seeks to identify, analyze, and report patterns in the data using a critical lens. It gives space, during analysis, to explore the individual and shared experiences of participants while being acutely aware of economic, social, historical, and political contexts; social and hegemonic structures; institutional power; and ideological impact. There are two main reasons this approach was used. First, many nurse public health directors are female and many females in leadership positions face challenges related to gender inequities in the workplace. [24,25] Studies show that females are required to navigate leadership in specific ways in order to access important resources and positions.[25-27] For example, in comparison to their male counterparts, females are expected to strike a balance between authoritative and relational communication and are required to earn respect, as opposed to the authority that is frequently conceded to men.[24-26] Second, nurse public health directors work amidst a hierarchical governmental system that, due to funding directives and public policy, operates predominantly from a medicalized perspective.[27-29] Nurses do their work in a unique way due to training grounded in social justice and a holistic view of health – this approach may be less valued in such a system and results in additional challenges in accomplishing their work.[30] By engaging in a critical thematic analysis approach, practices and strategies that the nurse lead executives describe can be analyzed in the context of these systems, providing insight into the distinctive way they accomplish their work.

In following the process for thematic analysis, the lead researcher familiarized themselves with the data, reading through each transcript and making notes on initial impressions.[22] Codes were then generated using a two-step coding process.[23] First the researcher engaged in open

coding, paying close attention to repeated or recurring patterns in the data to honor what participants were actually revealing about their experiences. Second, the researcher then conducted a closed coding process, whereby the researcher used repetition and recurrence to analyze connections between interview themes and ideologies, positions of power, and social hierarchies. After completing both open and closed coding, the following steps were taken, (a) codes were grouped into themes, (b) themes were reviewed, refined and connected visually via a thematic map, and (c) final themes were defined and named.[22]

Multiple strategies were employed to assure rigor and reflexivity throughout the study. One transcript was coded in conjunction with an advisory team member to establish interrater agreement. Additional strategies for maintaining rigor included memo-writing for individual interviews and regular check-in meetings with advisory team members. A final summary of major themes was shared with participants prior to publication to ensure their experiences and perspectives were portrayed accurately.[20,27]

## 4.4 RESULTS

A total of 13 public health directors with a nursing degree were interviewed; 12 identified as female and one as male. Participants directed health departments in rural and in urban areas that were located in Southern, Midwestern, Central and Northwestern regions of the country. No participants from the Northeast or the Southwest participated. Collectively, participant experience as a director ranged from 3-20 years (one participant had one year of experience as the director but had been the deputy director for three years prior to that).

Participants described both *what* strategies they employed to support LHD performance as well as *how* they employed these strategies. A short summary of former – what strategies are

