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THE IMPACT OF STATE CERTIFICATION OF COMMUNITY HEALTH WORKERS ON TEAM CLIMATE AMONG REGISTERED NURSES IN THE UNITED STATES.

by

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DISSERTATION

Submitted in Partial Fulfillment of the
Requirements for the Degree of

Doctor of Philosophy

Nursing

The University of New Mexico
Albuquerque, New Mexico

May 2014

DEDICATION

This work is dedicated to the Community Health Workers who are helping to promote health and prevent disease throughout the world. I am especially grateful to the Community Health Representatives who I had the honor of working with from the Chinle Service Unit, the Santa Fe Service Unit, and the Pueblo of San Felipe, and who taught me the value of Community Health Workers in health care.

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ABSTRACT

A number of states have adopted certification programs for community health workers (CHWs) to increase oversight, allow for direct funding, and improve recognition of CHWs as members of the health care team. More states are considering CHW certification programs to increase the use of CHWs by health care organizations with the hopes of improving health outcomes and decreasing health disparities. There has been little research into the impact of state CHW certification on the adoption and dissemination of CHWs into the existing health care system. This study examined the impact of state CHW certification on the perceptions of team climate among registered nurses (RNs) who work with CHWs in states with and without CHW certification programs. Team climate is defined as the perceptions of team members on how they work together, share a single vision, are open to new ideas, and if they feel safe and supported by other team members. This study recruited RNs using an online purposeful sampling method to compare the perceptions of team climate using the Team Climate

Inventory (TCI) short-form. The study found no significant differences in the overall mean TCI score or TCI subscale scores between RNs who work in states with CHW certification programs (n = 81) and those who work in states without CHW certification programs (n = 115). There was a significant difference in one survey question on the RNs views of whether state certification of CHW improved the ability of their health care team to deliver quality care. Further analysis of the results using multiple regression found few significant predictors of overall TCI and TCI subscale scores among the independent variables used in the regression models. Registered nurses are the largest part of the professional health care workforce, and their ability to collaborate and work with CHWs is critical to the integration of CHWs into existing health care organizations. More research on the impact of state certification of CHW and the factors that influence the adoption of innovative health care delivery methods is needed to meet the national goal of eliminating health disparities and improving health in minority and underserved populations.

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Chapter 1

Introduction

The estimated 2.8 million registered nurses (RNs) in the United States comprise the largest profession in the health care workforce (Health Resources and Services Administration [HRSA], 2013). Nursing workforce studies have predicted a need for an additional 250,000 RNs in the U.S. by the end of the decade and over 500,000 RNs by 2030. Causes of this shortage include an aging nurse workforce, increased prevalence of chronic diseases due to an aging population, and difficulty educating and retaining a sufficient number of RNs to meet the growing workforce needs (Aiken & Cheung, 2008; Buerhaus, 2008). While the number of RNs entering into the workforce has increased in recent years (Auerbach, Buerhaus, & Staiger, 2011; Staiger, Auerbach, & Buerhaus, 2012), the number of health care providers and programs working in community and public health has been declining due to decreased funding for state and local public health programs (National Association of County and City Health Official [NACCHO], 2013). There are over 100,000 RNs working in local, state, and federal, public health offices in the U.S., 20% of the total U.S. public health workforce, and there is concern that the growing shortage of RNs working in community and public health will have an impact on the public health infrastructure in the U.S. The projected rate of job growth for RNs in primary care and home health is almost double that of the projected rate of job growth for RNs in hospitals, meaning an even greater need for RNs who work in community-based care in the future. Rural health care programs also have a more difficult time recruiting and retaining RNs (HRSA, 2010; Quad Council of Public Health Nursing Organizations, 2007; Skillman, Doescher, & Rosenblatt, 2009; University of Michigan Center for

Excellence in Public Health Workforce Studies [UMCEPHS], 2013; U.S. Bureau of Labor Statistics, 2010).

The U.S. is becoming more culturally and ethnically diverse, and while the number of Hispanic and African American RNs continues to increase, the proportion of White, non-Hispanic RNs in the workforce continues to be larger than the U.S. population of working age adults. The proportion of Hispanic RNs is especially low, with only 5 percent of RNs in the workforce reporting Hispanic ethnicity compared to 14% of the U.S. working age population. Racial and ethnic diversity that reflects the populations being served is important in the delivery of culturally appropriate, accessible, and quality health care (HRSA, 2006; HRSA, 2013; Institute of Medicine [IOM], 2003).

Changes in Health Care Delivery

The U.S. has the most advanced tertiary medical care in the world, but it lags behind many developed countries in primary and public health outcomes (Carey, Herring, & Lenain, 2009; Organization for Economic Cooperation and Development [OECD], 2013; U.S. Burden of Disease Collaborators, 2013). The increase in the incidence and prevalence of chronic diseases is leading many health policy advocates to recommend a shift in the focus of the U.S. health care programs toward the primary prevention of disease and secondary prevention of complications related to chronic diseases. The economic cost of treating chronic disease is now a major concern for health care professionals and policy makers (American Public Health Association [APHA], 2013; Commonwealth Fund, 2013; Sassi & Hurst, 2008). Because the U.S. lacks a well-coordinated health care system, many individuals with chronic disease will typically see multiple providers each year, and the coordination of their health care is critical to

improving health care outcomes and lowering costs (Bodenheimer, 2008; Center for Health Affairs, 2012).

The foundation of a better health care delivery system in the U.S. must be built upon a comprehensive and easily accessible system of primary care providers and public health and social service programs that promote health and prevent chronic disease. Public health and social service programs need to ensure that individuals, families and communities have the resources (i.e., environmental, social, and economic) that are necessary to promote healthy lifestyles, and primary health care programs should identify, treat, and monitor patients diagnosed with chronic disease to ensure prevention of complications . But the nation's primary care and public health programs are unable to meet many of these needs due to a lack of primary care providers and RNs, fragmented services, and limited funding for public health and social programs (Auerbach, Staiger, Muench, & Buerhaus, 2013; Bodenheimer, 2008; Bodenheimer & Grumbach, 2011).

Accountable Care Organizations (ACOs) and patient-centered medical homes (PCMHs) are being promoted as innovative ways to improve health care by increasing coordination and follow-up, improving access to preventive care services, and changing the financial incentives away from fee-for-service and toward pay-for-performance or outcomes based care (Bolin, Gamm, Vest, Ewardson, & Miller, 2011; Guterman, Schoenbaum, Davis, et al., 2011). However, the resources, both human and financial, that will be needed to adopt innovative health care programs may not be available to many smaller primary care providers who work in rural and underserved areas, and the ability of primary and public health programs to adopt innovations is dependent on having qualified staff who have the skills and knowledge to implement these new models of care

(Bodenheimer, 2008; Solberg, 2011). Given the projected shortage of RNs, especially in rural and underserved communities, it is unlikely that RNs will be able to fully meet the future workforce needs of health care programs (Auerbach, Staiger, Muench, & Buerhaus, 2013; McEllistrem-Evenson, 2011).

Community Health Workers and Primary Health Care

Community health workers (CHWs) are community members who provide health and social services to residents of their community. CHWs are used throughout the world to improve the health and social conditions (Dussault et al., 2009; WHO, 2007). CHWs have been working in U.S. communities since the 1960s to address inequities in health care and to organize communities. The U.S. Department of Labor recognized CHWs as a unique job category in 2007 (IOM, 2003; Rosenthal, et al., 2010; U.S. Department of Labor, 2011). The work of CHWs often involves advocating for underserved communities that suffer disproportionately from disease and unhealthy living conditions. They work in areas such as health education, maternal child health, community organization, and health promotion, and they advocate for community and social change. Because CHWs are from the community, they are thought to possess a greater degree of homophily with many community members than do other health care providers with more education. Moreover, they often speak local languages and dialects, allowing them to communicate more effectively and understand cultural norms and values (Balcazar et al., 2011; Dussault et al., 2009; HRSA, 2007; Ingram, Sabo, Rothers, Wennerstrom, & Guernsey de Zapien, 2008; IOM, 2003).

The 2008 World Health Report (WHO, 2008) on changing primary care to meet the needs of communities advocates for policies that work toward a greater integration of

public health and primary care to ensure the health of communities and individuals. The report outlines steps that governments, health care organizations, and communities can take to improve the delivery of primary health care services, including the appropriate use of CHWs. Early efforts to use CHWs in place of more professionally trained providers sometimes failed in some countries because some people perceived the use of CHWs as lower quality care. However, CHWs have since been successfully used within primary health care teams to improve the cultural and linguistic delivery of primary care services (Balcazar et al., 2011; Herman, 2011; Landers, & Stover, 2011).

As the cost of health care in the U.S. increases and the racial and ethnic diversity of the population increases, many policy makers are examining the role that CHWs have in providing community-based, culturally appropriate health care and health promotion services (Balcazar et al., 2011; Herman, 2011; HRSA, 2007; HRSA, 2011; National Health Care for the Homeless Council, 2011; Rosenthal et al., 2010). The Institute of Medicine (2003) supports the use of CHWs to decrease health disparities in medically underserved populations. CHWs can improve individuals understanding of health and disease, increase access to health care services, and increase community capacity to address health issues. However, the IOM report cautions that more needs to be done to formalize training programs and to supervise and evaluate the effectiveness of CHWs programs.

The American Public Health Association (APHA, 2009) has adopted a resolution that supports the integration of CHWs into community-based health care teams to improve the health outcomes of underserved and vulnerable populations. The resolution calls for the federal and state policy makers, as well as private insurance companies, to

develop regulations to allow for the direct reimbursement for CHW services through Medicare, Medicaid, and other public and private health financing. The resolution also recommends the development of standardized training programs for CHWs that can be delivered in a variety of settings. The resolution does not make any recommendations on state certification or credentialing of CHWs.

Community health workers have been proposed as a solution to help meet the increased demand for health care workers in primary health care, public health, and social programs. Bolin et al. (2011) examined the provisions in the Patient Protection and Affordable Care Act of 2010 (PPACA) (Pub. Law 111-148, 2010) that increase resources for rural primary health clinics. PPACA increases the funding for primary health care programs and improves access to primary care services through the development of PCMH and interdisciplinary primary health care teams that include CHWs. These multidisciplinary primary health care teams will work to improve primary and secondary prevention programs and decrease health disparities. The PCMH model includes the delivery of coordinated health and social services in a culturally and linguistically appropriate environment. PPACA provides grant funding for demonstration projects to increase the adoption of CHWs into primary health care organizations. (Bolin et al., 2011; Public Law 111–148, 2010).

However, questions remain regarding the dissemination and integration of CHWs into primary health care teams. Bolin et al. (2011) write that “nurses and social workers are an integral part of the patient care team and may play a more prominent role in patient navigation and community health worker supervisions and planning” (p. 99); however, there has been little research on how to improve integration of CHWs into primary health

care teams. RNs may be hesitant to delegate duties to unlicensed CHWs because standards of care and the nurse practice act in many states limit the types of duties that can be delegated, and primary responsibility for the patient's safety remains with the RN (American Nurses Association [ANA], 2010; ANA, 2013).

CHWs are unlicensed in the U.S., and they are not required to be certified in most states. There is currently no national standard for CHW certification and training. A national training program for Community Health Representatives (CHRs) in the Indian Health Service (IHS) exists, but there is not a nationally standardized educational program for CHWs. Because of the lack of CHW certification and standardized education in most states, some health care professionals are unclear about the role CHWs have in the health care system (Doherty & Coetzee, 2005; IOM, 2003; Solberg, 2011; Spencer, Gunter, & Palmisano, 2010). There is also a lack of training about the role of CHWs in the health care system for many health professionals.

Rosenthal, de Heer, Rush, and Holderby (2008) write that while there have been recommendations by the IOM and others to increase the use of CHWs in health and social service organizations, there continue to be questions about how CHWs can be successfully and sustainably integrated into health care teams. While there is growing evidence on the effectiveness of CHWs (Lewin et al., 2010, Rosenthal et al., 2010, Viswanathan et al., 2010), both in terms of costs and health and social care outcomes, other factors affect the decision to adopt innovations. Reliable and valid evidence of the effectiveness of CHWs is important, but such evidence may not be sufficient to persuade policy makers and others in the current primary health care system to change existing programs. Resistance to dissemination of CHWs into primary health care programs may

be especially difficult if there is opposition to change from existing professional groups who may feel the roles they have traditionally held in the delivery of primary health care are threatened (Spencer et al., 2010)

Federal and State Policies and Programs in Support of CHWs

PPACA (Pub. Law 111-148, 2010) and the Children's Health Insurance Program Reauthorization Act (Pub. Law 111-3, 2009) both include language to support CHW programs to improve access and decrease health disparities in underserved populations. PPACA has identified CHWs as part of the health care workforce and as health professionals. PPACA defines a CHW as "an individual who promotes health or nutrition within the community in which the individual resides" (p. 635). According to the law a CHW

> (1) serves as a liaison between the community and a health care agency (2) provides guidance and social assistance to community residents (3) enhances the community residents' ability to effectively communicate with health care providers (4) provides culturally and linguistically appropriate health or nutrition education (5) advocates for individual and community health (6) provides referral and follow-up services and coordinates care (7) proactively identifies and enrolls eligible individuals in Federal, State, local, private, or nonprofit health and human services programs. (PPACA, p. 635)

The PPACA also includes funding for the development of innovations in the health care workforce through area health education centers that would develop interdisciplinary training programs involving licensed health care providers and CHWs.

Eighteen states have statutes or language in administrative codes that mention CHWs (see Table 1). Some states have statutory or administrative language that includes CHWs as part of community health teams or primary care medical homes that seek to integrate CHWs into their health care delivery system. States including Alaska, Maryland, Massachusetts, Minnesota, New Mexico, New York, Oregon, Washington, and West Virginia currently provide reimbursement for CHW services through state Medicaid programs (Centers for Disease Control and Prevention [CDC], 2013).

Table 1

U.S. States with language in administrative codes that mention CHWs

State	CHW Certification Program	Medicaid Reimbursement[1]
Alabama	No	No
Alaska	Yes[2]	Yes
California	No	No
Connecticut	No	No
Maine	No	No
Maryland	No	Yes
Massachusetts	Yes	Yes
Minnesota	Certificate	Yes
New Mexico	No	Yes
New York	No	Yes
Ohio	Yes	No
Oregon	Yes	Yes
Pennsylvania	No	No
Rhode Island	No	No
Texas	Yes	No
Vermont	No	No
West Virginia	No	Yes
Washington	No	Yes

[1] Adapted from CDC (2013) Summary of State Community Health Worker Laws
[2] Certification program limited to Community Health Aides in rural villages.

Alaska has CHW certification program for community health aides who provide care for rural Alaskans. The Alaskan CHWs program requires community health aides to

complete training through an accredited state training program. Community health aides have roles and responsibilities similar to RNs, LPNs, and EMTs, licensed by the state. The Alaska Medicaid program provides reimbursement for CHWs who work for tribally administered health care programs serving Alaska Natives. Alaska also has a special classification for dental health aides who provide dental health care services to Alaska Natives served by the Alaska Native Health Corporation under contract with the Indian Health Service (Alaska Statute § 18.28.100, 2011).

Minnesota requires CHWs to have a certificate demonstrating they have a completed an approved CHW training program through a Minnesota State University or College or to have worked for five years under the direction of a health care professional (Minn. Statute § 256B.0625, 2010). This differs from CHW certification which is a process whereby an external body (i.e., state board or agency) determines that an individual meets that minimum qualifications for a position. A certificate provides documentation that an individual has completed an approved training program (Rush, 2012). Minnesota requires CHWs to work under another health care professional (i.e., physician, dentist, RN, or certified public health nurse) in order for services to be reimbursable under Medicaid. The reimbursement for CHW services goes to the Medicaid certified provider, and CHWs are not directly reimbursed.

In Ohio, certification and oversight of CHWs, as well as CHW training programs, are administered by the Ohio Board of Nursing. Registered nurses in Ohio may delegate some activities to CHWs under the Ohio Code (Ohio Revised Code Annotated [ORC Ann.] 4723.82, 2011), and CHWs must be under the supervision of an RN. RNs are limited in the number of CHWs they may supervise at one time. The Ohio code defines

supervision by an RN as “initial and ongoing direction, procedural guidance, observation, and evaluation by a registered nurse who is continually available in person, or by some form of telecommunication, of the nursing tasks performed by a community health worker” (Ohio Administrative Code [OAC] Ann. 4723.26, Definition of terms, (P), 2011). CHWs are required to complete an approved training program or to have worked as a CHW to receive certification and complete 15 hours of annual continuing education to remain certified (ORC Ann., 4723.06, 2011; ORC Ann. 4723.82; ORC Ann. 4723.84, 2011).

CHW certification is voluntary in Texas unless the CHW or the organization employing the CHW wants to be reimbursed by Medicaid for CHW services, in which case CHWs are required to be certified by the state. Texas also requires certification of CHW instructors and CHW training programs as well as 10 hours of continuing education for certified CHWs annually (Texas Health & Safety Code § 48.002, 2010; 25 Texas Administrative Code [TAC] § 146.7, 2011; TAC §146.10 , 2011).

Legislative efforts by states to increase the use of CHWs continue to expand. Since 2011 ten states (i.e., Connecticut, Maine, Maryland, Maine, Rhode Island, Washington, Rhode Island, Vermont, and West Virginia) have added language to their Administrative Codes recognizing CHWs as members of community health teams or service workers under the state employment regulations; as well as allowing for Medicaid reimbursement for some service provided by CHWs, such as early childhood home visiting in Washington (CDC, 2013). Policy makers in these states may be reacting to language in the PPACA (Pub. Law 111-148, 2010) and looking for innovative ways to

deliver health care services due to the expansion of Medicaid services for low income adults in their state.

The adoption of a health care model that includes the integration of CHWs into primary health care systems has the potential to improve the linkage between clinical and community services, as well as follow-up and care coordination. The integration of CHWs into primary care programs can increase the ability of community health centers to provide social and educational services beyond primary medical care that can improve health and prevent disease (Adair et al., 2012; Balcazar et al., 2011).

However, integration of CHWs into primary care systems must be done systematically to ensure that other health care workers, including RNs, understand the roles and responsibilities of CHWs as well as their own roles in collaborating and supporting CHWs. Involvement of RNs and other licensed professionals who will be working with CHWs needs to occur throughout the integration of CHWs into the health care system. Health systems administrators need to understand the time requirements on primary care staff to integrate CHWs into existing primary health care program along with the requirement for ongoing monitoring, evaluation, and quality assurance for CHW programs (Solberg, 2011; Zuvekas, Nolan, Tumaylle, & Griffin, 1999).

Evidence to Support Community Health Workers

In a review of the evidence of the effectiveness and cost of CHW programs internationally, the World Health Organization (WHO, 2007) found that successful CHW programs required adequate support, both financial and from the community, as well as planning, leadership, training, and supervision. The concept of task shifting, or allowing unlicensed and nonprofessional health care team members to complete tasks that have

traditionally been done by licensed health care professionals, has been promoted by WHO and others to meet the health care needs of developing countries with inadequate health systems and shortages of licensed health care professionals (Dussault et al., 2009; Fulton et al., 2011; Global Health Workforce Alliance [GHWA], 2008). Whether the U.S. health care system can adopt or allow for task shifting to unlicensed professionals like CHWs remains to be determined. However, it is clear that the current health care system in the U.S. is not meeting the needs of many people, especially minority and low-income individuals where significant health disparities persist (Agency for Health Research and Quality [AHRQ], 2013).

The WHO (2007) policy brief on the effectiveness of CHW programs concluded that CHWs can improve health outcomes and the effective delivery of health care services, especially in pediatric care, but that CHW programs are not going to solve all of the health problems in a community. CHWs can be part of the solution to improving health and health care delivery, but CHWs need adequate support, including funding and policies promoting the use of CHWs as part of health care teams, from policy makers, community leaders, and health care professionals (Martinez, Ro, Villa, Powell, & Knickman, 2011).

A policy brief developed by the Centers for Disease Control and Prevention (CDC, 2011) outlines the evidence to support increasing the integration of CHWs into health care programs, including improved outcomes for high risk patients with hypertension, improved diabetes control (e.g., HA1c, cholesterol, and triglycerides) among African Americans, decreased use of emergency departments for care, improved asthma management, and improved breast and cervical cancer screening. The authors cite

barriers that many individuals face when trying to seek care for chronic diseases, such as cost, a lack of access to primary care providers, and inadequate understanding of treatment protocols; they also provide information on policy and organizational changes that can help support the integration of CHWs into the health care system.