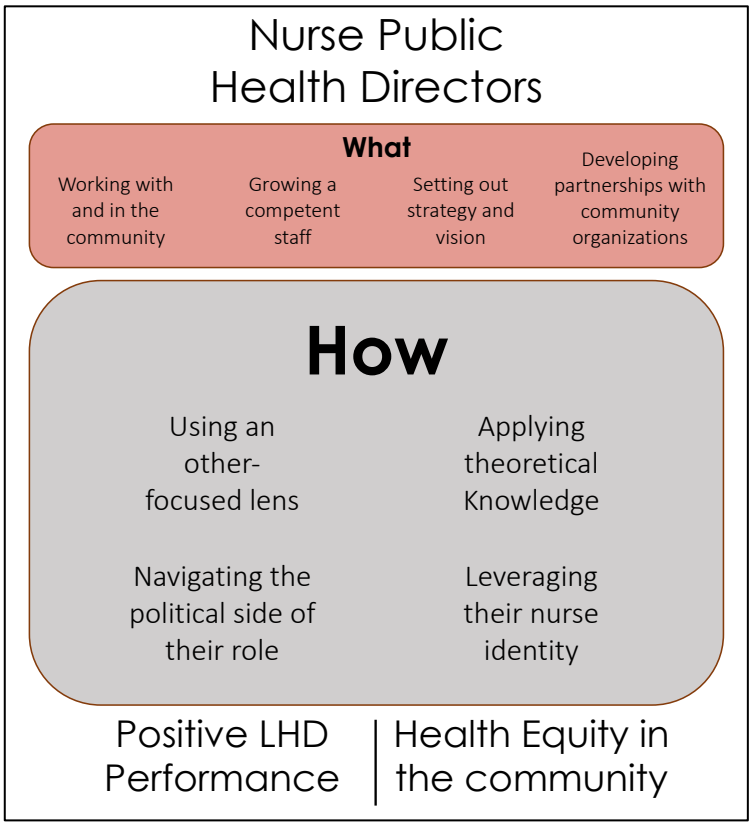


**Figure 1.** How nurse public health directors approach their work.

employed - is presented here as these strategies are an important part supporting LHD performance and advancing health equity; however, the major themes detailed below focus on the "how" as they provide a distinct picture of the *nursing* approach to public health leadership (Figure 1).

**Strategies employed to support LHD performance and community health**

Participants described a number of strategies they employed to promote LHD performance and community health. They affirmed their role in "setting out the strategic direction and vision" of the department and ensuring the work of the LHD was in line with this vision. Within this, they discussed the importance of inspiring and growing a competent staff, emphasizing the importance of creating staff buy-in as well as asserting the expectation for staff to set and accomplish goals. Beyond this focus within their agency, participants discussed the importance of developing and

maintaining partnerships with community organizations in building capacity to carry out the agency's services. Finally, participants discussed their work with and in the community. They stressed their role in being the face of public health to the community and the department's responsibility for protecting and promoting the community's health. Participants stated being connected to and "visible in" the community – through participating on community committees, attending neighborhood meetings, and offering avenues for community feedback – is an essential part of being able to readily respond to changing needs.

**How participants employ strategies**

Themes identified through the interviews regarding how they employ these strategies above included *approaching their work with an other-focused lens*, *applying theoretical knowledge*, *navigating the political side of their role*, and *leveraging their nursing identity*.

Approaching work with an other-focused lens

Participants described entering public health as a "calling" and illustrated an other-focused lens that was *grounded in empathy*, *inclusive*, and *valued integrity*. Several participants stated that as nurses, having "a different way of looking at the world" gave them an advantage as public health directors.

*Grounded in empathy.*

A majority of the interviewees had had previous direct care experience and cited this as being an important part of their ability to employ empathy in their work. One participant spoke specifically to their background in case management and how "getting in the muck of the daily grind" of the challenges their clients faced greatly influenced their current work. Such experiences

allowed them to see and understand other perspectives, ask insightful questions, and diffuse tense situations skillfully. Another participant, in discussing the value of empathy, stated:

> I think that really helps a lot in dealing with people and situations. I think that kind of having an empathetic approach, trying to figure out "Okay, why is this person asking this question?" I think that's…important and maybe not everybody approaches it that way.

Empathy influenced how participants communicated and helped them tailor their messages as needed, depending on their audience. Empathy was described as instrumental in their developing a positive reputation in the community, bringing partners together, and maintaining their place as a trusted entity. Participants noted their ability to listen and be present in the midst of difficult or "intense" moments as a reason for their successes.

*Inclusive.*

Participants described an ability to think and view situations in an inclusive way as being influential in their leadership. This was evident in explicit statements using words such as "inclusive," "holistic," and "whole" when describing their view of health and what sets them apart as a nurse. While discussing how they model an inclusive mindset for staff, one participant stated:

> I am always asking those questions [such as] have we included everybody? Have we left out something? And just really asking those questions and kind of setting that expectation so hopefully when I'm not in the room somebody else is asking those same questions, right?

Inclusive thinking was also evident in how they partnered with the community. It was clear that most cared about establishing an equal partnership with community members, one in which the community had power in decision-making, where community expertise was sought, and where all who were affected by an issue had a seat "at the table." They used phrases such as "learning with," "learning from," "coming together," and "meeting them where they are at" to emphasize this.

Several participants made comparisons to their non-nurse predecessors, noting that their predecessors seemed to care more about doing what they saw as right or as "popular" rather than operating based on community and staff involvement and that this was an underlying factor in difficulties the department faced under previous leadership. One participant, in discussing community involvement in decision-making, stated that they now avoid the term "engagement" as it did not make a strong enough statement about community partnership:

> There's a lot of health departments that want to figure out how to engage the community. I think the community gets sick of being engaged. They want to be ethical.

This participant clarified being "ethical" was in reference to ensuring the community drove and was a part of the work. Other participants stated that "being ethical" meant finding opportunities to "lift up [the community's] perspective and voices where they might not be present."