The National Research Council (NRC, 2010) has recommended the use of CHWs to help with individual counseling and education for the control of hypertension. The authors wrote that while the use of CHWs for patient education is similar to job duties performed by RNs, CHWs may be more effective in racially and ethnically diverse communities because of their knowledge of the community, cultural norms, and language. The NRC recommended that federal and state health programs work to develop and support CHWs to prevent hypertension and to control programs in high-risk communities.

The ability to translate these evidence-based CHW programs into current primary and pubic health care programs is dependent on resources, both financial and political, that promote adoption and integration of CHWs. Support from established health care professionals and from health care organizations is also required for increasing the adoption of CHWs into the current health care system. Health systems that do integrate CHWs into their work force need to closely monitor the new programs to ensure that the delivery of services by CHWs is meeting the needs of the community and established standard of care.

Diffusion of CHWs into Primary Health Care Programs

While the evidence supporting the use of CHWs in health care continues to grow, it may not be sufficient to increase the diffusion and adoption of CHWs by primary

health care teams and organizations. Scientific evidence is only one factor that influences the diffusion and adoption of innovations, and other professional and organizational factors may play a more critical role in integrating CHWs into primary health care teams. The integration of CHWs needs to occur within primary health care teams that are composed of multiple professions and nonprofessionals. These health care teams work in many different types of organizations, which makes dissemination more difficult and resource-intensive. RNs are integral members of health care teams, and therefore efforts to increase the adoption of CHWs into those teams will require the support of RNs (Åmo, 2006; Fitzgerald, Ferlie, Wood, & Hawkins, 2002; Solheim, McElmurry, & Kim, 2007).

The use of CHWs within primary health care programs can take many forms, so the ability to integrate CHWs into existing programs requires coordination among different levels of providers and health care staff. Well-defined job roles and responsibilities, as well as policies and procedures for monitoring and communication between CHWs and primary care providers and staff, need to be established first (Joshu, Rangel, Garcia, Brownson, & O'Toole, 2007). Integration of CHWs into health care teams may be viewed positively by some health and social service professionals and negatively by others. The ability to address concerns of licensed health and social workers will increase support for CHW programs (Denis, Hébert, Langley, Lozeau, & Trottier, 2002; Spencer et al., 2010).

The degree of support among RNs for increasing the use of CHWs within the health care system is largely unknown, and RNs may work to block greater use of CHWs if they are unclear about the role of CHWs or if they feel their own professional roles will be negatively impacted. Policy makers and others supporting the use of CHWs in health

care teams should work with RNs to ensure they understand the CHWs' roles and responsibilities, and the impact that increasing the use of CHWs within these teams will have on patient outcomes (Åmo, 2006; West, Barron, Dowsett, & Newton, 1999). In order for CHWs to be effective members of primary health care teams they must have the support of RNs and other health care professionals. More research is needed to address possible organizational and professional barriers to the diffusion and dissemination of CHWs into health care teams.

Statement of Problem

Adoption of innovative systems of health care that include CHWs can be promoted or delayed by socio-political and organizational characteristics. Policy makers or groups that wish to increase the use of CHWs in primary health care teams should carefully consider how these efforts would affect the team and organizational characteristics - including financial resources, staffing, and complexity - before proceeding. Adoption of such innovations is complex, and in order to increase the integration of CHWs into the health care system, organizational structures that may inhibit or promote wider adoption of CHWs need to be considered (Fleuren, Wiefferink, & Paulssen, 2004).

Brownstein (2008) describes the need to increase the translation of the CHW model into communities, and the difficulties faced by providers and health care organizations in adopting CHWs. Funding for CHWs is a principle problem, and there is a need for additional research on sustainable, effective CHW programs. In addition to overcoming barriers, a more evidence-based approach to diffusion is needed. Brownstein writes, "Little is known about the satisfaction of CHWs with their roles, of community

members being served by CHWs, or of the nurses, physicians, and others who supervise CHWs" (p. 177). Brownstein recommends that more research be done on how to integrate CHWs onto primary health care teams and increase support from policy makers to implement policies that support CHW programs and vulnerable populations.

Whether or not organizations adopt an innovation depends on the attributes of the innovation (i.e., compatability, trialabilty, observability), on the characteristics of the organization (i.e., values, norms, structure, culture and climate), on individuals working in the organization, and on social networks between individuals within and outside of the organization (Greenhalgh, Robert, MacFarlane, Bate, & Kyriakidou, 2004a; Rogers, 2003). Efforts to increase the diffusion of CHWs through state certification and standardization of training may increase the adoption of CHWs into primary health care teams, but more research is needed on how state certification of CHWs impacts health and social service organizations, health care professionals, CHWs, and the communities they serve.

Purpose of the Study

The purpose of this research is to determine if there is a difference in the team climate between RNs who work in states with CHW certification programs and RNs who work in states without CHW certification programs. The information for the study may be useful to state policy makers and primary health care organizations in determining the impact of state certification for CHWs on the diffusion and adoption of CHW into health care programs and on the delivery of interdisciplinary team based primary care.

Research Questions, Goals and Objectives

Research question 1: Is there a difference in perception of team climate for RNs who work in states with CHW certification programs and RNs who work in states without CHW certification programs?

Research question 2: What factors predict perceptions team climate for RNs who work with CHWs.

The goal of this research is to provide additional information on the impact of state CHW certification on perceptions of team climate among RNs that may affect the diffusion and adoption of CHWs into primary health care teams.

Objective 1: Administer an Internet-based survey that includes demographic variables and team climate factors (see Table 2) to a national sample of RNs who work in states with and without state CHW certification programs.

Objective 2: Compare Team Climate Inventory (TCI) scores of RNs who work in states with CHW certification with RNs who work in states without CHW certification.

Objective 3: Analyze results to determine if any independent variables have a significant role in predicting TCI scores.

Table 2

Concepts and Variables measured in study

Team Climate Factors	Team Climate Inventory	Measurement
Vision	Team Objectives	Ordinal
Participation Safety	Participation in the team	Ordinal
Support for Innovation	Support for new ideas	Ordinal
Task Orientation	Task Style	Ordinal
Independent Variables		
State CHW certification		Dichotomous
RN Gender		Dichotomous
RN Age		Continuous
RN Education level		Categorical
RN Race		Categorical
RN Ethnicity		Categorical

Table 2 (cont.)

Independent Variables	Measurement
RN Tenure on team	Continuous
Experience working with CHW	Continuous
Urban or rural worksite	Categorical
Organizational size	Continuous
Team size	Continuous
Organizational type (i.e., for-profit, non-profit)	Categorical
CHW Race	Categorical
CHW Ethnicity	Categorical
CHW type (i.e., CHW, CHR, promotora, etc.)	Categorical

Significance of the Study

There are no published studies that examine how state certification of CHWs impacts how RNs and CHWs interact on health care teams, and whether state certification of CHWs has an impact on team climate. A search of the literature found only one small qualitative study, completed in South Africa, examined the relationship between nurses and CHWs in a primary health care setting (Doherty & Coetzee, 2005). Two other surveys have reviewed certification and education standards of CHWs in the U.S., but neither examined how state certification of CHWs affects the diffusion or adoption of CHWs by health care organizations or primary health care teams (Goodwin & Tobler, 2008; Kash, May, & Tai-Seale, 2007).

Theoretical Framework: Diffusion of Innovation

For the diffusion of CHWs into health care programs to occur there must be a relative advantage over current methods, and CHWs must be compatible with organizational structures and norms. Additional factors that may promote or inhibit the adoption of CHWs into health care organizations include the ability of the organizational system to implement the innovation, the adaptability of the innovation to be changed to fit the organization, the amount of risk to the organization in adoption of the new

innovation, and the transferability of knowledge required to use the innovation (Greenhalgh et al., 2004a; Rogers, 2003).

Greenhalgh et al. (2004b) concluded that there are seven key factors that influence the adoption and implementation of innovations in health care organizations:

> (1) the attributes of the innovation, (2) the adoption process as engaged in (or not) by individuals, (3) communication and influence, (4) the inner organizational context, (5) the outer organizational context, (6) the nature of any active dissemination campaign, and (7) the nature of any active implementation process. (p. 321)

The authors (Greenhalgh et al., 2004b) developed a conceptual model for the dissemination of innovations in health and service organizations (see Figure 1). The concepts that promote or inhibit the adoption of innovations in health care organizations include both inner and outer contexts related to the organization. Inner contexts include “structural determinants of innovativeness, receptive context for change in general, absorptive capacity for new knowledge, and tension for a particular change” (Greenhalgh et al., 2004b, p. 321). Team climate can be viewed as part of this inner context. The outer contexts include “inter-organizational collaboration and networking, prevailing environmental pressures such as external competition, particular policymaking contexts and streams, and proactive linkage initiatives" (Greenhalgh et al., 2004b, p. 321). State policies that promote CHW certification or reimbursement for CHW services are part of the outer context of diffusion and dissemination.

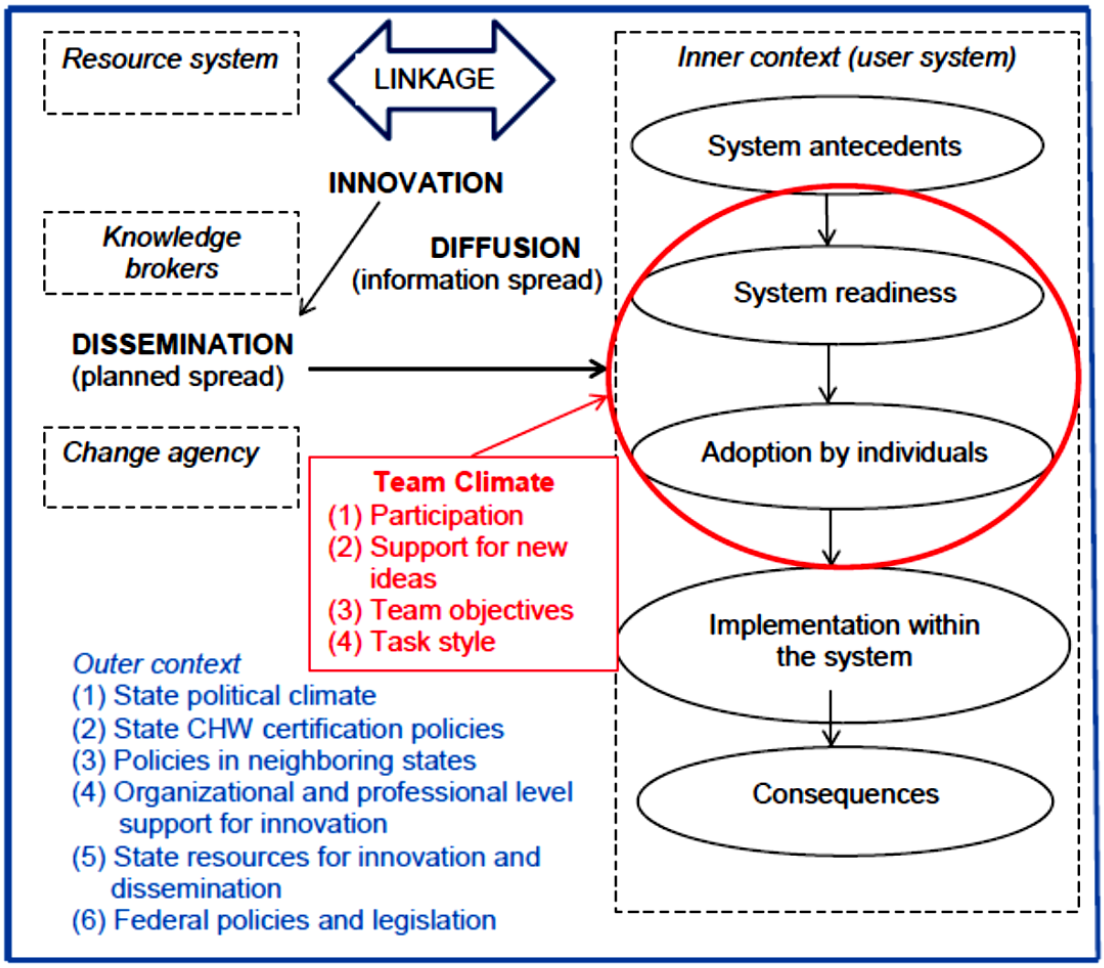

Figure 1. Model for dissemination of innovations in health organizations (adapted from Greenhalgh et al., 2004b.)

Efforts to increase the adoption of CHW programs should include identification of communication channels, development of messaging to meet the needs of different types of health care organizations, and evaluation and monitoring of adoption of CHW programs by health care organizations (Greenhalgh et al., 2004a). The flow of information through social systems of health care professionals depends on the social networks of those professionals. RNs may be in the best position within health care

organizations to disseminate information because their professional networks have a wider reach than others (Åmo, 2006).

Team Climate Inventory

The Team Climate Inventory (TCI) can be used to measure the degree to which work groups are open to innovation and change. Anderson and West (1998) describe two different definitions of climate pertaining to organizational work groups: (a) individual group member's perceptions of their work environment or *cognitive schema*, and (b) the *shared perception* of group members of the work environment. The authors contend that work-group climate is an important factor in group effectiveness and innovation.

The TCI was developed to measure the shared perceptions of team members on how they work together, share a single vision, are open to new ideas, and if they feel safe and supported by other team members (Waite & Nichols, 2002). According to Anderson and West (1998) the four major climate factors include vision, participant safety, task orientation, and support for innovation (see Table 3).

Table 3

Team Climate Inventory Factors[1]

Team Climate Factors	Definition
Vision	clarity, perceived value, sharedness and attainability
Participation Safety	decision-making, information sharing, and safety
Task Orientation	commitment to excellence, appraisal and task orientation
Support for Innovation	articulated and enhanced support

[1] Adapted from Anderson and West, 1998.

Mathisen and Einarsen (2004) examined survey instruments that measure work place innovation. The authors write that creativity and innovation in organizations can be promoted by a combination of internal and external factors. Organizations may be able to promote innovation through the acceptance of new ideas, flexibility, recognition, and

feedback, as well as a safe and supportive environment for change. Their review of team climate survey instruments examined reliability, validity, and factor structure. Five instruments meet the criteria for review, including the Team Climate Inventory. In their analysis Mathisen and Einarsen (2004) found the TCI to be valid with acceptable psychometric quality for use in a variety of organizational types.

Study Design

An Internet-based survey was used and distributed nationally. Study participants were recruited from the Public Health Nursing Section of the American Public Health Association (APHA), public health departments, state nursing associations, university faculty, and primary health care clinics. Nurses in certification states (i.e., Ohio and Texas) were targeted along with states neighboring New Mexico including Arizona, Colorado, Utah and California. Additional study participants were recruited through purposeful sampling that allowed the individuals who received the initial e-mail to forward it to others who met the inclusion criteria to participate in the survey, and through personal recruitment by the investigator and national and regional conferences such as the American Public Health Association Annual meeting and the New Mexico Public Health Association and New Mexico Nurses Association meetings.

The total sample size required in order to detect a medium effect size was calculated using Gpower® 3.1 computer software. A priori sample size for a *t*-test of the mean difference between two groups was calculated using a medium estimated effect size, 0.5, for a two-sided test with alpha of 0.05 and power of 0.80. This calculation provided a minimum sample size of 128, 64 per group. A second sample size calculation using Gpower® 3.1 computer software for multiple regression (i.e., F tests - Linear

multiple regression: Fixed model, R^2 deviation from zero) with 2 predictor variables tested and up to 5 total predictor variables, medium effect size (i.e., $f^2 = 0.15$), alpha = 0.05, and power = 0.80, resulted in a minimum sample size of 68 subjects (see Appendix B).

Chapter 2

Literature Review

While research on the effectiveness of CHWs continues to increase, there is little research into the best approach to increase the diffusion or dissemination of CHWs onto multidisciplinary health care teams. The impact of state CHW certification and training programs on the adoption and integration of CHWs is unclear, and there have been no studies that examine the impact of CHW certification on team climate in health care teams. The purpose of this review is to examine the literature related to the impact of state certification of CHWs from the perspective of policy diffusion among states in the U.S. and the diffusion of innovations in multidisciplinary teams within health care organizations. The literature on the use of the Team Climate Inventory (TCI) to assess team climate and innovation was also reviewed.

Conceptual Framework

Government policies that support CHW certification, training, and dissemination into the existing health care system may increase adoption of CHW programs by health care organizations and lead to improved health outcomes and decreased health disparities (see Figure 2). The factors or antecedents that increase the innovation and diffusion of state policies on CHW certification are similar to those that have been documented in previous research on policy diffusion, including policy learning, political and social climate, regionalism, and available resources (Berry & Berry, 2007; Nicolson-Crotty, 2009; Nowlin, 2011; Volden, 2006; Walker, 1969).

Nice (1990) outlines three factors that impact a state's innovativeness in public policy: (a) the problem environment, a need to address problems that the state is

experiencing; (b) available resources that can be used to address the problem; and (c) orientation of policy makers toward government intervention. In addition, internal and external determinants can influence the adoption of innovations at the state level. Efforts to increase the dissemination of CHWs in health care through the certification of CHWs by states may increase the rate at which CHWs are adopted into health care teams, but support from health care professionals and health care organizations is also required (Lewin et al., 2010; WHO, 2007)

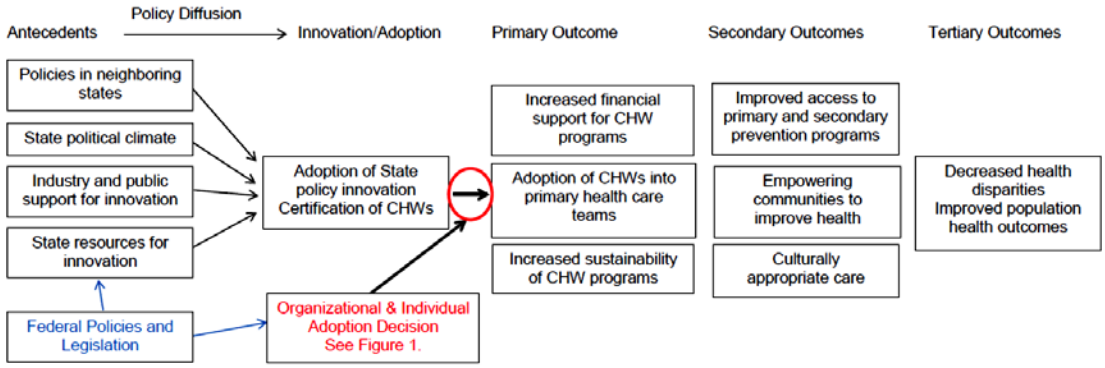

Figure 2. Proposed model of diffusion of CHW programs among states.

The proposed model of diffusion of CHW into health care organizations relies on two different levels of diffusion-of-innovation theory: policy diffusion of CHW certification between states and diffusion of innovation at the organizational level (i.e., adoption and integration of CHWs into primary health care teams). Efforts to increase the adoption of CHWs into health care programs are influenced by policies and actions at both levels, federal and state policies and organizational innovation, but there has been little research examining how the levels impact the diffusion of CHW programs. State CHW certification programs may or may not increase the diffusion of CHWs into health care organizations if the organizations or their staff are not prepared to adopt the

innovation. The lack of state certification of CHWs may be a barrier to increasing reimbursements for CHW services and may raise questions about competence among existing health professionals, decreasing the likelihood of adoption by health care organizations.

Diffusion of Policy Innovation

Walker's (1969) examination of the policy diffusion among states begins with the premise that policy makers are not only concerned with the budgetary impact of adopting innovations, but that "policy makers must also decide about the program's relative scope, provisions for appeal from administrative orders, eligibility requirements, the composition of regulatory boards and commissions, and many other matters which have little to do with money" (p. 880). Walker defined a policy innovation as being new to the state and not necessarily an entirely new idea or program. Therefore, a policy or program developed in one state and adopted by another meets the criteria for policy diffusion. Walker notes that the adoption of innovations by states does not mean that policy makers are directly copying policies or programs from other states, but that policy ideas are changed to meet the specific needs of different states. However, for diffusion to be present, policy makers must make a commitment "to offer a new service, establish a new principle of regulation, or create an agency which had never existed before" (p. 881) based on programs developed in other states.

Walker (1969) quantified the innovativeness of states based on the speed at which they adopted policy innovations present in other states. Walker then correlated this data with other factors that have been shown to influence the diffusion of innovations, including demographic factors (i.e., overall state population, per capita income,

educational level, urbanization, and industrialization), political factors (i.e., political competition; frequency of changes in state governments, whether the result of politics or turnover; funding for legislative services; and representation from urban versus suburban areas, or apportionment). The results of Walker's research corresponded with earlier research that has shown larger, wealthier, and more urbanized states are more likely to be innovators or early adopters of policies.

Walker (1969) also examined the attributes of the policy makers and factors that are correlated with their willingness to adopt innovations from other states. Walker's analysis of policy makers' adoption decisions was based on human and organizational decision theories. He believes that decisions about innovations begin with policy makers looking for solutions to problems that have been adopted in other states, or as Walker describes policy learning: "Look for an analogy between the situation you are dealing with and some other situation, perhaps in some other state, where the problem has been successfully resolved" (p. 889). Walker argued that the diffusion of innovation between states is improved when policy makers from different states share what they have learned. However, the policy diffusion process can be slowed by concerns about unintended consequences of adoption. Barriers to policy diffusion are decreased by examples of successful policies and programs in other states that policy makers can use to counter arguments against the policy innovation. As policy innovations are adopted by more and more states, it becomes more likely that policy makers in non-adopter states will support the policy innovation.

The diffusion of policy innovations and policy learning is also aided by the communication networks established between state organizations, legislators, policy

entrepreneurs, and by federal rules and regulations (Walker, 1969). National associations of state governments (i.e., National Conference of State Legislatures, National Governors Association, etc.) help with the diffusion of policy innovations through increasing communication and networking. Walker's analysis found the rate at which policy innovations were adopted has been increasing, and he concluded that improved communication networks and the professionalization of state government workforces has decreased the time it takes policy innovation to diffuse from innovator states to other states. Policy innovations that are prescribed by the federal government also have a significant influence on the adoption decisions by states.

Gray (1973) examined the diffusion of state policies in three areas: education, welfare, and civil rights. The author developed an equation to measure policy diffusion based on the interaction between states, the number of states that have adopted a policy, and the proportion of adopter to non-adopter states. The equation model demonstrated a strong relationship with goodness of fit-testing for diffusion of twelve laws among adopter and non-adopter states, and the author concluded that the model "generally confirmed that some of these innovations diffuse as do others – through the interaction of users and nonusers" (p. 1179).

However, not all policies examined by Gray (1973) showed the same pattern of diffusion, and some policies (i.e., civil rights laws) were less likely to be adopted by some states. Policies that were linked to federal funding were more likely to diffuse and be adopted by all states. The author concluded that "diffusion patterns do differ by issue area and by degree of federal involvement" (p. 1185). The impact of this study on the diffusion of state CHW certification programs highlights the role that federal support,

especially financial incentives for states to adopt policy innovations, has on the diffusion of state policies. To date there is no federal mandate for CHW certification by states, but there has been an increase in federal funding for CHW programs under PPACA.

Volden (2006) examined the diffusion and adoption of the federal Children's Health Insurance Program (CHIP) between states, and whether successful policies are more likely to be adopted or whether other factors, such as cost-effectiveness and motivation for reelection, impact CHIP policy adoption rates. Volden hypothesized that CHIP policy diffusion between states increases when programs demonstrate policy success through cost savings and decreased rates of uninsured children. Policy diffusion should also be more likely to occur between states that share political ideologies and fiscal climates. Every state was eligible for CHIP funding from the federal government, and because of the flexibility provided to states, a variety of different CHIP programs were developed to meet the needs of each state. Between the introduction of CHIP in 1998 and the end of the study period in 2001, states had made over 100 changes to their CHIP programs. Some of these changes qualified as policy diffusion because the states significantly changed income requirements or other programmatic features.

Volden's (2006) analysis found statistically significant support for the hypothesis that successful CHIP policies are more likely to be adopted by other states. State CHIP policies that decreased the number of uninsured children were 20% more likely to be adopted by other states than unsuccessful policies. Volden also found that states with similar political ideologies, Republican unified control of government, were 50% more likely to adopt CHIP policies from states with similar Republican controlled governments. A post analysis chi square test showed significant support (χ^2 (3) = 22.90,

$p < 0.001$) for the hypothesis that similar political ideologies increase the adoption of policies between states. Similarities in political ideology were an even more important factor when states considered adopting CHIP programs policies that lowered program costs. States were also more likely to adopt policy innovations from states with similar budget profiles, higher income, and greater Health Maintenance Organization (HMO) penetration.

The research into the diffusion of CHIP policies between states has implications for the diffusion policies around the state certification of CHWs. The finding that successful programs are more likely to be adopted (Volden, 2006) would seem to favor the adoption of CHWs into health care systems based on evidence of their effectiveness in improving health outcomes. However, there have not been any studies that have examined whether CHWs in states with certification requirements are any more effective than those in states that do not have CHW certification.

Policies that have been shown to decrease state costs are also more likely to be adopted by other states, but there have not been any studies that have examined the cost-effectiveness of state certified CHWs and non-state-certified CHWs on health care costs. States that directly reimburse for CHW services under their Medicaid program would likely see an initial increase in costs due to the addition of a new category of eligible provider, and cost savings related to improved health outcomes (i.e., decreased hospitalizations, etc.) may be difficult to demonstrate in the short term (i.e., two- and four-year election cycles). The impact that federal legislation and funding (i.e., PPACA) on the diffusion of state policies may be the most important factor in the dissemination of CHW certification programs among states.

Berry and Berry (2007) summarized the history of policy innovation and diffusion research. According to Berry and Berry there are two primary models of policy innovation: the internal determinants model and the diffusion model. The internal determinants model explains policy innovation based on political and socioeconomic factors that are present in the state with little or no external influence from other states. The diffusion model explains policy innovation as states learning from other states through intergovernmental communication networks. Most policy innovation is a combination of both internal determinants and diffusion.

Berry and Berry (2007) outlined three antecedents for policy diffusion between states: (a) policy makers faced with problems in their own state look for solutions that have been shown to be successful in other states; (b) state competition to prevent other states, particularly neighboring states, from gaining an economic advantage; and (c) external pressure from the federal government or other states to conform to national or regional standards. This external pressure can be from federal mandates or professional standards that are considered best practices.

According to Berry and Berry (2007) researchers have used these antecedents to develop models to explain policy diffusion. The national interaction model frames policy diffusion primarily through the interaction of state officials and policy makers and through regional or national meetings. Policy learning occurs as state officials learn about successful policy innovations from their peers much as individuals learn about innovations from others within their social and business networks. However, critics of the national interaction model point out that the model fails to consider variables that would

increase or decrease interactions, such as geography—policy makers are more likely to interact with policy makers in neighboring states.

Regional diffusion models are based on the assumption that states are more likely to adopt policies that are being used by states on their borders or within the same region. Neighboring or regional states are thought to be more similar economically and socially than states in different regions of the country (e.g., southwestern states compared to southeastern states). Diffusion of policy innovation between neighboring states is hypothesized to occur through both policy learning and competition. However, neighbor and regional diffusion models have been criticized for the assumptions that geography is a major determinant of diffusion. For example, in a regional diffusion model a southeastern state is more likely to be influenced by policy innovation of other southeastern states, and not by a state of a similar size or political structure from a different region. The diffusion of policy innovation between states that share similar size, resources, and political culture is termed *isomorphic diffusion*. Isomorphic diffusion models do not rely on geographic proximity to explain the adoption of policy innovations (Berry & Berry, 2007).

Berry and Berry (2007) contrasted regional and isomorphic policy diffusion models with the *internal determinants* model of policy innovation. The internal determinants model views policy innovation as dependent on the political, social, and economic factors within each state. The authors believe that there are examples of policy innovation that are not influenced by external factors; however, it is more likely that policy innovation is a combination of the diffusion of policy ideas between states and the internal factors that influence the consideration and adoption of policy innovations.

Nicolson-Crotty (2009) examined the differences between rapid adoption of public policies by states and policy diffusion that follows a more traditional S-shaped diffusion pattern. Early research into the diffusion of public policy demonstrated that diffusion occurs in predicable patterns, based primarily on a learning model (i.e., lawmakers observing and learning from early adopter states), and policy innovations depended on communication networks (i.e., organizations in state governments, policy entrepreneurs), compatibility, complexity, and trialability.

Elected officials also have a strong incentive to adopt policy innovations that are supported by a large number of constituents. Nicolson-Crotty (2009) described this as the *salience* of the policy innovation. Policy salience describes how important the innovation is to a large number of voters, and it is influenced by the degree to which individuals perceive the policy innovation as impacting their lives. Policy salience can be increased through advocacy and social media campaigns. A policy with high salience will diffuse more rapidly. Policy complexity also affects the rate at which policy innovations are adopted by states. Complex policy innovations require additional time for policy makers to gather information and learn about the benefits of the innovation, and therefore complex policy innovations will diffuse at a slower rate. Public policies with a high policy salience and low policy complexity are most likely to diffuse rapidly between states (Nicolson-Crotty, 2009).

Koski (2010) examined the diffusion of low salience policy innovations—policies that may not have an immediate political impact or be high on the political agenda of policy maker or constituents. Low-salience policy innovations are often complex or narrowly focused. Knowledge brokers are a key component to the diffusion low-salience

policy innovations. Knowledge brokers are individuals who are experts in certain policy areas, and who have contacts with policy makers. They help to communicate and interpret complex low-salience policy innovations to policy makers and to organizations who are looking for solutions.

Koski (2010) writes that advocacy organizations can help to increase attention around low-salience policy innovations, but they face a number of barriers in gaining the attention of policy makers. If there are only a small number of supporters for the policy innovation, knowledge brokers can act as intermediaries in promoting links between policy makers and advocacy groups to increase the salience of a policy innovation. Knowledge brokers can also work with organizations to increase the adoption of innovations outside of the policy arena. Koski concluded that knowledge brokers can increase the diffusion of low-salience policy innovations by developing communication networks that allow policy makers and organizations to evaluate innovations and promote adoption and diffusion.

Summary of policy diffusion.

The literature on policy diffusion in the U.S. demonstrates that policy makers learn from other states, and they are more likely to adopt policies that have been effective. The diffusion of state policies is aided by communication networks among policy makers, change agents or knowledge brokers that promote the adoption of certain policies, and by federal support and funding for policy adoption. The amount of constituent support for a policy also plays a role in decisions of policy makers on whether to adopt a new policy (Nicolson-Crotty, 2009). Policy adoption can be delayed by the political ideology of state legislatures and governors (Walker, 1969; Gray, 1973; Volden,

2006; Berry & Berry, 2007). For example the expansion of Medicaid to eligible adults under PPACA (Pub. Law 111-148, 2010) has only been adopted by half of the states, due in part to the differences in political orientation of state legislatures and governors (Smith, Gifford, Ellis, Rudowitz, & Snyder, 2013).

Policy innovations that promote the state certification of CHWs are increasing, likely due to increased federal recognition and funding under PPACA (Pub. Law 111-148, 2010), as well as the increase in evidence supporting the effectiveness of CHWs in the delivery of health care to underserved and minority populations. However, without a strong knowledge broker or support from constituents, including health care professionals and health care organizations (Koski, 2010), the adoption of CHW certification programs will continue to be a low priority for many policy makers unless state certification of CHWs can be shown to enhance the delivery of lower cost, high quality health care that meet the needs of constituents.

Proposed Model for Organizational and Individual Decisions for Adoption of CHWs into Primary Health Care Teams

Frambach and Schillewaert (2002) proposed a multilevel adoption model that includes both individual and organizational factors. The authors described two different types of organizational adoption decisions: decisions by individuals within organizations to support adoption and decisions by organizations to adopt an innovation. Organizational adoption can be further broken down into two components: initiation and implementation (Zaltman, Duncan, & Holbeck, 1984). An organization’s decision to adopt an innovation occurs only after the individuals within the organization learn about and evaluate the innovation. The decision to adopt the innovation is then followed by implementation of

the innovation. However, implementing the innovation within an organization depends on whether individuals within the organization accept the innovation and whether they are committed to integrating it into their current work roles and organizational structure. Frambach and Schillewaert described this as *intra-organizational acceptance*. When the organizational adoption decision precedes the individual adoption decision, has been labeled forced adoption by Rogers (2003) and others.

Frambach and Schillewaert's (2002) model of organizational adoption has been modified by Greenhalgh et al. (2004b) to reflect the uniqueness of health care organizations. In the original model developed by Frambach and Schillewaert, the internal characteristics of the organization, along with external variables, influence initiation and lead to the adoption decision. The authors describe the influence of individuals within organizations who have the power to decide whether or not to adopt innovations, and the importance of their perceptions of the innovation. These decision makers must perceive the innovation to be beneficial to the organization, and the organization must have the resources to adopt and implement the innovation. This model has been further refined to reflect the variables to be studied in this research project (see Figure 3).

Greenhalgh, et al. (2004b) describe the stages of the adoption decision for individuals within organizations as:

> 1) Knowledge: awareness of the innovation; 2) Persuasion: attempting to form favorable or unfavorable attitudes to the innovation; 3) Decision: engaging in activities that will lead to a choice to either adopt or reject the innovation; 4)

Implementation: putting the innovation to use or rejection, and 5) Confirmation: seeking reinforcement of the decision by observation of its impact (p. 150).

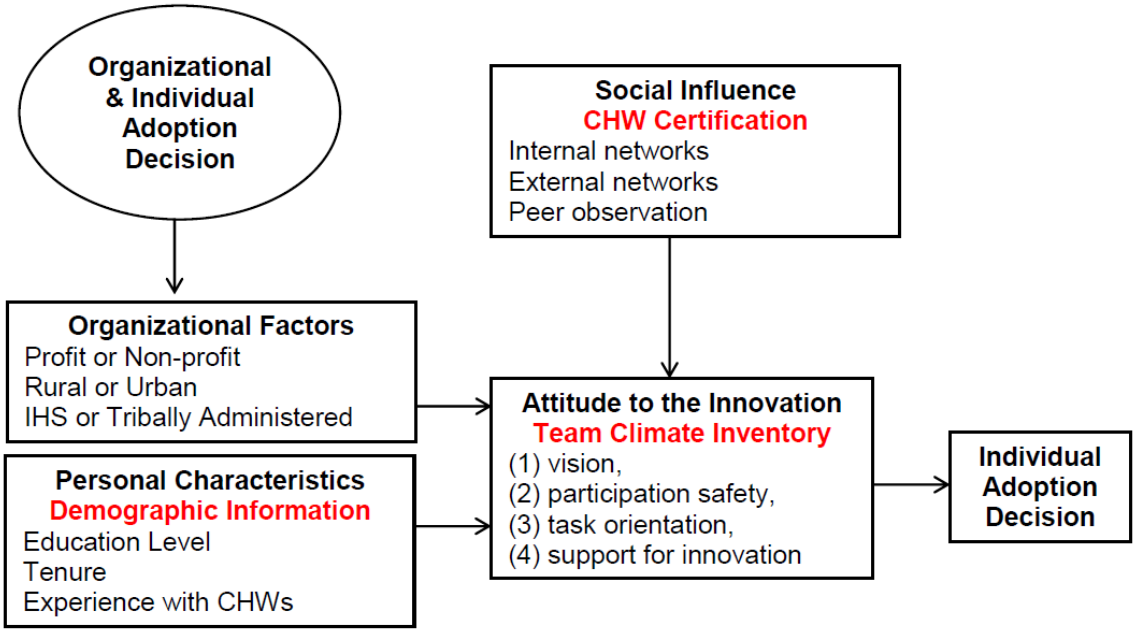

Figure 3. Conceptual model linking organizational and individual adoption decisions with model of diffusion of CHW programs (adapted from Greenhalgh et al. 2004b).

However, evidence from studies on the non-adoption of technology demonstrates the adoption decision is not necessarily linear or rational within multidisciplinary health care organizations. In a study of nurse's adoption of a new electronic health record the researcher's concluded that individual adoption decisions were influenced by the innovations perceived impact on individual and professional job roles. This perceived impact of the innovation is developed through social interactions with others and interpreted differently by different team members (Timmons, 2001).

Internal organizational factors that positively impact adoption decisions are related to a culture within the organization that is open to innovation and change. Organizations and individuals within organizations are also influenced externally by suppliers that market innovative new products and services. Within the context of state

certification for CHWs, states wanting to expand the use of CHWs in health care organizations can use certification as a marketing tool to increase acceptance of CHWs into existing health care teams. However, marketing innovations such as state CHW certification to health care organizations requires effort to ensure the marketing is targeted at the correct audience (i.e. decision makers within organizations, current employees), as well as communications messaging that addresses the perceived risk of adoption (Frambach & Schillewaert, 2002).

Diffusion of CHWs in Health Care Organizations

Evidence to Support CHWs in Health Care

Viswanathan et al. (2010) found limited evidence to support CHWs interventions when compared to other interventions to improve patient knowledge about disease, mixed evidence of improvements in positive behavior change and health outcomes, and some evidence of improved health care utilization for some outcomes (e.g., increased cancer screening and decreased emergency rooms visits). In general, the authors found that using CHWs may be a better alternative to current models of health care delivery for improving chronic disease outcomes, especially when resources, both financial and professional, are limited. The authors were unable to find any studies that evaluated CHW training and health care outcomes.

In a literature review and meta-analysis of studies on CHW interventions for maternal child health and infectious disease management, Lewin et al. (2010) found “promising benefits in promoting immunization uptake and breastfeeding, improving TB treatment outcomes, and reducing child morbidity and mortality when compared to usual care” (p. 2). The authors found that while the potential savings and decreased training

time for CHWs make them attractive alternatives to more highly trained health care workers, the substitution of CHWs for professional health care workers was not supported by their review. The review did not examine CHW interventions into chronic disease management or health promotion programs for adults.

Johnson et al. (2012) studied the outcomes of CHWs who worked as part of a Managed Care Organization (MCO) under the New Mexico's Medicaid program. The authors write that because most CHWs programs do not have a reliable source of funding and that evidence is still inconclusive on the cost effectiveness of CHWs, it is often difficult for health care organizations to integrate CHWs into their organizational teams. In the study, the MCO, Molina Healthcare of New Mexico, negotiated direct reimbursement under the NM Medicaid program for CHW of services designed to decrease unnecessary emergency department visits and improve chronic disease management.

After identifying patients at high risk (i.e., chronic diseases with poor control, history of substance abuse), the participating health care organizations used the CHWs to contact clients and assist them with a number of health and social service needs including: transportation, housing, government and private financial assistance programs (i.e., SNAP, SSI, etc.). The study outcomes included use of emergency room, hospitalizations, primary health care and specialist visits, and prescription drug and narcotic use, during a six month periods before the intervention, during the CHW intervention, and after the intervention. The clients who received CHW services had reductions in emergency room visits, hospitalizations, prescription drug and narcotics costs, and a cost savings of over $2 million dollars according to the study results. The

total cost of the CHW program was estimated to be $522,000 resulting in an estimated cost savings of $1.5 million dollars for the MCO (Johnson et al., 2012).

A comparison group of Medicaid clients not enrolled in the CHW program also experienced reductions in the number of emergency room visits, hospitalizations, and prescription drug costs. There was a significant difference between the intervention and control groups in the number of hospitalizations ($p < 0.01$), but the control group saw greater reductions in non-narcotic prescription use and emergency room visits during the 18 month study period. There was no difference between the two groups in prescription narcotic drug use and use of primary or specialty health care services. The results should be viewed with caution according to the authors as the study design was retrospective and group members were not randomly selected (Johnson et al., 2012).

Health care team members involved with CHWs in the study (Johnson et al., 2012) expressed appreciation of the work the CHWs did with clients in helping to ensure follow-up tests to monitor chronic disease were completed, the assistance CHWs provided to clients in establishing a primary health care home, and education on urgent and non-emergency care. The program was expanded to all of New Mexico's 33 counties by the MCO as a result of the initial pilot, and two other MCO have adopted the model and been approved for funding for CHW services through the New Mexico Medicaid program. The authors concluded that a CHW generalist, who is trained to provide a variety of health and social service roles, is better able to meet the needs of health care organizations than more specialized CHWs who are trained to provide services based on specific disease categories (Johnson et al., 2012).