*Value integrity.*

Participants also operated through a core value of integrity in their other-focused approach. They cared that the community trusted them to follow through and hold themselves accountable

to their work. One participant described this as being an important part of managing high stress situations:

> [I want to make] sure that people know that we are who we [say we] are […] here at the health department regardless of one specific decision under stress and duress that you may or may not agree with…

Integrity was important for communicating the limits of public health--what they could and could not do. Participants saw this as a foundation for trust with the community. This included such actions as demonstrating good stewardship of resources, owning up to mistakes, and committing to the work of changing systems and eliminating structural inequities. One participant pointed to this with regard to addressing racism:

> Institutions will want to stay how they are […] and so if we're really going to address racism, you have to be into it for the long haul and you have to understand how you're going to show up as a leader. My nursing education particularly […] shaped that.

Applying Theoretical Knowledge to their Work

Participants viewed their theoretical knowledge and background gained in their nursing education as an asset in their work. They stated that they *employ the nursing process* – assessment, planning, diagnosis, and evaluation - frequently in their job and find that their ability to *engage in systems thinking* to be a key to their success.

*Employ the nursing process.*

Participants discussed a number of ways that they use the nursing process in their daily work, highlighting the way it sets them apart from other types of leaders in their ability to observe and understand human behavior as well as assess and work through complex situations. Many described it as "ingrained" in them since their training in nursing school.

> […] You would never just do something without checking things out first. You just innately do that and I think if you are someone who can apply that to the other pieces of work, managing staff, whatever it is, you're going to be more successful.

Use of the nursing process was particularly emphasized with respect to managing change in the organization. One participant described using all components of the nursing process to address staff resistance to a program. By assessing for and identifying the issues, developing and implementing a plan to address concerns, and evaluating the overall process, they gained buy-in from many of the previously resistant staff.

Their ability to engage in the nursing process was also an important part of managing multiple types of programs and overseeing a staff with many different specialties. This was particularly useful when working through situations that were outside of typical nursing areas of expertise. One participant described learning this through an experience related to environmental health. They stated that by using the nursing process to assess complex environmental situations, they were able to identify all the needs that were present – social, health, and technical - in order to successfully address the problem.

Participants used the nursing process in their work with communities as well. As one participant noted:

> […] You have to define assessment with a few new tools that you didn't have originally. Maybe your stethoscope doesn't work in the community, but…maybe you listen in to social media, you know, social media is your stethoscope. What are people talking about? What are people saying? What is the issue? So how do we diagnosis this? How do we find and evaluate it?

This deeper understanding of how the nursing process applies to communities facilitated their going beyond surface-level questions of "what is happening" to, more deeply, "why is this happening" or "how did this happen?" They noted that in this way, they were better able to understand what was and was not working in the community. Such an understanding facilitated their targeting of resources to current needs as well as their readily knowing when needs had been met. They also discussed the way it supported their ability to assess the community's readiness for change.

*Engage in systems thinking.*

Participants stated that to really succeed in this leadership role, systems thinking was critical. They emphasized it was essential in being able to plan long-term for their agency and for what will be needed to improve health in the community, while balancing the requirement to think through the daily details and operations of the organization. In addition to this, systems-thinking afforded participants an ability to see and understand the multiple levels which make up a large organization and how best to ensure they operate as a whole. Several participants described this as being an advantage in leading major departmental reorganizations. One participant described their experience this way:

> I walked into a department where there was a lack of transparency, lack of staff involvement and engagement, lack of communication and some real concerns about how the department was working, low staff morale – a number of issues. Not to mention the fact that the structure – there were so many layers from the top to the bottom that a lot got lost in translation…so we put a transformation plan in place […] and [we] started to engage staff in the strategic planning and then the work of the department, trying to make sure that they felt like they were part of something,...

Systems were noted by participants to be an important part of the way their values were embedded into the organization. As one participant stated when discussing strategies to address equity and inclusion in the organization:

> … this is something we haven't launched yet but we're working on it, a way to have any new policy, procedure or protocol type thing be essentially vetted from an equity and a trauma informed care kind of perspective. So we're reviewing tools to look at with the idea in mind of building it into the system so that these are always the questions we're asking, that we're always checking these things.