Allen & Benz Scott (2003) proposed the use of CHWs to improve primary and secondary prevention of cardiovascular disease (CVD). The authors write that traditional approaches to identification and treatment of CVD in the U.S. are not effective for many individuals and populations, and that incorporating CHWs into health care teams has the potential to improve outcomes. The authors' recommendation for increasing the use of CHWs in health care is primarily based on research demonstrating the effectiveness of CHWs in helping urban African Americans control hypertension. The authors' concluded that there is a need to increase translation of these positive research results into practice, but they do not provide any recommendations on how to increase the use of CHWs in health care.

Felix, Mays, Stewart, Cottoms, and Olson (2011) examined the results of a community outreach project in Arkansas that used CHWs to target elderly residents and adults with disabilities and to work with them to meet long-term care needs. The project, the Community Connectors Program, took place in rural counties with high rates of poverty and ethnic and racial minorities, and with greater levels of health disparities compared to other areas of the U.S. The CHWs worked to connect seniors enrolled in Medicaid with home- and community-based long-term care services. Overall results showed a statistically significant lower increase in Medicaid costs for the CHW intervention group. The researchers estimated the total savings from the program to the Arkansas Medicaid program to have been $2.6 million over three years, and a return on investment of $2.92 per program dollar. In addition, the study demonstrated that active recruitment of elders and disabled adults for home- and community-based long-term care services did not result in a dramatic increase in requests for these services, but instead

resulted in cost savings due to a decrease in nursing home costs paid for by Medicaid (Felix et al., 2011).

The design of the Community Connectors Program, using CHWs in the community rather than clinic-based staff, may have increased the success of the program because CHWs were able to target and match individuals with agencies that provide the home and community-based long-term care services. The CHWs were more effective in their outreach because of their knowledge of the communities and their close ties with the residents. This is especially important in minority, rural, and underserved communities where individuals in need of assistance may not be aware of the services available, and access to primary care is inadequate. The results of the study provide evidence to support the adoption by states of similar CHW programs targeting Medicaid-eligible seniors and disabled adults to begin to address some of the costs of long-term care (Felix et al., 2011; Gorski, 2011).

In a randomized control trial, Olds et al. (2002) found that the outcomes for CHW home visiting programs were not significant when compared to those for RNs. The Nurse Family Partnership home visiting program using RNs has shown significant positive differences in prenatal tobacco use, subsequent pregnancies, reentry into the workforce, interactions between mothers and children, and language and cognitive development when compared to controls. In a study that compared the results of the CHW home visitation program with RN home visitors, CHWs outcomes were 50% lower on average than those of the RNs. Olds et al. hypothesized that mothers who participated in the study may have valued the information provided by the RNs to a greater degree than CHWs because of the high esteem in which the public holds most nursing professionals.

Results from a follow-up study comparing the outcomes of CHW and RN home visiting program after 4 years (Olds et al., 2004) found an increases in the effect size from CHW home visitors in some outcome measurers, but the authors did not believe the results warranted a replacing RNs with CHWs. Comparative cost-effectiveness of the CHW and RN home visitors were not available, but the authors noted that in some cases the CHW home visitors may be more costly due to the need for greater supervision and fewer home visits (Olds et al., 2002). The shortage of nurses in the U.S. and other countries may require greater use of CHWs in many areas. The key, according to the authors, is to find the right combination of training, supervision, and program model to ensure that CHWs are effective (Olds et al., 2004).

Nemcek and Sabatier (2003) reviewed the literature on process and outcome evaluations of CHW programs. The authors explained that the goals of incorporating CHWs into the health care system include improving the therapeutic relationship between clients and health care providers, improving the relationship between health care professionals and communities, and decreasing health care costs through culturally appropriate primary and secondary activities and care coordination. Nemcek and Sabatier highlight three outcomes of CHW programs: improvements in utilization of health care service, increased strength of relationships with provider organizations, and reduced risk of poor health outcomes. The overall outcomes of CHW programs should be reduced health care costs and improved quality of care. The authors' review of the published studies on CHW outcomes between 1960 and 1987 found few studies that have rigorously evaluated CHW outcomes, and they concluded that "the effectiveness of nurse-supervised CHW care in the community needs to be demonstrated" (p. 268).

Summary of evidence supporting use of CHWs in health care.

The evidence of improved health care outcomes through the delivery of health education and care management by CHWs continues to increase. Comprehensive literature reviews have found moderate evidence supporting the use of CHWs to improve cancer screening rates and decrease emergency room visits (Viswanathan et al., 2010), increase breastfeeding and immunization rates, and treatment for pulmonary tuberculosis (Lewin et al., 2010), and improvement in control of hypertension (Allen & Benz Scott, 2003) when compared to usual care. There is also evidence that demonstrates the cost-effectiveness of CHWs in the delivery of some health care services, including substance abuse treatment (Johnson et al., 2012), and care coordination for low income and disabled adults (Felix et al., 2011).

Other studies have shown that the impact of CHWs on maternal and child outcomes is not as strong as when care is delivered by registered nurses (Olds et al., 2002; Olds et al., 2004), and that the introduction of CHWs into existing health care delivery systems may have unintended consequences that decrease the effectiveness of CHWs (Waitzkin et al., 2011). What is missing from all of these studies is whether state certification of CHWs would improve the delivery of health care services to underserved populations either directly (i.e., improved quality of care) or indirectly through increased performance of primary health care teams.

State Certification of CHWs

The support of state governments and health care organizations is required to develop sustainable CHW programs, but it is still not clear if state certification can increase the dissemination of CHWs into health and social care organizations. There is a

need to ensure that training programs are accessible and affordable, and that state certification provides benefits to the CHWs (i.e., increased salary, improved career opportunities) and the communities they serve. A number of reasons have been suggested as to why stakeholders, including state governments, may want to promote CHW certification and standardized training: (a) health care organizations require greater control over service providers to ensure quality and integration of services, (b) communities need well-trained health care workers to improve access and culturally appropriate care, (c) improved professional identity and career opportunities for CHWs, and (d) deceasing the cost of health care through primary and secondary prevention of disease, and care coordination using CHWs (CDC, 2013; May, Kash, & Contreras, 2005).

However, May et al. (2005) highlight potential negative consequences to state CHW certification and training programs. Additional state funding is needed to administer and monitor the certification and training programs, and the certification process can be prohibitive to some qualified community members due to costs and access to training. According to the authors, the certification process may also change how CHWs are viewed by the communities they serve, so that instead of being viewed as members of the community they become members of the health care system.

May et al. (2005) developed five policy recommendations to improve CHW certification and training based on their survey results: (a) CHW certification and training programs must define the roles and responsibilities of CHWs in the health care system, (b) CHW training must match the skill requirements for their roles and responsibilities, (c) evaluation of CHW certification and training must be developed to ensure the programs are meeting the needs of all stakeholders, (d) CHW programs must be

supported by sustainable funding to ensure job opportunities for certified CHWs, and (e) certification and training programs must be based on the needs of the community and health care organizations.

Catalani et al. (2009) used principles of Community Based Participatory Research (CBPR) to work with CHWs in New York City (NYC) to explore their perceptions of training and certification. According to the authors, the increasing use of CHWs within the U.S. health and social care system is limited by uncertainty "about the definition of CHW, how CHW roles differ from other health professionals, CHW training needs, and the potential impact of the growing regulation on certification and reimbursement" (p. 228). Focus groups of CHWs felt that more formalized training was needed. The CHWs felt that professional skills training would increase the respect they receive from health and social service professionals and allow them to express their views and ideas more openly. The majority of the training received by the CHWs was targeted on a particular disease, health problem, or ethnic group, and CHWs felt it did not provide them with enough training to deal with more complex individuals and families with multiple problems or needs.

Catalani et al. (2009) found the CHWs who participated in the focus groups to be supportive of credentialing, but they were apprehensive about how credentialing might limit their job role to one more focused on medical diagnoses. The CHWs felt their primary job was to represent the community and help the community meet its needs, and not necessarily the needs of health care organizations. They were concerned that being part of a health care organization may impact the way community members their work, and they may no longer be seen as working for the community. The CHWs were also

concerned about individuals being excluded from certification because of their immigration status or criminal history.

Catalani et al. (2009) concluded that the results of their research demonstrated that CHWs from NYC who participated in the focus groups felt the need for better training to allow them to collaborate with other health and social work professionals. The CHWs felt it was critical that members of the CHW community be involved in the development and delivery of training for CHWs. Focus group participants supported credentialing of CHWs provided it did not limit the scope of their practice, and that training and credentialing programs provided flexibility to allow low-income or non-English speakers to become credentialed and to allow credentialing for CHWs who have been practicing and have experience in the field.

Harris, McArthur, Huang, Harcrow, and Dacso (2008) reviewed the impact of certification on CHWs in Houston, Texas. Texas has had a voluntary state certification program for CHWs since 2001. While CHW certification is voluntary, the state requires contractors to use certified CHWs for primary care case management services, outreach, and education under its Medicaid regulations (HRSA, 2007). Texas had a well-established CHW education and certification program which had certified over 500 CHWs, but according to the authors “only 52% of CHWs who were due for re-certification had re-certified, and the number of recertifications (*sic*) and certifications have been falling” (CHW Advisory Committee, as cited by Harris et al., 2008, p. 106).

Based on interviews with CHWs and employers, Harris et al. (2008) found that many CHWs believed the process of certification to be a barrier to increasing the use of CHWs into health care organizations. For example, organizations were required to

develop their own training programs, and the programs must be revised every two years to meet state regulatory requirements. CHWs interviewed also cited the cost of certification, difficulty accessing courses, and language as barriers to certification. After they were certified, CHWs had difficulty maintaining certification because of a lack of adequate continuing education courses.

The CHWs and employers interviewed by Harris et al. (2008) described positive aspects of certification, including "heightened credibility, quality, recognition and acceptance" (p. 107) from other health care team members. However, most of the CHWs interviewed did not believe that certification improved job opportunities or pay. The lack of improved pay and job opportunities may have led many CHWs to question the need for re-certification, leading to the decrease in the number of CHWs applying for certification and re-certification.

A report titled *New Mexico's Community Health Workers: A model certification and training program* (NMCHW Report) outlined recommendations for the development of a model state certification and training program for CHWs in New Mexico (Despres, 2007). According to the report, the development of a state certification and training program for CHWs in New Mexico is critical to increasing the capacity of the health care workforce and to reducing health disparities. The author found strong support overall from CHWs in New Mexico for the development of a state certification and standardized training program. However, there was concern that the process of state certification and training would not be flexible enough to meet the needs of CHWs and other stakeholders. CHWs were also concerned about whether a standardized training program would be culturally appropriate for New Mexico's diverse CHW workforce, whether such a

program would narrow the definition of CHWs' job roles, the eligibility requirements for state certification and training, and the cost of training and certification.

Support for state CHW certification by employers and supervisor's was mixed. The supervisors felt that standardized training and state certification would improve the consistency of CHW skill levels, improve evaluation of CHW effectiveness, and increase other health care professionals' confidence CHWs as members of health care teams. However, employers were concerned about whether a state certification program would be able to meet the diverse needs of CHWs and organizations, and about any additional costs and regulations under a state CHW certification program (Despres, 2007).

The report recommended that the New Mexico Department of Health (NMDOH) take the following steps toward state certification and standardized training: (a) create and fund an Office of Community Health Workers within the NMDOH to provide a central agency for technical support and coordination of CHW programs with the guidance of the New Mexico Community Health Worker Advisory Council, (b) develop a voluntary, comprehensive state CHW certification and credentialing process and a registry of CHWs in New Mexico, (c) develop CHW core competencies for a general CHW certification, (d) develop an evaluation framework for CHW programs, training, and credentialing, and (e) develop policies to finance CHW programs in New Mexico (Despres, 2007).

Rosenthal, Wiggins, Ingram, Mayfield-Johnson, and Guernsey De Zapien (2011) reviewed the major CHW workforce studies published in the past two decades, and they analyzed the studies' findings around "CHW demographics, core roles and competencies, training and credentialing, and career advancement and workforce issues" (p. 248). The

authors examined three national studies: the National Community Health Advisor Study (NCHAS), the National Community Health Worker Advocacy Survey, and the Community Health Worker National Workforce Survey (HRSA, 2007). The authors found that while standardized training programs for CHWs have been recommended to increase the level of professionalism, the majority of CHWs did not complete standardized training, and most were trained on the job.

Rosenthal et al. (2011) found strong support for the development of standards of practice for CHWs by health care organizations that employed the CHWs, and the NCHAS advisory council believed that the development of CHW credentialing programs would have a more positive benefit for CHWs. The authors noted that while discussions of CHW credentialing programs have increased, there continues to be a need for CHWs to work with other stakeholders to develop model credentialing and training programs that are sustainable and meet the needs of CHWs, communities, and health care organizations. The threat is that the work roles of CHWs will be narrowly defined to meet the needs of health care organizations, and therefore not allow CHWs to completely fill the diversity of needs in communities. The authors' final recommendation was "that practice and policy initiatives seeking to promote the integration of CHWs pay close attention to the full range of CHW roles identified in the past and ensure that they are sustained in the present" (p. 258).

Summary state certification of CHWs.

Three states, Massachusetts, Ohio, and Texas, have established state CHW certification programs, a fourth state, Minnesota has developed a CHW certificate program. Efforts to develop CHW certification programs as well as allowing

reimbursement for CHW services through state Medicaid programs are ongoing in a number of other states. Advocates for increasing the use of CHWs in the delivery of health care services promote CHW certification and standardized training as a way to ensure quality of care, improve access, culturally appropriate care, and increase the professional identity of CHWs (CDC, 2013; May et al., 2005).

Whether state CHW certification programs will lead to deceasing the cost of health care is still unclear. Additional state funding is needed to administer and monitor the certification and training programs (May et al., 2005), and early evidence from Texas' voluntary CHW certification program found many of the CHWs who were certified by the state did not believe that certification improved job opportunities or pay (Harris et al., 2008). A more recent review of major CHW workforce studies found strong support for the development of standards of practice and CHW credentialing programs by health care organizations that employed the CHWs. The authors noted that while discussions of CHW certification programs have increased, there continues to be a need for CHWs to work with other stakeholders to develop model certification and training programs that are sustainable and meet the needs of CHWs, communities, and health care organizations (Rosenthal et al., 2011).

Factors in the Success or Failure of CHWs

Rosenthal et al. (2008) summarized the results of a national conference aimed at identifying gaps in the research, practices, and policies related to CHWs. The majority of the conference participants believed that if sufficient evidence existed on the effectiveness, both in terms of costs and health care outcomes, that this would stimulate policies to support additional funding for CHW programs. While reliable and valid

evidence of effectiveness is helpful to move new policies forward, evidence is often not sufficient to persuade policy makers to change existing policies, especially if other state and organizational factors (i.e., slack resources, political will, or federal regulations) are not also present.

In a more recent review of efforts to increase state CHW certification programs and the adoption of CHWs into primary health care programs, Rosenthal et al. (2010) highlighted the policy changes in two states Massachusetts and Minnesota. The authors wrote that previous efforts to increase the adoption of CHWs into health care programs in Maryland, Ohio, and Texas, have only had limited success. Barriers to the increased use of CHWs include a lack of sufficient incentives for health care organizations to hire state certified CHWs, and therefore limited incentives for CHWs to pursue state certification. Massachusetts and Minnesota policy makers have worked to integrate CHWs into discussions on changing their health care systems. Minnesota passed legislation in 2007 that allows for Medicaid reimbursement for CHW services as part of health care teams supervised by health care professionals. Massachusetts has developed CHW training and educational programs, and requires state contractors to support education and workforce development for CHWs. However, the authors note that there continue to be problems with integrating CHWs into health care programs due to a lack of knowledge about the roles of CHWs within health care organizations and among many health care professionals.

Rosenthal et al. (2010) recommended the following legislative actions to increase the adoption of CHWs into health care organizations and ensure that CHWs programs are sustainable: (a) develop sustainable financing for CHW programs and services through

Medicaid, Medicare, and other state and federal health and social service programs, (b) develop line-item funding for CHWs through Federally Qualified Health Centers (FQHC) similar to line-item funding for CHR programs within the Indian Health Service, (c) develop incentives and regulations that promote the hiring of CHWs for public health programs, (d) increase workforce development programs for CHWs, and (e) develop standards for certification and training of CHWs.

Rosenthal et al. (2010) concluded by recommending that CHWs be part of the policy development process, and ensuring that health care organizations have the flexibility to adapt CHW work roles to meet the needs of their communities and organizations. However, it is unclear whether states or the federal government have the resources necessary to actively promote the dissemination of CHWs into health care organizations, and whether health care organizations have the capacity to adopt and integrate CHWs into health care teams. The adoption of CHWs into the existing health care teams may require additional resources and support from health care workers and organizations. Organizational processes and procedures, along with regulations for financing CHW in health care, need to be developed to ensure adequate oversight and management of CHWs.

Many health care providers do not know or understand the role of CHWs. CHWs often work outside of the clinical setting and health care providers may be skeptical about their scope of practice since few CHWs are required to be certified or to have completed a standardized education program. There is debate as to whether state credentialing of CHWs would improve knowledge and acceptance of the CHWs by other health care professionals or whether it would limit access to CHW training because of barriers to

formal education, including cost, anxiety over formal education programs, and testing (Ross & Patrick, 2006).

May et al. (2005) argued that the support of state governments and health care organizations is required to develop sustainable CHW programs, and state certification and standardized training programs can increase the dissemination of CHWs into health care organizations if sufficient resources are provided. The authors further argued that training programs must be accessible and affordable and that state certification must provide benefits to the CHWs (i.e., increased salary, improved career opportunities) and the communities they serve.

Summary factors in the success or failure of CHWs.

Efforts to promote the integration of CHWs into the current health care delivery systems through the adoption of state certification polices have been mixed. Barriers to the integration of CHWs include a lack of knowledge about the role of CHWs among health care professionals and in many health care organizations, as well as few incentives for health care organizations to hire state certified CHWs (Doherty & Coetzee, 2005; Keller et al., 2011; Waitzkin et al., 2011). Recommendations to increase the adoption of CHWs into health care include working to develop sustainable financing for CHW programs, developing policies that promote the hiring of CHWs for public health programs, developing standards for certification and training of CHWs (Rosenthal et al., 2010).

However, unless sufficient resources, both financial and administrative, are provided by states and health care organizations for the development of certification and training programs it is unlikely that the use of CHWs by health care organizations will

increase. There is currently no evidence that state certification of CHWs improves the knowledge and acceptance of the CHWs by other health care professionals, or whether state certification programs act as a barrier to CHW adoption because of increased cost and regulation. CHW training programs need to be accessible and affordable, and state CHW certification, if adopted, must provide clear benefits to the CHWs, the health organizations they work for, and the communities they serve (May et al., 2005; Ross & Patrick, 2006).

Relationship between CHWs and Primary Health Care Teams

Keller et al. (2011) examined the role of promotores (CHWs) in federally qualified health centers in the United States-Mexico border region. The authors used the Assessment of Chronic Care (ACIC) survey instrument to assess the staff (i.e., physicians, nurses, certified diabetes educators, laboratory personnel, and CHWs) perceptions of collaborative team work in diabetes education. Analysis of the survey transcripts found that clinicians and clinical staff viewed the primary role of CHWs as assisting with contacting patients about up-coming appointments and not as health educators or members of the clinical team. The CHWs considered diabetes education to be their primary role, but they did not describe this role as being part of the diabetes or clinical team. They viewed the Certified Diabetes Educators (CDEs) both as their supervisors and as the clinical staff members they worked with most closely. The researchers found that the CHWs were not well integrated as part of the chronic care model (CCM). The CHWs interviewed for the study were not able to identify five of the six key elements of the CCM, but the researchers found that CHWs were much better at

describing a broad spectrum of community resources than were clinicians or clinical staff.

Keller et al. (2011) developed a model to describe the relationship between CHWs and the clinical team with the diabetes educators acting as an intermediary or "filter" between the CHWs and other team members within the CCM framework. The authors believe that this arrangement results in "a functional gap between the providers and promotores that affects systems communications and contributes to the perception that promotores have no direct role in diabetes education and self-management support" (p. 79). Because CHWs have traditionally worked outside of the clinical setting and in the community, there appears to be a critical knowledge gap among health care professionals working in community clinics about the roles of CHWs within CCM. Staff members, such as diabetes educators, can act as intermediaries between CHWs and other clinical team members, but a more effective means of delivering care would be to have CHWs as true members of the health care team. Keller et al. concluded that more research is needed on how to integrate CHWs into the CCM and multidisciplinary health care teams.