Participants credited their ability to understand different systems in relation to the variety of settings in which they'd had training and worked as a nurse. These settings provided an opportunity for them to understand different approaches to working on health, how different systems fit together and operated, their strengths and limitations, and the value of systems change. One participant described it this way:

> The thing that really sort of turned me on about nursing … was the ability to … look at systems and how they impact things. You pull a string over here and it has an effect over there and how you have to think about systems, and you have to do that in public health because if you don't, you're missing the boat.

Participants illustrated their capacity to understand the systems beyond their organization as well, discussing their leadership responsibilities in a way that made it clear they understood how their local public health system fit into the larger network of other local public health systems, the state's priorities, and national priorities. This included work to participate in local and state coalitions as well as connecting to national public health efforts.

Navigating the political side of their role

Participants were realistic about the political nature of the job and their reliance on county government to provide funding. They noted that an ability to understand this and navigate it was an important part of being able to inform policy needed to move the department forward and promote health in the community. Participants described using their skills in *strategic communication* and *collaboration and relationship-building* to facilitate a strong rapport with county officials. Throughout their discussion pertaining to this political work, participants also demonstrated *persistence in the face of adversity* as well as an ability to *manage up*.

*Strategic communication.*

In the context of their relationships with county officials, participants described an ability to exert influence in certain ways due to their skill in communicating strategically and persuasively. They noted that their own competence in this aspect was an important part of

securing a place of respect and authority with county officials and identifying common ground among multiple agendas. One participant described their role this way:

> My responsibility is to make sure that the public health department […] is moving forward for the health and protection of the community. So I always started with where our programs are right now, what the community expects of us, what our elected officials expect of us; matched with what we know we need to do and if there's a gap there […], then it's my job to help pull through that and message that so that there's alignment.

Participants discussed their capacity to strategically leverage existing resources when working to persuade officials to provide support for potentially controversial programs or programs without direct funding. One participant specifically discussed leveraging opportunities afforded by certain events, pointing to the chance to demonstrate the value of public health during the COVID-19 pandemic:

> I do think that it is this moment in time that we need to leverage and use; to amplify the work that happens behind the scenes of public health every day and promote the work that we know needs to happen that isn't.

*Collaboration and relationship-building.*

Finding and building on places of connection were important aspects of their relationships with county officials. Participants discussed nurses' ability to read and understand others, which was instrumental in collaborating with others.

> Well, public health is fundamentally human in engagement or a human endeavor and so I think nursing's deep understanding of human beings and association with them and interest in them and how they operate brings a potential source of wisdom to the table.

Participants spoke to understanding the power of relationships as part of being successful in their work, noting that this is something which may be less apparent in other clinical professions.

> I think clearly nurses by the very nature of how we have to do our work, …we're much more relationally based. I think we know how we have to establish a relationship…. It's not the same as other providers where you come and go and in a lot of instance, the ability to get care happening relies on that relationship. So that skill is incredibly important in these jobs.

A majority of participants described positive relationships with county officials. They noted the value in this and also the reality that this contrasted with the experience of other health departments in their state with non-nurse public health directors.

*Persistence in the face of adversity.*

Navigating the political nature of the job came with its own challenges – acceptance of and growth from these experiences were underlying factors in their continued ability to accomplish their work. They discussed the importance of addressing these challenges directly and also of making the choice to move forward from them. Participants also asserted that it was important not to take things personally in this role. Situations where they were insulted or unfairly blamed were seen as opportunities to demonstrate their own strength and calm under pressure.

Several female participants, however, discussed the ways they had been socialized, both as nurses and as women, to deal with challenges. They highlighted that they were socialized to interact with systems in a certain way, to "just work harder" in the face of difficulties rather than advocate for themselves. One participant noted that this might put them at a disadvantage, compared to non-nurses or any other group not socialized this way, when communicating a need for more support or funding:

> We're always needing to state our case and get funding and I think we've taken on a lot … and haven't been able to be as vocal and aggressive or state our case well enough for public health to get more support.

These participants contended that the challenges they face as women in leadership or as nurses in a medicalized system did offer them an opportunity to build connection with other female leaders. They stated that this connection was an important part of their ability to persevere amidst these particular difficulties. Further, they noted that such challenges will continue to be a part of their experience due to male-dominance in areas of decision-making.