Doherty and Coetzee (2005) explored the working relationship between CHWs and nurses in South Africa. The study found three general phases in the working relationship between CHWs and nurses. During the first phase of the relationship, the nurses were not sure what the roles of the new CHWs were in the health system, and because of the lack of certification they did not understand their educational preparation. During the second phase, nurses began to understand the skills of the CHWs, and nurses began to utilize them in both clinical and community settings. Finally, the nurses

accepted the CHWs as part of the health care team, and valued them for their connection to the community.

From the CHWs' perspective during the initial phase of working with the nurses they understood that the nurses were unsure about their roles and job duties because these roles had never been formally developed. The lack of formal certification for the CHWs' health care training made it difficult for the nurses to understand the CHWs unique job skills. However, soon the nurses began to use the CHWs for clinical care because of shortages of nursing staff. Some CHWs found they were often doing the work of nurses, and this became a problem because it prevented them from completing some of their duties in the community. The CHWs also felt they did not receive the same recognition as members of the health care team compared with the nurses (Doherty & Coetzee, 2005).

Doherty and Coetzee (2005) recommended the certification of CHWs in South Africa to increase acceptance of CHWs by other licensed health care professionals. The authors felt the development of a national certification program along with standardized training for CHWs would allow other health care professionals to understand the roles and responsibilities of CHWs as members of health care teams. There have not been any studies that have examined the impact that state CHW certification programs have on the perceptions of professional health care workers toward CHWs or whether state certification of CHWs would increase acceptance of CHWs as members of health care teams.

The difficulty in integrating CHWs into health care teams was highlighted in a study using CHWs to improve mental health services at community health clinics (CHCs) in New Mexico. Researchers experienced "unexpected challenges…in the intervention's

implementation, involving infrastructure at the health centers, boundaries of the promotores' roles, and 'turf' issues with medical assistants" (Waitzkin et al., 2011, p. 316). Training on the work roles and responsibilities was provided to CHWs, CHC staff, and providers, but after the study was begun the CHWs reported being asked to provide services that were not part of their role. Medical Assistants (MAs) at the CHC acted as gatekeepers to information necessary for the CHWs to complete their work. The CHWs had to complete work for the MAs in order to be allowed access to information (i.e., medical charts) to complete their primary work (Waitzkin et al., 2011).

Primary Care Providers (PCPs) and other clinical workers expressed support for the CHWs, and they valued the additional time the CHWs were able to provide patients, and the cultural and language skills of the CHWs. Waitzkin et al. (2011) believe that the difficulties with integrating the CHW in the CHCs may have contributed to the insignificant results among clients suffering from depression. The lack of clarity around CHWs job roles and functions, and the conflicts with MAs that occurred, should be a cautionary signal for advocates seeking to increase the adoption of CHWs into existing health care teams. The authors recommended further research on how to integrate CHWs into health care teams and what organizational structures and attributes (i.e., team climate, resources, staffing) might be more receptive to the adoption and integration of CHWs into health care teams.

Summary of CHWs and primary health care teams.

The use of CHWs as part of primary health care teams continues to increase as the need decrease health disparities remains a national priority (U.S. Department of Health & Human Services, 2012). How CHWs are integrated and work within existing health care

teams will have an impact on the quality of care delivered and on patient and population outcomes. Few studies have examined the relationship between CHWs and other members of primary health care teams. Studies of teams that use CHWs or home visitors have found a difference in the perceptions of team work between clinical and community based workers (Keller et al., 2011; Ross, Rink, & Furne, 2000; Waitzkin et al., 2011). Problems with integrating CHWs into existing primary health care teams may be due to CHWs working primarily outside of the clinical setting, decreasing the opportunity for interaction between team members, or a lack of knowledge about the role of CHWs among primary health care teams (Doherty & Coetzee, 2005). More research is needed on how to successfully promote the adoption and integration of CHWs into primary health care teams.

Teams in Health Care

There is a wide diversity of teams working in health care today, including in-patient acute care teams, chronic care teams, primary care teams, and management teams, all of which have specific functions within the health care system. Heinemann (2002) defines a multidisciplinary health care team as consisting of at least three different types of health care professionals or health care workers who have a common goal to improve the health of individuals or populations. The outcomes of health care teams are dependent on a well-functioning team, where team members share common goals, communicate well, and are provided the resources to complete their work. Well-functioning teams are difficult to develop and maintain (Heinemann, 2002).

Reeves, Lewin, Espin, and Zwarenstein (2010) outlined a sociological framework for teamwork in health and social care teams. Multidisciplinary teamwork has been

championed as a solution to improve problems with the delivery of health and social services, and if team members are not adequately prepared or oriented to their job duties patient outcomes will be negatively impacted. The authors outlined six essential elements that are required for multidisciplinary teams to effectively deliver patient-centered care: "(a) clear team goals (b) a shared team identity among team members (c) a shared team commitment (d) clear role and responsibilities (e) interdependence between team members, and (f) integration between work practices" (Reeves et al, 2010, p. 4).

The development of well-functioning teams is a difficult process. Resources need to be committed to developing policies and regulations that outline the functioning of each team member within the team and organization, and communication systems need to be developed to ensure that team members are all working together toward the same goals. All of these factors require leadership support and the support of health care workers who are expected to work together as a team. Improving team performance can improve health care outcomes, but more evidence is needed about which factors are most important to improving team performance and health care outcomes (Baker, Day, & Salas, 2006; Reeves, Lewin, Espin, & Zwarenstein, 2010; West & Field, 1995; Xyrichis & Lowton, 2008).

Bodenheimer (2007) interviewed primary health care workers, including physicians, nurses, medical assistants, community health care workers, and managers involved in primary health care delivery to develop recommendations on improving team performance in primary care programs. Bodenheimer describes the problems faced by the primary health care system: too few primary care providers, an increasing number of patients with complex chronic diseases, an inefficient health care system that leaves

many people without adequate access to preventive health care services, and limited time for patient counseling and education by primary care providers. The solution, according to Bodenheimer, is to develop health care teams where nonclinicians work closely with patients to fill in the gaps that the primary care clinician is unable to complete. The question is, who is best qualified to accomplish these tasks, what types of training, education, or experience are needed, and how will performance and outcomes be measured?

Xyrichis and Lowton (2008) completed a review of the literature on multidisciplinary teams in primary health care. Demographic changes and the shift toward chronic disease management and primary prevention have increased the importance of multidisciplinary health care teams. The authors found that team structure and team processes continue to impact the delivery of care, and that improving teamwork depends on team structure, team size, composition, and organizational support. Improving team effectiveness depends on team processes, clear goals and objectives, and communication between team members.

Xyrichis and Lowton (2008) concluded that based on their review of the literature the critical factors of effective teams include ability to work in close proximity with other team members, good intrateam communication, clear team goals and objectives, and continuous monitoring of performance. Perhaps most important was support for teams from the organizational level, especially support for innovation by teams. However, despite efforts to transform health care teams, there has been little progress toward developing evidenced-based models of multidisciplinary teams for the delivery of primary and community-based health care.

Arksey, Snape, and Watt (2007) examined how different members of primary health care teams (PHCT) viewed other team members, both clinicians and none clinicians, in northern England. The interviews with PHCT members revealed that there was confusion within the small primary care practice teams, especially about clinical and nonclinical role functions. While all of the team members interviewed spoke about how team members depended on each other for the team to provide quality care, there were problems with understanding what their work roles and the roles of other team members were. These gaps can lead to decreased team performance and patient care.

Weinberg, Cooney-Miner, Perloff, Babington, and Chanan Avgar (2011) examined informal teams in both hospital and primary care settings. The authors found that because of the hierarchical nature of health care, with physicians historically making most of the decisions regarding patient care, it is difficult for other members of the health care team, especially those without a professional degree or licensure, to feel included. The hierarchical nature of health care teams is reinforced by policies and regulations that limit what some health care professionals can do, and which fail to outline roles and responsibilities for many unlicensed health care personnel.

The results of the research on informal health care teams in hospitals have implications for interdisciplinary health care teams outside of the acute care setting. Weinberg et al. (2011) described the educational and regulatory barriers to developing collaborative practice teams in hospital settings where workers are together for most of the day. In the community setting some health care workers are based in community clinics while others work primarily in the home or community, and opportunities for interaction and communication are limited. Weinberg et al. concluded that in order to

improve team performance in health care, a more collaborative approach needs to be taken to decision making and team-based care.

Ruddy and Rhee (2005) argued that the integration of nontraditional members, such as CHWs, onto primary health care teams can improve chronic disease management and patient outcomes, especially in culturally diverse populations. Additionally, the authors noted, the education and background of team members should in part be based on the community, and not solely on professional qualifications. However, the integration of new disciplines into primary health care teams does not guarantee improved performance. For integration to succeed, primary health care teams need support from leadership, organizational resources, training, clear roles, and common goals and outcome measures.

Summary teams in health care.

Changes to the delivery of health care services, with an emphasis on health promotion, disease prevention, and care coordination are being promoted as a way to decrease costs and improve care in the U.S. health care system. A team based approach with professionals and non-professionals working to deliver primary health care services is seen as a model for the future of primary health care (Baker et al., 2006; Bodenheimer, 2007; Reeves et al., 2010; Xyrichis & Lowton, 2008). It is unknown how many primary care organizations use CHWs as part of their health care teams, but there is growing support for the adoption and integration of CHWs into primary health care teams (Balcazar et al., 2011; CDC, 2011; Martinez et al., 2011).

How current health care teams adopt and redesign the delivery of health care services that include CHWs will impact patient care outcomes and quality. Efforts to increase the adoption of CHWs into the primary health care system will require

additional resources as well as strong leadership and organizational support. Developing team processes, including clear goals and objectives, and ensuring communication between team members are necessary for teams to function effectively (Xyrichis & Lowton, 2008).

More research is needed on effective methods of interdisciplinary team development and health care delivery. Hierarchical models of care delivery have not been effective in many health care settings, and a more multidisciplinary approach, that includes professional and unlicensed health care providers, need to be developed (Martinez et al., 2011; Ruddy & Rhee, 2005; Weinberg et al., 2011). It is unknown whether state certification of CHWs improves the ability of primary health care teams to deliver quality health care services or increases the adoption and integration of CHWs as part of multidisciplinary health care teams.

Measuring Team Performance in Health Care

There is an increasing emphasis in health care organizations on measuring team performance. Organizations need to be able to monitor and report team progress toward meeting standards of care, and they should also be able to report on process measures that affect team outcomes. There are a number of barriers to measuring team performance outcomes: the resources needed may not be available in many smaller health care organizations; less rigorous assessment instruments are available, but these may not meet the needs of health care organizations; many team performance measurement instruments have been developed for business and industries other than health care, but their validity in measuring team performance in health care teams may not be as robust (Zeiss, 2002).

Measuring team performance is related to the effectiveness of outcomes in clients and within organizations. Teams that have poor internal performance scores are unlikely to be able to adapt to the needs of a changing health care system with higher acuity patients, fewer health care providers, and changes in payment systems that focus on patient and population outcomes. However, Zeiss (2002) cautioned that measurement of team performance is impacted by external factors such as changes in the availability of resources as well as internal factors like changes in team membership. Assessments of a team's performance over time need to compensate for these internal and external changes.

Waite and Nichols (2002) reviewed a variety of different team performance survey instruments which evaluate different dimensions of health care teams. They described the Team Climate Inventory (TCI) as "a theoretically based, well validated instrument that yields an overall scale score and subscale scores on five components of team performance – vision, frequency of interaction among team members, participant safety, task orientation, and support for innovation" (p. 217). The TCI was originally developed for research on team innovation, and it is best suited for use with professionals working in teams. The authors concluded that the TCI is a well-designed instrument for research, has "good face validity," and is "sufficiently sensitive to detect differences in climate across teams in different settings" (p. 220).

Team Climate and Team Performance

Anderson and West (1998) described two different definitions of climate pertaining to organizational work groups: (a) individual group members' perceptions of their work environment or *cognitive schema,* and (b) the *shared perception* of group

members of the work environment. The authors contend that work-group climate is an important factor in group effectiveness and innovation, and that the shared perception of team climate is an appropriate level at which to measure organizational climate.

A work group is defined as a team of employees who work together to perform specific tasks or functions within an organization. A work group may work on a temporary project or be part of the core functions of an organization. The members of the work group may belong to multiple groups, but their primary work group represents their most frequent job functions. Anderson and West (1998) outlined three criteria that individuals in work groups must have in order for a shared climate to develop: (a) the employees must interact as part of their job duties, (b) the employees must be working toward a common goal, and (c) the employees functions are interdependent and require a mutual understanding of the duties of others. The authors state that these are necessary but not sufficient conditions for shared climate to develop.

Work group climate can also be influenced by individuals outside of the group, including organizational leadership and other work groups inside and outside the organization. Therefore, shared perceptions are not solely developed within primary work groups. However, Anderson and West (1998) argued that because of the level of interaction between employees within their primary work groups, it is likely that shared perceptions develop, and that it is important to measure the organizational climate at the work group level.

Studies of Team Climate in Health Care

Howard, Brazil, Akhtar-Danesh, and Agarwal (2011) used the TCI short form (TCI-SF) to assess organizational factors associated with team climate in family health

teams in Ontario Canada. The family health teams (FHT) were created by the government of Ontario to increase access to high quality primary health care services, and they were designed to be multidisciplinary health practices that operate independently or as part of a larger care network. The researchers sampled health care team members (n = 411) using the TCI-SF, and then compared overall TCI-SF scores using multiple regression analysis with organizational factors including: leadership style, use of electronic health records (EHR), organizational culture, organizational size, and team mix.

The study by Howard et al. (2011) found a statistically significant positive association between overall TCI-SF scores and leadership, EHR capability, and developmental organizational culture. Organizational factors that were negatively associated with team TCI-SF scores included: hierarchical culture, organizational time (i.e., months or years since the FHT was established). The authors concluded that the interpersonal relationships established between members of the health care team were the most important factors in perceptions of team climate.

Goh and Eccles (2009) examined studies that used the TCI survey and quality of care in primary care in the United Kingdom. The authors noted that the factors measured by the TCI do not directly translate into quality health care outcomes, but they likely act as mediators on other variables within health care organizations and health care teams that do have an effect on patient outcomes. The studies included original research using the TCI among primary health care workers (i.e., physicians, nurses) working in the National Health Service (NHS), and research outcomes for quality of care (i.e., chronic disease management goals, patient satisfaction) as well as team effectiveness. The authors' analysis found that average TCI scores of primary health care teams in the NHS

were lower than those reported for multidisciplinary teams in other types of organizations.

Goh and Eccles (2009) noted that the use of the TCI to measure health care outcomes was not what the instrument was originally designed for, and the authors were unable to find evidence that higher TCI scores were related to health care quality or team effectiveness from the studies reviewed. The authors concluded that while the TCI is an appropriate instrument for use in health care teams, the ability to gather team-level data depends on a large proportion of team members responding and that additional research is needed to determine whether the factors measured by the TCI can be linked to health care outcomes.

In a study of team climate and team structure, Bower, Campbell, Bojke, and Sibbald (2003) found that programs designed to improve the efficiency and effectiveness of health care programs must be translated from the policy and organizational level to health care teams. Barriers to implementation of interprofessional teamwork include a lack of support from new roles, inadequate communication and preparation, and professional role conflicts. The authors studied the impact of organizational structure on team climate and whether this structure predicted positive patient outcomes.

The study by Bower et al. (2003) involved observation of 60 primary care teams in England and data on patient outcomes from chart reviews. Primary care team members completed the TCI, and observational data included the size of the primary care practice, length of employment, and skill mix or the ratio of clinicians to other staff. The results from the study showed a high intercorrelation between team effectiveness, innovation, and chronic disease management outcomes. According to the authors the relationship

between team climate and positive diabetes outcomes was similar to previous studies that link positive team climate to better care outcomes. Larger team size was predictive of better diabetes management. The authors hypothesized that team size may be a measure of greater diversity of skills and specialists leading to improved diabetes care management outcomes.

Ross, Rink, and Furne (2000) used a mixed method design to study of how organizational change impacted nurses working on primary health care teams in England. In the late 1990's the British NHS began to emphasize the delivery of health care services using a public health based approach that emphasized decreasing professional and organizational boundaries and reducing health inequity. Nurses were a key part of the reorganization of the health care delivery system, and the NHS began to look to integrated nurse managed teams as a way to provide effective cost efficient primary health care services.

The study evaluated how the integration of nurse lead teams into existing primary health care organizations of practices was perceived by other professionals working in the primary care organizations. Ross et al. (2000) used the Primary Health Care Team Questionnaire (PHCTQ) developed by Anderson and West (1994) to measure team climate. The PHCTQ is the earliest version of the Team Climate Inventory. PHCTQ scores from two primary health care organizations, and two NHS Health Authorities (HA), one HA was assessed after the integration of the new health care delivery system, and the second was assessed both before and after integration.

PHCTQ scores were highest for District Nurses (n = 32; PHCTQ μ = 3.95), and lowest for Health Visitors (n = 11; PHCTQ μ = 3.15), but there were no significant

differences between PHCTQ mean subscale scores and mean scores from previous research. Ross et al. (2000) did not define the differences in job duties or roles between district nurses (DN), practice nurses (PN), and health visitors (HV). However, the NHS (n.d.) has defined health visitors as Registered Nurses or midwives who have special training in working with children and families especially during the first years of life, similar to the U.S. nurses working in the Nurse Family Partnership program. District nurses provide home visiting services to a wider range of individuals, families, and elderly. Practice nurses work with General Practitioners in primary health care clinics assisting with patient screening, follow-up, and primary and secondary prevention, and patient education activities (National Health Service, n.d.).

The results of interviews with primary health care team members found that there was not a general understanding among team members on the meaning of integrated nursing teams. Physicians involvement in the integration of nurse managed teams was mixed, with some reporting no involvement and others reporting being actively involved. Nurses generally felt the nurse managed teams provided an opportunity to demonstrate the value of nursing care and educate other team members on the strengths of multidisciplinary care. However, the complexity of integrating the nurse managed teams into existing health care programs was a barrier according to the nurses interviewed. Nurses also expressed concern about task shifting to less qualified staff, and difficulty in integrating a new model of health care delivery while having to maintain their current work duties (Ross et al., 2000).

The authors concluded that policy makers wanting to make changes in health care organizations and teams need to consider the different viewpoints of current health care

team members, and they need to work with nurses and other health care professionals to develop models of adopting and integrating innovations into existing health care organizations. This is critical for health care team members whose primary roles are outside of the primary health care clinic. Ross et al. (2000) found that health visitors had lower overall team climate scores. The authors speculate that the low team climate scores for home visitors may also be a result of the different perspectives that home visitors have toward primary health care as being more population focused rather than individually focused.

Summary team climate and health care teams.

Attempts to measure team performance in health care have focused on a number of factors including organizational size, workforce diversity, slack resources, organizational culture, and team climate to determine if workers are preforming together to deliver quality health care. Internal and external factors impact teams, and the ability of teams to meet the increasing demands of a changing health care environment (Zeiss, 2002). The Team Climate Inventory (TCI) developed by Anderson and West (1998) measures one aspect of team work, the team climate or the shared perceptions of the work environment. The TCI has been shown to be a reliable and valid measure of team climate in a variety of health care settings, including primary care (Waite & Nichols, 2002).

Studies using the TCI with interdisciplinary health care teams have found a positive association between team climate scores and leadership and organizational culture, and a negative association with a hierarchical team culture and team tenure (Howard et al, 2011). Whether team climate has a direct effect on patient care outcomes is still unclear (Goh & Eccles, 2009), but one study has shown a strong correlation

between team climate and positive diabetes care outcomes (Bower et al., 2003). More importantly the integration of CHWs into health care organizations is likely to have a disruptive effect on health care teams, and the ability of health care organizations to monitor and adapt to changes in team climate will be critical to the success and sustainability of these new models of health care delivery.

Studies done in the United Kingdom after the development of a new primary health care delivery model focused on nurse lead teams found problems in the implementation of the new models of care and confusion among exiting team members about the roles of the new teams (Ross et al., 2000). Similar problems are likely to occur within health care organizations and primary health care teams as they attempt to adopt CHWs into their health care delivery network (Doherty & Coetzee, 2005; Waitzkin et al., 2011). Being aware of and monitoring team climate may allow organizations and teams to appropriately adapt the innovations to decrease the negative consequences of disruptive change and work to promote effective delivery of health care services by interdisciplinary teams.

Moderating and Mediating Effects

Kim, Kaye, and Wright (2001) describe moderating variables as having an influence on dependent variables and mediating variables as explaining “how or why a relationship exists between the independent and dependent variables” (p. 74). A number of moderating variables could impact the TCI scores of RNs including: maturity of team (i.e. length of time working with CHWs on team), leadership support for team activities, resources available to team, and training on team work and overcoming barriers to team performance (see Figure 4).

One potential mediating variable that may impact the TCI scores is whether or not CHWs are reimbursed for their work on teams through private or public insurance plans (see Figure 5). Some state Medicaid programs and private insurance plans reimburse for CHW services without requiring state certification of CHWs. Reimbursement for CHW services can impact team climate by increasing the value of CHWs because of their work has the potential to generate revenue for the organization. Direct reimbursement of CHW services could also have a negative effect on team climate if some team members resent or feel less valued because their services are not reimbursed. For example, RNs services are not reimbursable in most states, and RNs may feel CHWs are not qualified to receive direct reimbursement for services if they have less education or training.

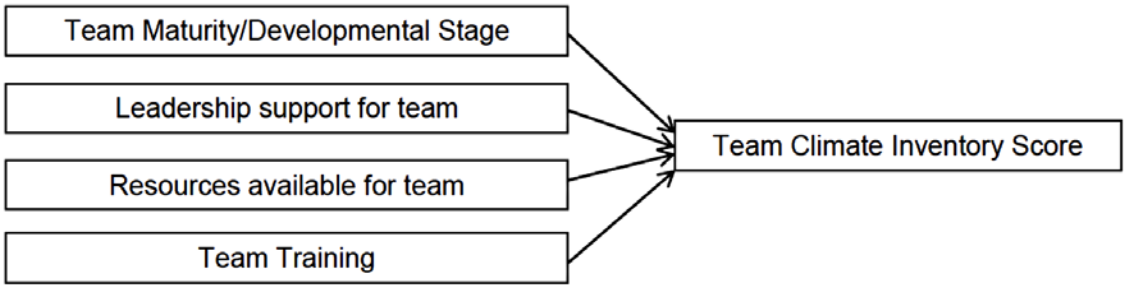

Figure 4. Potential Moderating Variables on Team Climate Inventory Scores.

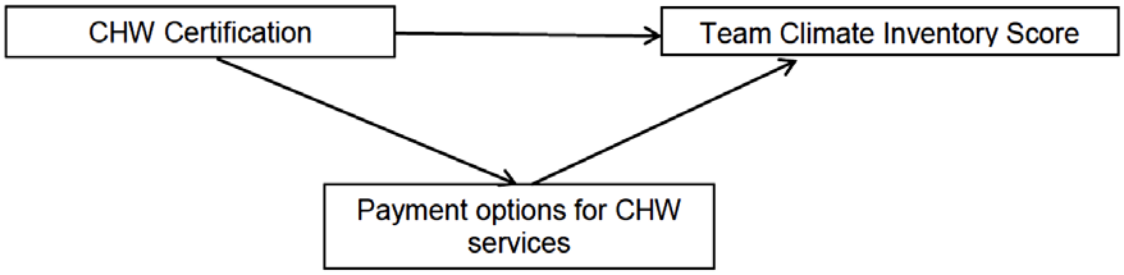

Figure 5. Certification of CHWs and Reimbursement as Mediating Variable on TCI Score.

Conclusion

The dissemination of CHWs into health care organizations is being promoted as a way to improve chronic disease outcomes and meet health care workforce needs. State certification of CHWs has been advocated by some as a way to increase the adoption and integration of CHWs into health care teams. State certification has been used to increase professional recognition of CHWs role, standardize training programs, and to create mechanisms for billing public and private health insurance programs for CHW services. However, there has not been any research into whether state CHW certification programs do improve the adoption and integration of CHWs onto health care teams.

This research examined the differences in team climate, the shared perceptions of individuals of their work teams, between RNs who work in states with CHW certification programs and RNs who work in states without these programs to determine if state certification of CHWs has an impact on team climate. Team climate has an impact on a health care team's effectiveness and innovation. The results of this research may help to determine if state CHW certification programs have an impact on team climate from the perspective of RNs. The information could help inform state legislators and other policy makers on the impact of state CHW certification programs and increase or decrease policy diffusion of CHW certification between states. The results of this research may also be useful to health care organizations wanting to adopt and integrate CHWs into their current organizational structure by providing more information on the impact of state certification.

Chapter 3

Research Design and Methods

The study collected data about team climate, as measured by the Team Climate Inventory (TCI) among RNs who work in states that have CHW certification programs (i.e., Ohio, and Texas) and states that do not have CHW certification programs. Team climate, the shared perceptions of work team members, is an important factor in team effectiveness and innovation (Anderson & West, 1998). Teams with a more positive team climate are thought to be more innovative and therefore may have fewer barriers to the adoption and implementation of innovations like CHWs (Anderson & West, 1998). Data collection began in November 2012 and ended in May 2013.

Study Instrument

Team Climate Inventory

The Team Climate Inventory (TCI) was developed to measure the shared perceptions of team members on how they work together, share a single vision, are open to new ideas, and if they feel safe and supported by other team members (Waite & Nichols, 2002). According to Anderson and West (1998) the four major predictive factors of team climate include: vision, participant safety, task orientation, and support for innovation. *Vision* is described as a goal that workers share that motivates and guides their work. Vision comprises “clarity, visionary nature, attainability, and sharedness” (Anderson & West, 1998, p. 240). *Participant safety* refers to a nonjudgmental atmosphere within the work group that allows group members to share ideas and opinions. *Task orientation* deals with accountability among team members, methods to monitor and evaluate team and individual performance, and open communication

networks that allow team members to provide feedback, critique, and overcome controversy. Successful task orientation leads to a shared sense of quality and vision about the outcome of team performance. *Support for innovation* comes not only from the members of the work groups, but also from organizational leadership. Support of innovation should also be evident by the team adopting innovations and not just expressing support for them (Anderson & West, 1998).

The TCI measures the team climate factors using an ordinal scale. The original TCI "uses 46 questions covering 4 dimensions and 13 sub dimensions calculated as mean scores on included items" (Rathje & Hill l, 2010, p. 133). Kivimäki and Elovainio (1999) developed a short version that includes questions from the same four dimensions as the original. The Team Climate Inventory Short Form uses 19 questions from the original TCI (see Appendix A) and includes the following subscales: (a) *Participation* is measured through 7 questions using a 5 point Likert scale, range 1-5 points (i.e., Strongly disagree, Disagree, Neither agree nor disagree, Agree, and Strongly agree) to assess the perceptions on how much participation there is on the team, with higher scores representing greater perception of participation by team members (b) *Support for innovations* asks 5 questions on a 5 point Likert scale, range 1-5 points (i.e., Strongly disagree, Disagree, Neither agree nor disagree, Agree, and Strongly agree) to measure individual's perceptions about attitudes toward change within the team, with higher scores representing greater perception of support for new idea by team members (c) *Team objectives* assesses individual understanding of the team's objectives through 5 questions using a 7 point ordinal scale, range 1-7 points, (i.e., Not at all, Somewhat, …Completely), with higher scores representing greater perception of vision or coherence in team

objectives reported by team members, and (d) *Task orientation* assesses how the team monitors performance asks 4 questions using a 7 point ordinal scale, range 1-7 points, (i.e., To a very little extent, To some extent,...To a very great extent), with higher scores representing greater perception of team engagement.

Anderson and West (1998) describe the development and testing of the TCI including the initial review of literature on work-group climate as well as the validity and reliability testing of the four-factor TCI. A pilot-test to gather reactions to the TCI was completed with hospital nursing teams and hospital management teams prior using the survey instrument for research. The TCI was then used in a longitudinal study of management teams from the British National Health Service (NHS) to help the NHS assess the innovativeness of health care teams in relation to team climate. The use of the TCI in a found that support for innovation scores were predictive of team innovativeness, participant safety scores were predictive of the number of innovations adopted, and task orientation scores were predictive of administrative effectiveness (Anderson & West, 1998).

Agrell and Gustafson (1994) assessed the reliability and validity of the TCI among Swedish work groups and found the overall correlation was positive and supported previous findings of instrument validity. After translation of the TCI into Swedish, the authors used the TCI to study (n =17) teams from both private and public organizations not involved in health care. The teams, which had been working together for at least one year prior to the study, performed administrative work that regulated production within the organizations. The researchers found a high level of internal consistency for TCI subscales, Cronbach's alpha $r = 0.95$. The authors found

“acceptable” levels of validity (r = .48) through the comparison of survey responses with observation of group processes and “correlating each subscale with the observers' ratings” (p. 146) of group production in terms of quantity, quality and innovation. The authors concluded that the TCI would be useful in assessing the innovative capacity of Swedish workgroups (Agrell & Gustafson, 1994).

Loo and Loewen (2002) completed a confirmatory factor analysis TCI using 72 teams composed of undergraduate management students. The purpose of their study was to determine the best fit among the four factors of the TCI as well as test the internal consistency, reliability, and inter-correlation between the scales for both the original and TCI short form (TCI-SF). The results of the study supported the use of the four factor TCI model. The authors found acceptable Cronbach’s alpha levels for internal reliability “.84 to .90 and .89 to .93, respectively” (p. 262) consistent with previous studies for the TCI, and the results of internal reliability for the TCI short form subscales, Cronbach’s alpha: “.70 to .80 and .76 to .82, respectively” (p. 263), were also consistent with previous studies. However, the authors write that this was the first study to examine the use of the TCI to measure team performance over time, and they cautioned that further research is needed to determine if the TCI is an appropriate instrument to measure progress toward team development and maturity (Loo & Loewen, 2002).

Hsu-Min, Feng-Chuan, and West (2009) tested the psychometric properties of the TCI on health care teams in Taiwan to determine the instrument’s validity. The TCI surveys were distributed to health program managers and administrators, the majority of whom had advanced degrees. The authors examined the four primary factors of the TCI - vision, support for innovation, participant safety, and task orientation, - and a fifth factor,

interaction frequency, which is related to participant safety. The overall analysis of the internal consistency of the translated TCI found all factors met the Cronbach's alpha level of 0.8, and results from the factor analysis of the TCI Taiwan version found the four factors accounted for 60% of the variance: vision 19.28%, support for innovation 16.1%, participant safety 16.05%, and task orientation 8.79%.

Mathisen, Torsheim, and Einarsen (2006) used a multilevel modeling analysis to examine the reliability of the TCI from both the individual and team levels. The authors write that past studies have used aggregated individual TCI scores to reflect team climate at the group level. These studies have found support of the hypothesis that team climate is impacted by work group and organizational factors, but questions remain about the influence of individual level factors on team climate. The authors explored the extent that individual level factors impact the variance in team climate and whether the four-factor TCI is valid at the individual and team levels using multilevel confirmatory factor analysis (MCFA).

Mathisen, Torsheim, and Einarsen (2006) surveyed 1,487 individuals from a wide variety of industries, and who were members of work teams, using the Norwegian version of the TCI. The authors found the TCI factors to be reliable at both the individual (Cronbach's alpha range .91 to .94) and team levels (Cronbach's alpha range .83 to .89). Level of internal consistency between TCI factors at the team and individual level were all above .70 with the exception of task orientation subscale (r_{wg} = .66). Interclass correlation test results (range .33 to .40) showed a high proportion of the total variance could be explained by group membership. However, the authors note that 60% to 67% of the variance in TCI scores cannot be explained by team membership, and therefore

individual level factors (e.g., personality, cognitive style, status, demographic differences) account for a greater amount of variance in TCI scores. The results of the MCFA demonstrated that the TCI fit measurement at both the individual and team levels (Mathisen, Torsheim, & Einarsen, 2006).

Team Climate Inventory Short Form

The TCI short form (TCI-SF) was developed and tested by Kivimäki and Elovainio (1999) to overcome potential barriers (e.g., resistance to taking the long survey) to the longer TCI survey instrument. The researchers believe the TCI-SF may be better suited for initial surveys where a larger number of questions may be a deterrent to participation. The researcher's sampled two groups of government health and social service workers in Finland. The researcher's used confirmatory factor analysis to analyze the TCI and develop a TCI-SF that maintained the original structure and core areas of the TCI. The analysis of the TCI-SF found high internal reliability ($r = .91$) and evidence in support of the reliability, homogeneity, and normality of both the TCI and TCI-SF instruments. The researchers concluded the shortened TCI had a comparable predictive value to the original.

Demographic Variables

The study survey instrument included a number of independent variables to allow for multiple regression analysis of TCI scores (Table 4). Variables that have been shown in previous published research to impact team climate include: (a) organizational size, larger organizations having additional resources to commit to team building and adoption of innovations (Greenhalgh et al., 2004a) (b) team tenure, employees who have worked together for longer have high team climate scores (West, 2004), and (c) organizational

type, non-profit organizations have been shown to have higher team climate than for profit or government organizations (Heponiemi, et al., 2011).

Table 4

Independent and Dependent Variables

Dependent Variables:	Variable	Response
Team Climate Inventory Total	Scale: ordinal	Sum of 4 subscales scores
TCI subscale: Participation	Scale: ordinal	5-point Likert scale
TCI subscale: Support for new ideas'	Scale: ordinal	5-point Likert scale
TCI subscale: Team objectives	Scale: ordinal	7-point ordinal scale
TCI subscale: Task orientation	Scale: ordinal	7-point ordinal scale
Independent Variables	Variable	Response
Gender	dichotomous	Female/Male
Age	Continuous	Years
RN Education Level	Categorical	ADN, BSN, MSN
Race	Categorical	White, …(see Appendix A)
Ethnicity	Categorical	Not Hispanic,...(see Appendix A)
Urban vs. Rural	Categorical	RUCC codes based on zip codes
Organizational Tenure	Continuous	Years & months
Team Tenure	Continuous	Years & months
Experience working with CHW	Continuous	Years & months
Organizational size	Continuous	Number of employees
Team size	Continuous	Number of team members
Organization type	Categorical	For profit/Not for profit
CHW Race	Categorical	White, ...
Ethnicity	Categorical	Not Hispanic, Hispanic, ...
Independent Variables	Variable	Response
CHW type	Categorical	CHW, Promotores, CHR, ...
Number of CHWs on team	Continuous	Number of CHWs on team

Other variables that may have an impact on team climate include the age of RN (i.e., impact team tenure), years of work experience (i.e., impacts job skills and task orientation), gender, education level, and urban or rural practice setting. The impact of the RN's race and ethnicity on perceptions of team climate are unknown, and survey questions on race and ethnicity were included to allow for analysis of differences in team climate perception among RNs from different racial and ethnic groups. RNs were also

asked questions about the race and ethnicity of the CHWs and the number of CHWs they work with as part of their team to allow for analysis of differences in team climate perception among RNs who work with CHWs from different racial and ethnic groups.

Study Design

This study used a cross–sectional survey design and a convenience sample of RNs who work with CHWs in community health care settings (i.e., primary health care clinic, state health program, or home health program) in states with CHW certification programs (i.e., Ohio, and Texas) and states that do not have CHW certification programs. An Internet-based survey was distributed nationally beginning in November 2012. Study participants were recruited via email from the Public Health Nursing Section of the American Public Health Association (APHA), public health departments, state nursing associations, university faculty, and through personal recruitment by the investigator at national and regional conferences such as the American Public Health Association Annual meeting, the New Mexico Public Health Association, and New Mexico Nurses Association. Additional study participants were recruited through snowball sampling that allowed the individuals who received the initial e-mail to forward it to others who met the inclusion criteria to participate in the survey (see Figure 6).

Inclusion criteria

Inclusion criteria for the study were the following: (a) participants must be adults 18 years of age and mentally capable of making an independent informed decision to participate in the research, (b) participants must have a current Registered Nursing license and be employed in a health care setting, defined as a hospital, clinic, community health center, school-based health clinic, or local public health office, (c) participants

must have experience working with CHWs during the past year, knowledge of CHWs work and skills, and (d) participants must be able to read and understand English. Permission to solicit participants for the survey using email list serves (i.e., request survey information be forwarded to members by the organization) was granted by the APHA Public Health Nursing and Community Health Worker Sections.

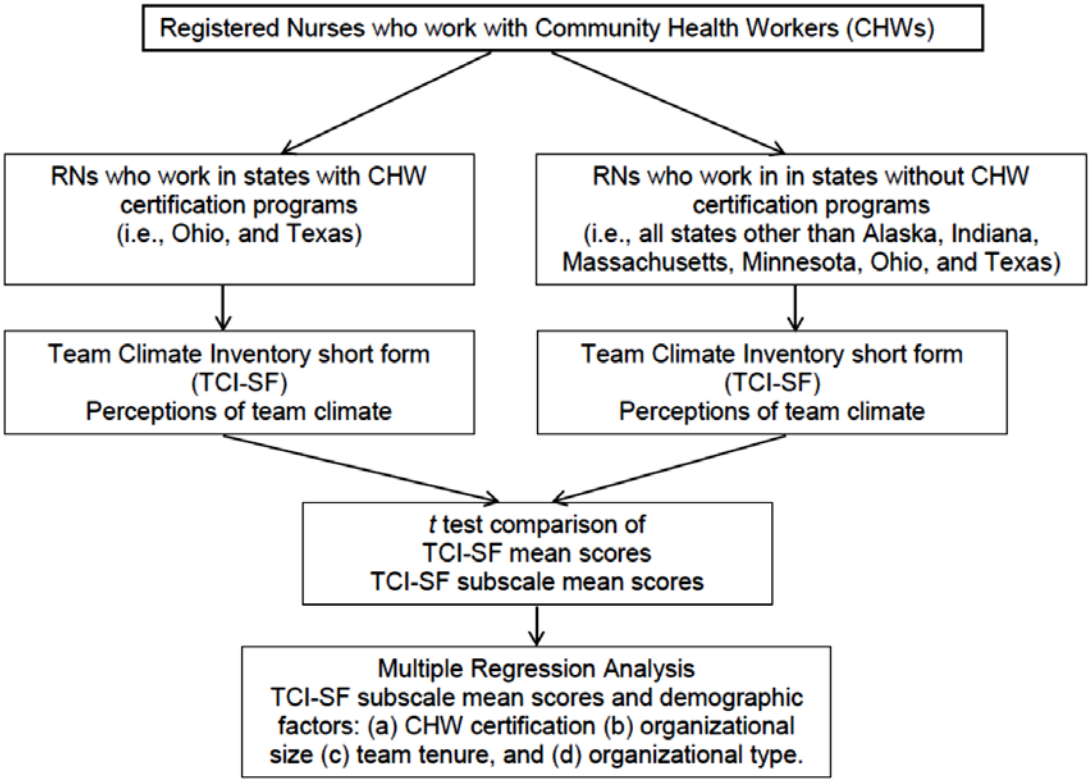

Figure 6. Study design and data analysis.

Study Sample

This research sampled two groups of RNs:

a) RNs who work with CHWs in states with state level CHW certification programs: Ohio, and Texas, and b) RNs who work with CHWs in states without state level CHW certification programs: all states other than Alaska, Indiana, Ohio, Minnesota, Massachusetts, and Texas.

Survey Power and Sample Size

The total sample size required for the survey to detect a medium effect size was calculated using Gpower 3.1® computer software (Faul, Erdfelder, Lang, & Buchner, 2007). A medium effect size was used for this research because there was no prior research or evidence on the effect of state certification of CHWs on RN team climate perceptions. A priori sample size calculations for a t-test of the mean difference between two groups was calculated for a two-tailed test using an estimated effect size = 0.5, with alpha = 0.05, and power = 0.80, provided a minimum sample size of 128, 64 per group. A second sample size calculation using for multiple regression (i.e., Gpower 3.1®, F tests - Linear multiple regression: Fixed model, R^2 deviation from zero) with 2 predictor variables tested and up to 5 total predictor variables, medium effect size (i.e, $f^2 = 0.15$), alpha = 0.05, and power = 0.80, resulted in a minimum sample size of 68 subjects (see Appendix B).