> [We are] challenged, I think, by being much more of a minority in terms of decision makers, whether it's city councils or state legislators or county commissions or school boards. There still seems to be far more men than women in those decision-making rolls.

Still, as nurses, many participants affirmed their ability to handle difficult situations because of their training and experiences.

> You need to have hard conversations, you need to give bad news, you have to be with people in intense moments that are often unlike a lot of other professions. So I think that it allows me… to be comfortable in a lot of uncomfortable settings. … that's a skill that needs to be developed for a leader to be effective and for a leader to have any sort of longevity.

Participants were clear that having confidence when interacting with county officials was an important part of being able to stand strong in the face of adversity, particularly when one or more might be pushing back on a decision. They noted that experience advocating on behalf of individuals as a nurse supported this skill. Inability to do this was noted by several participants as a reason they have seen other leaders struggle to effectively accomplish work in partnership with county officials.

*Managing up.*

Participants described their relationships with county officials in a way that illustrated a clear power imbalance. They used words such as "boss," "oversight," "power," and "govern" when discussing the role that county officials play. As one participant stated:

> You need to have a great relationship with your county management… I have an old saying, "He who holds the purse strings holds the power," and they contribute a lot of money and to have a board of commissioners who is supportive of public health is just, is so important.

Participants noted the value of being careful in their communication and approach due to this differential. They demonstrated an ability to "manage up" in these relationships, exhibiting skill in intuiting when and how to move forward on certain strategies or ask for additional funding or support. This was particularly important when the official had an alternate agenda - they described the significance of being realistic in these instances with appeasing various parties while also staying focused on vital work:

> … it's really important to have someone who is able to weather the storm, be strategic and be able to move things. …knowing those moments when you need to go big and get a louder voice when needed and when it's best to take the more subtle approach that might, again, take longer, but I think being able to navigate that and know when to use what approach is critical.

Leveraging their nursing identity

While participants clearly described behaviors and approaches as nurses which were advantageous to their leadership, they also discussed the advantage afforded them by their nursing identity. They emphasized the importance of being explicit about their credentials as a nurse, noting the power it held in establishing relationships with staff, elected officials, partners, and the larger community. They noted the fact that it provided them with more authority and credibility and increased the likelihood that they would be listened to:

> Having the credentials of a nurse, to be completely honest and candid with you, does help me to carry a little more weight like in the community. … because people take that pretty seriously…

They understood this was something which should be treated with respect, but also which could be leveraged strategically in building connection and moving work forward in the community. One participant discussed her intentionality with including her nursing credentials this way:

> I made a decision … to always have my nursing credentials on business cards, … because … I felt it was an asset…I think that nurses are trusted around the country, … everybody's got a nurse in their family somewhere. It builds a connection. So, I use it strategically as well as just feel that professionally it's important.

Participants discussed that it was valuable to increase awareness that nurses can be skilled leaders in multiple contexts, including public health and that in the public health context, they are seen both as the director and as a nurse.

## 4.5 DISCUSSION

This study provides evidence of the leadership approach that nurse public health directors bring to their LHDs and to the communities they serve. Past studies have demonstrated that the nurse public health director has a positive association with LHD performance.[15,16] This study adds valuable insight into what might underlie that relationship, illustrating what strategies nurse public

health directors use and how they employ these strategies in order to both support public health performance and health equity in the community (Figure 1). While previous studies found that directors with a nursing degree were more likely to develop policies and plans, link their community to needed services, and assure a competent workforce, participants in this study described prioritizing such actions through supporting and inspiring staff, developing partnerships, and working with the community.[15,17] Even more, participants discussed how they implemented these actions, applying their core values of inclusivity, empathy, and integrity, utilizing their knowledge of systems and the nursing process, and leveraging their nursing identity. They also described the reality of the political environment within which they work and how their skills as a nurse, in terms of strategic communication, collaboration, and relationship-building, were a valuable asset in navigating this setting. They further illustrated an ability to exert influence within relationships with existing power imbalances, as well as persist in the face of adversity. This study articulates a distinctive combination of skills which the nurse public health director suggests they bring to their leadership role. Such skills reflect the interprofessional nature of public health nursing practice, demonstrating a specialized approach which may set them apart from other types of public health leaders.[31]