Data Collection

A preliminary email (see Appendix C) was sent introducing the study and providing a link to an electronic version of the survey which included the survey consent form (see Appendix D), the Team Climate Inventory (TCI) Short-Form survey and demographic questions (see Appendix A). The survey was administered online through the SurveyMonkey® Gold, a web-based internet data collection system. Respondents who complete the online survey were eligible for a $10 gift voucher to Amazon.com. Data from the SurveyMonkey® survey were downloaded onto a secure computer owned by the University of New Mexico, College of Nursing (UNM CON). The survey was anonymous, and no identifying information was stored on the researcher's computer.

Data from the initial survey were downloaded from the SurveyMonkey® site to the researcher's computer. The survey data will be deleted from the researcher's computer hard drive after 5 years.

A link to a second voluntary survey for distribution of the Amazon gift vouchers required participants to enter their names and addresses, which was required for compliance with financial policies. This second survey was administered by the Administrative Assistant to the Research Team at University of New Mexico, College of Nursing, and the researcher did not have access to names or other identifying information from this survey. Data from the second survey was downloaded from the SurveyMonkey® site to the UNM CON computer for use in financial reports and audits. The survey data will be deleted from the UNM CON computer hard drive per the financial policies regarding distribution of incentives for research (Germack, 2013).

Statistical Analysis

Step 1: Data Analysis

Data were screened for accuracy by examining data frequency information using Stata® 12.1 (2011) statistical software, and missing data and patterns of missing data were identified. Outliers for mean TCI-SF and subscale scores were identified and assessed for impact for each RN group (i.e., RNs who work in states with CHW certification and RNs who work without CHW certification). Outliers were included in the data analysis unless there was very strong evidence to support deleting them after analysis and consultation with statistician (Mertler & Vannatta, 2010).

Univariate analysis was used to assess the normality of distribution, central tendency (i.e. mean, median, and mode), variability, skewness, and kurtosis. Univariate

normality for the dependent and independent variables were examined using both frequency tables, box plots, and histograms; and skewness and kurtosis were evaluated using Stata 12.1 software. Significance testing for skewness and kurtosis were completed at .01 alpha level, and testing of the dependent variables, mean overall TCI-SF and subscale scores, for both groups was completed to assess normality of the distribution (Mertler & Vannatta, 2010). Internal consistency was tested for the overall TCI-SF score and subscales through Cronbach's alpha testing.

Step 2: *t*-test

A *t*-test was used to determine if there was a significant difference in group means to answer research question 1: Is there a difference in perceptions of team climate for RNs who work with CHWs in states with state certification programs and RNs who work with CHWs in states without state CHW certification programs?

Step 3: Regression Analysis

Regression analysis was used to answer research question 2: What factors predict team climate for RNs who work with CHWs. Regression analysis provides information on the extent of any linear relationship between state certification of CHWs and overall TCI and TCI subscales scores (Bewick, Cheek, & Ball, 2003). Additional independent variables that potentially predict the dependent variables were identified using a correlation matrix, and independent variables (IVs) with a correlation of 0.2 or above were included in the multiple regression models with the intent of increasing the explained variance of the dependent variables (DVs).

Prior to multiple regression analysis IVs were assessed for multicollinearity using the following methods: examination of correlation matrixes; tolerance testing of IVs, with

0.1 as a minimum level of acceptable tolerance; variance inflation factor (VIF) testing, with values less than 10 considered an acceptable level. Decisions on how to address multicollinarity among IVs were made after consultation with committee chair and UNM CON statistician (Mertler & Vannatta, 2010).

Mertler & Vannatta (2010) describe two sets for assumptions for multiple regression analysis: raw scale assumptions and residual assumption. The raw scale assumptions include: fixed DVs, no measurement error for IVs, and linear relationship between IVs and DVs. Assumptions for residuals include: multiple replications mean of residuals is equal to zero, independence of errors between observations of dependent variables, independence of errors between IVs and DVs, consistent variance of residuals for IVs, and normal distribution of errors. Testing for assumptions involved data screening and analysis described for independent t-tests (i.e., normality, variability, skewness, and kurtosis, and internal consistency) using both frequency tables, histograms, and post regression residual-versus-fitted plots.

CHAPTER 4

RESULTS

Registered nurses (RNs) who work with community health workers (CHWs) were recruited for the study through email and at national meetings. Nine hundred and three emails inviting RNs to participate in the online survey were sent out between November 12, 2012, and May 1, 2013. In addition to inviting RNs to participate in the survey, the email also asked recipients to forward the message to RNs they may know who work with CHWs. The online survey on SurveyMonkey® was accessed 322 times between November 13, 2012, and May 21, 2013. Survey data from SurveyMonkey® were downloaded into IBM® SPSS® Statistics version 19 and then transferred to a Microsoft® Excel® spreadsheet for review.

The review of the data set for missing information found 224 (70%) survey respondents who answered more than one survey question, and 217 (67%) who provided residency information (i.e., state of residency or zip code). Survey responses that did not include residency information or answers to at least two survey questions (n = 105) were withheld from further analysis, leaving a survey sample of 217 participants. Differences in demographic characteristics between participants who answered more than one survey question and nonresponders (e.g., one or no answer to survey questions) were not analyzed due to a lack of demographic information for nonresponders.

Survey responses from 217 RNs who completed the survey were then downloaded into Stata® 12.1 (2011) statistical software for further analysis. RNs working in 19 different states responded to the online survey. The majority of the responses (n = 160), 73.7%, were received from RNs working in four states: California

(*n* = 62), Ohio (*n* = 53), New York (*n* = 17), and Texas (*n* = 28). RNs from Ohio and Texas were targeted for the survey because these states have established state CHW certification programs. Survey results were then categorized into two study groups: (a) RNs who work with CHWs in states with CHW certification programs (i.e., Ohio and Texas), and (b) RNs who work with CHWs in states without CHW certification programs (see Table 5).

Table 5

Work State of Registered Nurses Who Completed One or More Survey Questions

CHW certification state	Non-Certification State	Frequency	Percent
Ohio		53	24.4%
Texas		28	12.9%
	Arizona	8	3.7%
	California	62	28.6%
	Georgia	1	0.5%
	Illinois	1	0.5%
	Indiana[a]	6	2.8%
	Louisiana	1	0.5%
	Massachusetts[b]	9	4.1%
	Michigan	5	2.3%
	Minnesota[c]	6	2.8%
	Mississippi	2	0.9%
	New York	17	7.8%
	North Carolina	1	0.5%
	Oregon	4	1.8%
	Tennessee	1	0.5%
	Utah	1	0.5%
	Virginia	1	0.5%
	Washington	10	4.6%
		217	

[a] Indiana has a CHW certification program for a limited number of CHWs who work in maternal child health, but the legislation was repealed in 2013.
[b] Massachusetts adopted a state CHW certification program in 2012, but it has not been implemented in 2013.
[c] Minnesota has a CHW certificate program.

Three states, Indiana, Massachusetts, and Minnesota, had or have CHW certification programs in 2013 that did not meet the criteria for inclusion in the study. Indiana's CHW certification program, under the state Medicaid case management for pregnant women (405 IAC 5-11-1, 2011) was repealed in 2012 (405 IAC, Article 5, 2013). Massachusetts has not yet implemented its state CHW certification program, and Minnesota requires CHWs to have a certificate of completion from a state approved CHW education program. The certificate program is voluntary, but it allows CHWs to be reimbursed for services through Medicaid (Rosenthal et al., 2010). Survey data from RNs in these three states (n = 21) were dropped from the analysis to prevent potentially confounding the results of comparisons between states with certification programs, leaving a total sample size of n = 196 with 81 responses from RNs in CHW certification states and 115 responses from RNs in non-CHW states (see Table 6).

Table 6

Summary of RN Survey Responses by State CHW Certification

State CHW Certification	Freq.	Percent
Yes (i.e., OH & TX)	81	41.3
No (i.e., AZ, CA, GA, IL, LA, MI, MS, NY, NC, OR, TN, UT, VA, & WA)	115	58. 7
Total	196	

Analysis of Independent Variables

Missing values for independent variables for both groups were assessed for frequency (see Table 7) and pattern of missing values (see Table 1.E, Appendix E). A summary of independent variables is shown in Table 7. After the review of missing values for independent variables, a decision was made not to replace missing values as both groups met the minimum sample size of 64 per group, and there did not appear to be a patterns of missing values between the two groups.

Table 7

Summary of Independent Variables by State CHW Certification

Independent Variable	Obs	Missing	Percent missing	Mean	*SD*	Min	Max
RNs from CHW certification States							
RN Ageyears	77	4	4.94%	50.31	13.80	25	76
RN Workyears	75	6	7.41%	7.70	6.94	0	27
Team Tenure	69	12	14.81%	6.39	5.28	0	25
Organization Size	79	2	2.47%	1558.41	4079.01	2	20000
Team Size	78	3	3.70%	14.83	20.17	0	150
NumCHWonTeam	79	2	2.47%	10.11	23.87	0	200
RNs from Non-CHW certification States							
RN Ageyears	111	4	3.48%	47.66	11.65	25	68
RN Workyears	106	9	7.83%	8.15	7.27	0	32
Team Tenure	104	11	9.57%	8.13	6.89	0	31
Organization Size	110	5	4.35%	734.85	2202.17	1	17000
Team Size	112	3	2.61%	20.18	24.91	0	204
NumCHWonTeam	112	3	2.61%	5.85	8.48	0	70
RNs from CHW certification States							
CHW certification	81	0	0%	1.00	0.00	1	1
RN Gender	81	0	0%	0.94	0.24	0	1
RN Race	80	1	1.23%	1.44	1.52	1	8
RN Ethnicity	81	0	0%	1.41	1.21	1	7
RN Education	81	0	0%	2.96	1.32	1	6
RN Nurse Education	81	0	0 %	2.84	1.33	1	6
Organizational Type	73	8	9.88%	3.10	1.08	1	4
Metropolitan or Rural	77	4	4.94%	1.81	0.93	1	4
CHW Race	81	0	0%	2.89	2.47	1	8
CHW Ethnicity	79	2	2.47%	1.82	1.67	1	7
CHW type	80	1	1.23%	5.05	3.71	1	10
Team Member	79	2	2.47%	5.53	3.69	1	10
RNs from Non-CHW certification States							
CHW noncertification	115	0	0%	0.00	0.00	0	0
RN Gender	115	0	0%	0.97	0.18	0	1
RN Race	114	1	0.87%	1.99	1.90	1	8
RN Ethnicity	111	4	3.48%	1.84	1.87	1	7
RN Education	113	2	1.74%	3.35	0.88	1	6
RN Nurse Education	115	0	0%	3.23	0.90	1	6
Organizational Type	110	5	4.35%	3.89	0.46	2	4
Metropolitan or Rural	109	6	5.22%	1.59	0.75	1	4
CHW Race	114	1	0.87%	4.46	3.00	1	8
CHW Ethnicity	114	1	0.87%	2.39	1.40	1	7

Demographic Characteristics of Registered Nurses

Demographic information for RNs who completed the online survey is shown in Table 8. The majority of survey respondents were female (95.4%) and self-identified their race as White (78.4%) and ethnicity as non-Hispanic (79.2%). Assumptions for chi square testing were met for all variables, comprising frequency data, independent observations, and theoretical basis for categorization of demographic variables (Munro, 2005a). Variables for race, ethnicity, and education had cells with fewer than 5 responses per cell, so Fisher's exact-tests were used to analyze differences in these variables.

Table 8

Demographic Information for RNs in CHW Certification and Noncertification States

Gender	Non-CHW Certification (*n* = 115)		CHW Certification (*n* = 81)		Total (*n* = 196)	
Female	111	96.5%	76	93.8%	187	95.4%
Male	4	3.5%	5	6.2%	9	4.6%
χ^2 (1) = 0.79, p = 0.38; Fisher's exact = 0.49						
What is your race?	**Non-CHW Certification (*n* = 114)**		**CHW Certification (*n* = 80)**		**Total (*n* = 194)**	
White	82	71.9%	70	87.5%	152	78.4%
Black or African American	7	6.1%	5	6.3%	12	6.2%
Asian	15	13.2%	1	1.3%	16	8.2%
Native Hawaiian or other Pacific Island	1	0.9%	0	0.0%	1	0.5%
Multiracial	6	5.3%	1	1.3%	7	3.6%
Other race	3	2.6%	3	3.8%	6	3.1%
χ^2 (2) = 12.53, p = 0.28; Fisher's exact = 0.01*						
Which best describes your ethnicity?	**Non-CHW Certification (*n* = 111)**		**CHW Certification (*n* = 81)**		**Total (*n* = 192)**	
Not Hispanic, Latino, or Spanish	85	76.6%	67	82.7%	152	79.2%
Hispanic, Latino, or Spanish	7	6.3%	7	8.6%	14	7.3%
Mexican, Mexican American	6	5.4%	4	4.9%	10	5.2%
Another Hispanic or Latino	1	0.9%	0	0.0%	1	0.5%
Puerto Rican	1	0.9%	0	0.0%	1	0.5%
Other Ethnicity	11	9.9%	3	3.7%	14	7.3%
χ^2 (2) = 4.53, p = 0.48; Fisher's exact = 0.48						

Table 8 (cont.)

What is the highest level of education you have completed?	Non-CHW Certification (n = 113)		CHW Certification (n = 81)		Total (n = 194)	
Associate Degree	5	4.4%	15	18.5%	20	10.3%
Diploma in Nursing	1	0.9%	9	11.1%	10	5.2%
Bachelor's Degree	68	60.2%	34	42.0%	102	52.6%
Master's Degree	32	28.3%	14	17.3%	46	23.7%
Doctorate or professional degree	3	2.7%	5	6.2%	8	4.1%
Other degree	4	3.5%	4	4.9%	8	4.1%
χ^2 (5) = 25.70, p < 0.001**						
Fisher's exact = <0.001**						
What is your highest degree in nursing?	**Non-CHW Certification (n = 115)**		**CHW Certification (n = 81)**		**Total (n = 196)**	
Associate Degree	7	6.1%	17	21.0%	24	12.2%
Diploma in Nursing	2	1.7%	11	13.6%	13	6.6%
Bachelor's Degree	72	62.6%	33	40.7%	105	53.6%
Master's Degree	29	25.2%	12	14.8%	41	20.9%
Doctorate in Nursing	1	0.9%	4	4.9%	5	2.6%
Other Nursing degree	4	3.5%	4	4.9%	8	4.1%
χ^2 (5, N = 196) = 28.70, p < 0.001**						
Fisher's exact = p <0.001**						

* p < 0.05, ** p <0.001

Chi square testing found no significant differences between the two groups in reported gender or ethnic background. However, significant differences were found in reported race with RNs from non-CHW certification states reporting race other than White more frequently (e.g., Black or African American, Asian, Native Hawaiian or other Pacific Islander, or multiracial). Significant differences were also found in the highest level of education reported by RNs, with RNs in the non-CHW certification states reporting higher rates for bachelor's and master's degrees, and RNs in the CHW certification states reporting higher rates for associate degrees and doctorates or other professional degrees. Similar differences were found between the two groups in the reporting of their highest level of nursing education with more RNs from CHW certification states reporting associate degrees, diplomas, or doctorates in nursing.

RN Age, Work Experience, and Team Tenure

Analyses of the data for normal distribution and homogeneity of variance (e.g., Levene's test) for survey questions on RN age (Ageyears), years of experience in their current position (Workyears), and years of experience on current work team (TeamTen) with CHWs were completed for continuous independent variables (see Table 9). Histograms and box plots were also used to assess normality for continuous independent variables (see Figures 1.E – 6.E, Appendix E).

Table 9

Descriptive Measures for RN Age, Work Experience, and Team Tenure

Variable	Mean	*N*	*SD*	Variance	*SE*(mean)	Skewness	Excess kurtosis
Ageyears All	48.74	188	12.61	159.01	0.92	-0.29	-0.92
Ageyears CHWcert Yes	50.31	77	13.80	190.51	1.57	-0.34	-0.90
Ageyears CHWcert No	47.66	111	11.65	135.79	1.11	-0.35	-1.05
Workyears ALL	7.96	181	7.12	50.72	0.53	1.16	0.79
Workyears CHWcert Yes	7.70	75	6.94	48.20	0.80	1.09	0.35
Workyears CHWcert No	8.15	106	7.27	52.89	0.71	1.20	1.01
TeamTen All	7.44	173	6.34	40.17	0.48	1.25	1.60
TeamTen CHWcert Yes	6.39	69	5.28	27.92	0.64	1.13	1.19
TeamTen CHWcert No	8.13	104	6.89	47.42	0.68	1.17	1.19

[a] Excess kurtosis = Stata kurtosis calculation minus 3 (see Acock, 2012, p. 95).

Skewness and kurtosis tests found the variables are skewed to the right with significant kurtosis for Ageyears and TeamTen variables (see Table 2.E, Appendix E). Levene's homogeneity of variance testing found no significant differences in variance for RN Age (Ageyears), $F(110,76) = 0.71$, $p = 0.1$; or RN work experience (Workyears), $F(105,74) = 1.10$, $p = 0.68$. However, there was a significant variance for RN experience on team with CHW (TeamTen), $F(103, 68) = 1.70$, $p = 0.02$ (see Table 3.E, Appendix E). Levene's test of homogeneity of variance by CHW state certification, with robust

estimations for independent variables, also found significant homogeneity of variance for RN team tenure (see Table 4.E, Appendix E).

The variables for RN age (Ageyears) and for years of work experience in current position (Workyears) met the assumptions for *t*-test, including interval level variable and mutually exclusive groups, with a near normal distribution (Cohen, Welkowitz, & Lea, 2012; Skovlunda & Fenstadb, 2001). Levene's testing of RN team tenure (TeamTen) was significant, and therefore an unequal variance *t*-test was used for a comparison-of-means test for RN team tenure (see Table 10).

Table 10

Comparison of Means Testing: RN Age, Years of Work Experience, and Team Tenure[a,b]

RN Age (Ageyears)	Non-CHW Certification (n = 111)	CHW Certification (n = 77)
mean	47.66	50.31
Standard deviation =	11.65	13.80
p =	0.16	
About how long have you been in your current position? (Workyears)	Non-CHW Certification (n = 106)	CHW Certification (n = 75)
mean	8.15	7.70
Standard deviation =	7.27	6.94
p =	0.67	
How long have you worked on a team that includes a CHW(s)[a] (TeamTen)	Non-CHW Certification (n = 104)	CHW Certification (n = 69)
mean	8.13	6.39
Standard deviation =	6.89	5.28
p =	0.06	

[a] Unequal variance for *t*-test used due to significant variance (Acock, 2012).
[b] Complete *t*-test results are shown in Appendix E, Table 5.E

Independent sample *t*-tests found no significant difference in RN age, mean number of years working in their current position, and number of years working on current team.

Organizational Type, Organizational Size, and Team Size

Organizational type (i.e., not-for-profit, for-profit, government, etc.), metropolitan or nonmetropolitan worksite, and organizational and team size were analyzed using chi square tests for categorical variables (i.e., organizational type and metropolitan or nonmetropolitan worksite). Assumptions for chi square testing, including independent observations and adequate sample size (i.e., cell size greater than 5), were not met for the variables, so Fisher's exact-tests were completed for variables with cell sizes less than 5.

Table 11

Chi Square Analysis of Organizational Characteristics

Rural-Urban Continuum	Non-CHW Certification (n = 109)		CHW Certification (n = 77)		Total (n =186)	
Metro-1 million population	59	54.1%	36	46.8%	95	51.1%
Metro-250,000 to 1 million	39	35.8%	26	33.8%	65	34.9%
Metro-fewer than 250,000	8	7.3%	9	11.7%	17	9.1%
Nonmetropolitan areas	3	2.8%	6	7.8%	9	4.8%
χ^2 (2) = 3.84, p = 0.28						
Fishers exact = 0.29						
Organizational Category	**Non-CHW Certification (n = 110)**		**CHW Certification (n = 73)**		**Total (n = 183)**	
For-profit	0	0.0%	4	5.5%	4	2.2%
Not-for-profit	6	5.5%	27	37.0%	33	18.0%
State, county, or city health department	104	94.5%	42	57.5%	146	79.8%
χ^2 (2) = 37.75, p < 0.001**						
Fishers exact < 0.001**						

* p < 0.05, ** p <0.001

No significant difference was found in the reported metropolitan or nonmetropolitan work location with the majority, greater than 80%, of RNs from both groups reporting their worksite was located in a metropolitan area with more than 250,000 residents. Significant differences were found in the types of organizations that

RNs reported working for, with 94.6% of RNs from non-CHW certification states reporting they worked for state, county or local health departments, and 57.5 % of CHWs from certification states reporting working for state, county, or local health departments.