Results presented here add to nursing and public health leadership literature in several ways. A recent quantitative study led by this study's author explored organizational factors associated with the nurse public health director which also provides insight as to their relationship with positive LHD performance. That study found that nurse public health directors, as compared to non-nurse public health directors, were more likely to have completed a community health assessment and to engage in policy activities (Kett, unpublished). Those quantitative findings corroborate the emphasis that interview participants placed on assessment and the value of policy

in this qualitative study. Results in this study also revealed the public health nurse leaders' capacity to "manage up" in navigating the political side of their role. In other previous research, such a skill was noted to be essential for public health leaders in effectively accomplishing their work due to various power structures present in most organizations.[32,33] Finally, participants' abilities to see the big picture while understanding its effects at a minute level, as well as their nuanced understanding and application of the nursing process, demonstrates significant strengths nurses bring to leadership. Such themes have been discussed in relation to hospital nursing executives but have not previously been highlighted with respect to public health nurse leaders.[34,35]

Through acknowledging the hierarchical structures within which nurse public health directors work and succeed, this study represented a unique opportunity to elicit shared experiences, while using critical methodologies that interrogate power.[23] Discussion in the literature regarding research on nurse leadership notes this perspective is often missing in such studies, resulting in an incomplete understanding of their experience.[24,36] Experts have further asserted that while nurses are increasingly represented in leadership overall, many systems still fail to treat them as equal partners in decision-making processes.[35,37] Such experts note that nurses are often seen implementing social and health policy developed by others, mimicking historical perspectives that nursing work is mainly comprised of following orders.[35] Participants in this study noted difficulties they faced as nurses; however, they also demonstrated their ability to effectively work among sociopolitical structures to engage in policy development within their organizations, within their community, and at the state and national level. Such perspectives provide key insight into how public health nurse leaders conduct themselves and offers a model for other areas of nursing leadership.

Health departments must engage in effective approaches to address health inequities. Evidence presented here suggests that nurse public health directors engage in strategies in a way which supports health equity work and equitable community health improvements. This is evident with respect to their inclusive thinking, their way of partnering with the community, and their clear understanding of the importance and power of policy and systems to create change. Health equity research stresses the need for leaders who emulate these attributes, as leaders are instrumental in influencing the culture of an organization and, thus, how that organization acts on the social determinants of health and equity.[4,38] The presence of a leader with a health equity perspective, therefore, is not enough. This perspective must be integrated throughout the organization. Participants in this study demonstrated an understanding of this in the way they discussed their interactions with staff, the need for change at a systems level, and their responsibility to lead the strategic direction of the organization. They suggested that nurses provide a type of leadership critical to engaging in a course-correction toward greater equity in population health outcomes.

## 4.6 STRENGTHS AND LIMITATIONS

In conducting this study, strategies were undertaken to mitigate study limitations. First, all interviews were conducted systematically using an interview guide to ensure all participants received the same information. Second, the investigators acknowledged their own assumptions as well as potential to influence analysis, reducing the possibility of bias in the result. Finally, credibility was achieved through interrater agreement as well as member checking with participants. Nonetheless, the potential for bias exists due to the limited sample size, lack of racial and ethnic diversity, and data collection taking place during a pandemic. This study also does not provide comparative information about other types of public health directors. However, the goal

of the study was not to compare, but instead was to increase understanding of what public health directors with nursing degrees bring to their leadership role.

## 4.7 CONCLUSIONS

The day-to-day and subtle nature of power relations within an organizational structure can exert significant influences on the nurse lead executive. Through acknowledgement of these influences in the analysis process, this study provides insightful information about the practice of the nurse public health director. This brings deeper clarity to the relationship between the nursing leader's practice, LHD performance and a healthy population. Such evidence has important implications for public health practice and policy, as it gives further insight into the value nurse leaders bring to public health and highlights their strengths as leaders. This information can be used to inform policy and practice with respect to effectively employing nurse leaders in carrying out significant public health work.

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# Chapter 5

# CONCLUSION

## 5.1 SUMMARY

The evidence presented here more deeply explores the nurse public health director's known association with positive LHD performance. Previous evidence has demonstrated an association between the nurse lead executive and performance of certain essential services, as well as better health department performance overall.[1,2] However, public health has historically lacked evidence as to why this might be and whether it translates to improved health outcomes. The three studies presented here address that gap. Aim 1 provides evidence which suggests that, in fact, having a nurse in a public health leadership role is good for the community's health, with results indicating that the public health director with a nursing degree has a significant statistical relationship with reductions in 15-44 mortality disparities and improvements in access to prenatal care. Results from Aim 2 suggest that the nurse lead executive, as compared to the non-nurse, is more likely to engage in assessment and planning processes and to emphasize policy activities which are focused more upstream, on the social determinants of health. Finally, Aim 3 supports an understanding of how the nurse lead executive accomplishes their work and demonstrates that the nurse lead executive holds an important compilation of attributes and competencies which support their success in the leadership role. All together, these studies provide a comprehensive understanding of the nursing approach to public health leadership and the importance of that leadership to population health.

## 5.2 IMPLICATIONS FOR PUBLIC HEALTH SYSTEMS

In using a health equity lens to conduct this research, evidence suggests that the public health director with a nursing degree emphasizes work to address the inequities in systems and structures which negatively affect well-being. The conceptual model developed for these studies acknowledges the significant influences outside of the leader's control which impact health outcomes; however, it also highlights the factors that the public health leader, in their role as the "Chief Health Strategist," can leverage to improve health and advance health equity.[3] In statistical models which include covariates reflecting organizational and systemic influences, the nurse lead executive is shown to emphasize a number of these factors – such as community health assessment and SDOH-related policy activities - and to be associated with reduced health disparities. This novel evidence underscores the value of the public health nurse leader in addressing inequities.[4,5]

COVID-19 has demonstrated the cracks in the US public health system's ability to perform the core parts of its role – assessment, policy development, and assurance. There is a need to re-think and improve current public health systems to ensure these responsibilities are fulfilled in a way which addresses the social determinants of health and inherently racist structures that perpetuate health inequities.[6-8] Leadership is a critical part of this and to be effective, must be able to adapt as needed and utilize skills important in a crisis, such as persistence, situational awareness, collaboration, and an ability to be both flexible and decisive.[8] The evidence from this study demonstrates that the specialized, interprofessional nature of the public health nurse leader is just such a leader.[9]

## 5.3 POLICY IMPLICATIONS

Public health has suffered historically from underfunding and underinvestment, resulting in a lack of capacity and ability to adequately respond to ongoing and emergent public health concerns. The public health nurse workforce has experienced the effects of funding cuts, with a 36% decrease since 2008 in the size of the PHN workforce.[10] The PHN workforce is a source for public health nursing leadership – a decrease in size has significant implications for the future of nursing leadership in public health and as evidenced in this and other research, potentially negative consequences for the public's health. There is an opportunity to apply this evidence towards sufficiently funding and employing public health nurses; this will in turn ensure continued nursing involvement in public health leadership.

This is also significant as Schools of Nursing are being called to critically appraise how they train nurses to work in the current health care landscape, as such a landscape requires knowledge of population health and an understanding of health equity.[11,12] It is clear that nurses bring something unique and important to public health – beyond ensuring there is adequate funding to employ nurses in public health, comprehensive education and training are also important. A gap in public health nursing leadership could further hurt an already fragile public health system; thus, this evidence underscores the need for advance practice public health nurses and the importance of developing programs which provide adequate preparation for such a role.[13,14]

## 5.4 RESEARCH IMPLICATIONS

Future research is needed detailing how to effectively train, employ, and utilize public health nurses and public health nurse leaders to address population health inequities. Such

research includes exploring best practices and policies which support public health nurses to work to the top of their licensure and address health inequities, identifying where public health nurses are most effective, as well as gaining a deeper understanding of the needed skill mix of public health practitioners. Additional research is also needed to isolate unique factors which are present in health departments effectively engaged in health equity work, such as the type of leader, specific policies and programs, and the workforce composition present in such health departments.

## 5.5 FUTURE DIRECTIONS

The three papers presented here collectively provide a distinct picture of how the nurse public health director contributes to a high-performing public health system which advances health equity. Not only is it clear that public health nurse leaders have valuable skills for the multifaceted role of public health director, it is also clear that they focus energy – and thereby the LHD's work – on the types of activities needed to address inequities in health. At a time when experts are calling for a "reimagining" of our public health system [8], these studies demonstrate the importance of looking to the public health nurse leader as an example of who should lead such a system and where it should focus.

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