Continuous level variables, including organizational size (OrgSize), team size (TeamSize), and number of CHWs on team (NumCHWonTeam) were analyzed for skewness, kurtosis, and variance, and found to be significantly skewed to the right and leptokurtic (see Table 6.E, Figures 7.E-12.E, Appendix E), with significant levels of variance for organizational size and number of CHWs on team (see Tables 7.E & 8.E, Appendix E), and therefore nonparametric tests of differences in means (i.e., Mann-Whitney U test) were completed for these independent variables (see Table 12)

Table 12

Two-sample Wilcoxon Rank-sum (Mann-Whitney) Test by CHW State Certification

Organizational Size	Obs	Rank sum	Expected
OrgSize CHWcert No	110	11390	10450
OrgSize CHWcert Yes	79	6565	7505
Ho: OrgSize(CHWcertNo) = OrgSize(CHWcertYes) z =	2.54		
Prob > |z| =	0.01*		
P{OrgSize(CHWcertNo) > OrgSize(CHWcertYes)} =	0.61		
Team Size			
TeamSize CHWcert No	112	11489	10696
TeamSize CHWcert Yes	78	6655	7449
Ho: OrgSize(CHWcertNo) = OrgSize(CHWcertYes) z =	2.13		
Prob > |z| =	0.03*		
P{OrgSize(CHWcertNo) > OrgSize(CHWcertYes)} =	0.59		
Number of CHWs on Team			
NumCHWonTeam CHWcert No	112	10214	10752
Number of CHWs on Team CHWcert Yes	79	8122	7584
Ho: OrgSize(CHWcertNo) = OrgSize(CHWcertYes) z =	-1.44		
Prob > |z| =	0.15		
P{OrgSize(CHWcertNo) > OrgSize(CHWcertYes)} =	0.44		

* $p < 0.05$

Significant differences were found in the size of the organizations that RNs reported working in with almost half, 48.2%, of RNs from non-CHW certification states reporting they worked in organizations with between 100 and 499 employees while over half, 54.5%, of RNs from CHW certification states reported working in organizations with fewer than 100 employees. Significant differences were found in the reported team size, but not in the number of CHWs RNs reported working with. The majority of RNs from both groups reported they worked in teams of less than 20 people and with five or fewer CHWs on their team.

CHW Characteristics

The survey results for variables on CHW race (CHWrace), ethnicity (CHWethnic), and type (CHWtype) reported by RNs met assumptions of chi square testing, including frequency data, independent observations. However, adequate sample size (i.e., cell size greater than 5) was not met for questions on CHW race and ethnicity, so Fisher's exact-tests were completed for variables with cell sizes less than 5. Chi square and Fisher's exact-testing found significant differences in the RNs' responses to questions about the race and ethnicity of the CHWs the RNs worked with. A much higher proportion of RNs from CHW certification states reported working with Black or African American CHWs, and a higher proportion of RNs working in non-CHW certification states reported working with multiracial or other race CHWs. A much higher proportion of RNs from CHW certification states reported working with non-Hispanic or Latino CHWs, and a higher proportion of RNs from non-CHW certification states reported working with CHWs whose ethnic background was Hispanic or Latino (see Table 13).

Table 13

CHW Race and Ethnicity

CHW race	Non-CHW Certification (n = 114)		CHW Certification (n = 81)		Total (n = 195)	
White	33	28.95%	30	37.04%	63	32.31%
Black or African American	19	16.67%	30	37.04%	49	25.13%
Asian	5	4.39%	2	2.47%	7	3.59%
Some other race	10	8.77%	4	4.94%	14	7.18%
Multiracial	18	15.79%	8	9.88%	26	13.33%
Other	29	25.44%	7	8.64%	36	18.46%
$\chi 2$ (5) = 18.71, $p < 0.01$*						
Fisher's exact < 0.01*						
CHW ethnicity	**Non-CHW Certification (n = 114)**		**CHW Certification (n = 79)**		**Total (n = 193)**	
Not Hispanic, Latino	25	21.93%	51	64.56%	76	39.38%
Hispanic, Latino	56	49.12%	18	22.78%	74	38.34%
Mexican or Mexican American,	18	15.79%	3	3.80%	21	10.88%
Another Hispanic or Latino or Spanish origin	6	5.26%	0	0.00%	6	3.11%
Cuban	1	0.88%	0	0.00%	1	0.52%
Puerto Rican	4	3.51%	1	1.27%	5	2.59%
Other ethnicity	4	3.51%	6	7.59%	10	5.18%
χ^2 (2) = 43.40, $p < 0.001$**						
Fisher's exact < 0.001**						

* $p < 0.05$, ** $p < 0.001$

Results of chi square testing of variables, including the types of CHWs that RNs reported having worked with during the past year (i.e., CHWtype, Which of the following have you worked with during the past year?), and the types of CHWs that RNs are currently working with as part of their current health care team (i.e., TeamMemb, Which of the following do you consider as part of the team that you currently work with in your health care organization?) are shown in Table 14.

Response categories with fewer than 5 responses in both groups (i.e., Non-CHW certification and CHW certification) were combined into the category "Other." Results

did not show any significant differences in the types of CHWs that RNs reported working with in the past year, but did show a significant difference in the types of CHWs RNs reported working with on their current team. A higher proportion of RNs from non-CHW certification states reported they worked with Community Health Workers, Outreach Educators, and Peer Health Educators.

Table 14

Type of CHW RN's Reported Working with as Part of Health Care Team

Worked with during the past year	Non-CHW Certification (n = 115)		CHW Certification (n = 80)		Total (n = 195)	
Community Health Workers	45	39.13%	27	33.75%	72	36.92%
Promotores(as)	4	3.48%	6	7.50%	10	5.13%
Outreach Educators	14	12.17%	5	6.25%	19	9.74%
Peer Health Educators	9	7.83%	7	8.75%	16	8.21%
Community Health Representatives	17	14.78%	7	8.75%	24	12.31%
Peer Health promoters	8	6.96%	12	15.00%	20	10.26%
Other	18	15.65%	16	20.00%	34	17.44%
χ^2 (6) = 8.49, p = 0.20						
Fisher's exact = 0.21						
Consider as part of the team that you currently work with	**Non-CHW Certification (n = 115)**		**CHW Certification (n = 79)**		**Total (n = 194)**	
Community Health Workers	53	46.09%	23	29.11%	76	39.18%
Promotores(as)	3	2.61%	5	6.33%	8	4.12%
Outreach Educators	18	15.65%	4	5.06%	22	11.34%
Peer Health Educators	12	10.43%	5	6.33%	17	8.76%
Community Health Representatives	9	7.83%	11	13.92%	20	10.31%
Peer Health promoters	8	6.96%	13	16.46%	21	10.82%
Other	12	10.43%	18	22.78%	30	15.46%
χ^2 (6) = 20.76, p < 0.01*						
Fisher's exact < 0.01*						

* p < 0.05

Analysis of Team Climate Inventory Survey Scores

Team Climate Inventory (TCI) survey data (v5–v23) as well as survey questions 24 (i.e., State certification of CHWs increases or would increase my confidence in working with them) and 25 (i.e., State certification of CHWs increases or would increase the ability of my team to provide quality care) were screened for missing values and patterns of missing values. Ninety-six percent of survey participants answered all of the TCI survey questions, and the pattern of missing values was less than 1% (see Tables 1.F and 2.F in Appendix F). New TCI variables were developed by adding variables and calculating the mean values for overall and subscale survey results including: (a) participation in the team (i.e., TCIpartn, mean of v5–v10), (b) support for new ideas (i.e., TCIsuppt, mean of v11–v15), (c) team objectives (i.e., TCIobject, mean of v16–v19), (d) task style (i.e., TCIstyle, mean of v20–v23), and (e) overall TCI survey score (i.e., TCIall sum of subscales TCIpartn, TCIsuppt, TCIobject, and TCIstyle). After combining the TCI survey questions into TCI subscales, only one missing value was found for TCIobject subscale and overall TCI survey variables (see Table 15), and a decision was made not to replace missing values based on the high response rates for TCI survey questions.

Results from the TCI survey, TCI subscale, and survey questions 24 and 25 were screened for linearity, normality, homogeneity of variance (homoscedasticity), and independence. Histograms, using frequency percentage of average scores and box plots, were developed for the two survey groups, RNs from states with CHW certification programs (i.e., Yes) and RNs from states without CHW certification programs (i.e., No). These histograms are shown in Appendix F, Figures 1.F through 14.F.

Table 15

TCI Survey, TCI Subscale, Survey Questions 24[a] and 25[b] by CHW State Certification.

Variable	Missing	Obs	Mean	Std. Dev.	Min	Max
TCIpartn	0	196	4.04	0.83	1	5
TCIsuppt	0	196	3.81	0.80	1.2	5
TCIobject	1	195	5.62	1.08	2.5	7
TCIstyle	0	196	5.30	1.27	1	7
TCIall	1	195	18.75	3.45	7.75	24
v24[a]	0	196	3.72	0.99	1	5
v25[b]	0	196	3.70	0.99	1	5
No CHW state certification						
TCIpartn CHWcert No	0	115	4.08	0.73	2	5
TCIsuppt CHWcert No	0	115	3.78	0.74	1.2	5
TCIobject CHWcert No	0	115	5.57	1.07	2.5	7
TCIstyle CHWcert No	0	115	5.24	1.25	1.5	7
TCIall CHWcert No	0	115	18.67	3.20	9.2	24
v24 CHWcert No[a]	0	115	3.63	1.00	1	5
v25 CHWcert No[b]	0	115	3.56	1.01	1	5
CHW state certification						
TCIpartn CHWcert Yes	0	81	3.98	0.96	1	5
TCIsuppt CHWcert Yes	0	81	3.86	0.88	2	5
TCIobject CHWcert Yes	1	80	5.69	1.11	2.5	7
TCIstyle CHWcert Yes	0	81	5.38	1.29	1	7
TCIall CHWcert Yes	1	80	18.85	3.81	7.75	24
v24 CHWcert Yes[a]	0	81	3.86	0.97	1	5
v25 CHWcert Yes[b]	0	81	3.90	0.93	1	5

[a] Survey question 24 (v24): State certification of CHWs increases or would increase my confidence in working with them.

[b] Survey question 25 (v25): State certification of CHWs increases or would increase the ability of my team to provide quality care.

Appendix F, Figures 21.F–27.F, shows scatter plot matrices for overall TCI scores, TCI subscale variables, v24 and v25 and continuous level independent variables—RN age (Ageyears), RN work experience in current position (Workyears), and number of years on current team (TeamTen)—and transformed (i.e., natural logarithm) variables—organizational size (logOrgSize), team size (logTeamSize), and number of CHWs on team (logNumCHWonTeam). A review of the histograms, box plots, and descriptive statistics for the TCI subscales and TCI survey response show few outliers

(n < 4) for both groups in each TCI subscales. Descriptive statistics for the two survey groups are shown in Table 16.

Table 16

Descriptive Measures, Combined Average of Responses to TCI and v24–v25 Questions

	Mean	*N*	*SD*	Variance	*SE* (mean)	Skewness	Excess kurtosis[a]
TCIall	18.75	195	3.45	11.92	0.25	-0.71	0.18
CHWcert = No	18.67	115	3.20	10.22	0.30	-0.62	0.08
CHWcert = Yes	18.85	80	3.81	14.50	0.43	-0.81	0.14
TCIpartn	4.04	196	0.83	0.69	0.06	-1.27	2.11
CHWcert = No	4.08	115	0.73	0.53	0.07	-0.66	0.16
CHWcert = Yes	3.98	81	0.96	0.93	0.11	-1.51	2.18
TCIsuppt	3.81	196	0.80	0.64	0.06	-0.61	-0.07
CHWcert = No	3.78	115	0.74	0.55	0.07	-0.75	0.64
CHWcert = Yes	3.86	81	0.88	0.78	0.10	-0.52	-0.71
TCIobject	5.62	195	1.08	1.17	0.08	-0.63	-0.17
CHWcert = No	5.57	115	1.07	1.13	0.10	-0.65	0.05
CHWcert = Yes	5.69	80	1.11	1.23	0.12	-0.61	-0.45
TCIstyle	5.30	196	1.27	1.61	0.09	-0.79	0.38
CHWcert = No	5.24	115	1.25	1.56	0.12	-0.75	0.20
CHWcert = Yes	5.38	81	1.29	1.68	0.14	-0.85	0.63
Increased confidence (v24)[b]	3.72	196	0.99	0.98	0.07	-0.22	-0.75
CHWcert = No	3.63	115	1.00	0.99	0.09	-0.06	-0.85
CHWcert = Yes	3.86	81	0.97	0.94	0.11	-0.47	-0.41
Increased quality of care (v25)[c]	3.70	196	0.99	0.98	0.07	-0.26	-0.58
CHWcert = No	3.56	115	1.01	1.02	0.09	-0.10	-0.66
CHWcert = Yes	3.90	81	0.93	0.87	0.10	-0.46	-0.26

[a] Excess kurtosis is defined as the results of kurtosis measures in Stata minus 3 (Acock, 2012).

[b] Survey question 24 (v24): State certification of CHWs increases or would increase my confidence in working with them.

[c] Survey question 25 (v25): State certification of CHWs increases or would increase the ability of my team to provide quality care.

The distribution of responses is significantly skewed left for all TCI survey and subscale variables in both groups. Responses from RNs in CHW certification states for TCIpartn subscale, TCIpartn subscale, TCIpartn CHWcert Yes, v24, v24 CHWcert No, and v25 have probability kurtosis values below 0.05 due to the extreme leptokurtic nature

of the distributions (see Table 3.F in Appendix F). Overall TCI survey, TCI subscale, and survey questions 24 and 25 have a near normal distribution and meet the guidelines for *t*-test (Cohen, Welkowitz, & Lea, 2012; Skovlunda, & Fenstadb, 2001).

Homogeneity of Variance Testing for Dependent Variables

Levene's tests for homogeneity of variance were completed on the overall TCI survey, TCI subscale scores, and survey questions 24 and 25 (Table 4.F, Appendix F). The analysis found significant variance, less than 0.05, between CHW certification groups for TCIpartn subscale and therefore we cannot assume equal variance for this variable. Levene's homogeneity of variance test with robust estimations for dependent variables also found significant, less than 0.05, homogeneity of variance for TCI support subscale (see Table 5.F, Appendix F).

Internal Consistency Testing for Dependent Variables

Cronbach's alpha for internal consistency for overall TCI survey questions, TCI subscales, and survey questions 24 and 25 was completed (see Table 17).

Table 17

Cronbach's Alpha Results for Internal Consistency Reliability

Item	Obs	Sign	Item-test correlation	Item-rest correlation	Average inter-item covariance	Alpha
TCIall	195	+	0.96	0.88	0.34	0.76
TCIpartn	196	+	0.79	0.73	0.88	0.73
TCIsuppt	196	+	0.80	0.76	0.88	0.73
TCIobject	195	+	0.83	0.78	0.80	0.71
TCIstyle	196	+	0.87	0.81	0.72	0.68*
v24[a]	196	+	0.29	0.16	1.08	0.79
v25[b]	196	+	0.29	0.16	1.08	0.79

[a] State certification of CHWs increases or would increase my confidence in working with them.

[b] State certification of CHWs increases or would increase the ability of my team to provide quality care.

The analysis showed satisfactory, alpha > 0.70, (Bland & Altman, 1997), internal consistency for all TCI variables and v24 and v25, except for TCIstyle The results are consistent with alpha testing of the TCI short form (TCI-SF) from previous research (Hsu-Min, Feng-Chuan, &West, 2009; Loo & Loewen, 2002; Mathisen, Torsheim, & Einarsen, 2006).

Research Question 1: Analysis of Differences in Means

Research question 1: Is there a difference in perception of team climate between RNs who work in states with CHW certification programs and RNs who work in states without CHW certification?

The assumptions for *t*-tests—mutually exclusive group groups, near normal distribution, and homogeneity of variance (Munro, 2005b)—were met for all TCI variables with the exception of TCI partner subscale, which had significant unequal variance. Results of two sample means testing between RNs who work in CHW certification states and non-CHW certification states to overall TCI scores, TCI subscales, and survey questions 24 and 25 are shown in Table 18.

Table 18

Results of Two Group t-test TCI Overall Mean, TCI Subscale Means, v24 and v25 Means

TCI survey overall	Obs	Mean	*SE*	*SD*	95% CI
TCIall CHWcert No	115	18.67	0.30	3.20	18.08 - 19.26
TCIall CHWcert Yes	80	18.85	0.43	3.81	18.00 - 19.70
combined	195	18.75	0.25	3.45	18.26 - 19.23
diff		-0.18	0.50		-1.17 - 0.81
Ha: diff != 0 Pr(|T| > |t|) =	0.72				
TCI Partner subscale[a]	Obs	Mean	*SE*	*SD*	95% CI
TCIpartn CHWcert No	115	4.08	0.07	0.73	3.95 - 4.21
TCIpartn CHWcert Yes	81	3.98	0.11	0.96	3.76 - 4.19
combined	196	4.04	0.06	0.83	3.92 - 4.15
diff		0.10	0.13		-0.15 - 0.35
Ha: diff != 0 Pr(|T| > |t|) =	0.41				

Table 18 (cont.)

TCI Support subscale[a]	Obs	Mean	*SE*	*SD*	95% CI
TCIsuppt CHWcert No	115	3.78	0.07	0.74	3.64 - 3.91
TCIsuppt CHWcert Yes	81	3.86	0.10	0.88	3.66 - 4.05
combined	196	3.81	0.06	0.80	3.70 - 3.92
diff		-0.08	0.12		-0.32 - 0.16
Ha: diff != 0 Pr(|T| > |t|) =	0.50				
TCI Object subscale	**Obs**	**Mean**	***SE***	***SD***	**95% CI**
TCIobject CHWcert No	115	5.57	0.10	1.07	5.37 - 5.77
TCIobject CHWcert Yes	80	5.69	0.12	1.11	5.44 - 5.94
combined	195	5.62	0.08	1.08	5.47 - 5.77
diff		-0.12	0.16		-0.43 - 0.19
Ha: diff != 0 Pr(|T| > |t|) =	0.45				
TCI Style subscale	**Obs**	**Mean**	***SE***	***SD***	**95% CI**
TCIstyle CHWcert No	115	5.24	0.12	1.25	5.01 - 5.47
TCIstyle CHWcert Yes	81	5.38	0.14	1.29	5.09 - 5.66
combined	196	5.30	0.09	1.27	5.12 - 5.48
diff		-0.13	0.18		-0.50 - 0.23
Ha: diff != 0 Pr(|T| > |t|) =	0.47				
Increased confidence in CHWs (v24)[b]	**Obs**	**Mean**	***SE***	***SE***	**95% CI**
v24 CHWcert No	115	3.63	0.09	1.00	3.44 - 3.81
v24 CHWcert Yes	81	3.86	0.11	0.97	3.65 - 4.08
combined	196	3.72	0.07	0.99	3.59 - 3.86
diff		-0.24	0.14		-0.52 - 0.04
Ha: diff != 0 Pr(|T| > |t|) =	0.10				
Increased quality of care by team (v25)[c]	**Obs**	**Mean**	***SE***	***SD***	**95% CI**
v25 CHWcert No	115	3.56	0.09	1.01	3.37 - 3.74
v25 CHWcert Yes	81	3.90	0.10	0.93	3.70 - 4.11
combined	196	3.70	0.07	0.99	3.56 - 3.84
diff		-0.34	0.14		-0.62 - -0.06
Ha: diff != 0 Pr(|T| > |t|) =	0.02*				

* $p < 0.05$

[a] Unequal variance test.

[b] Survey question 24 (v24): State certification of CHWs increases or would increase my confidence in working with them.

[c] Survey question 25 (v25): State certification of CHWs increases or would increase the ability of my team to provide quality care.

Only survey question 25, which asked RNs if state certification of CHWs increases or would increase the ability of their team to provide quality care, was found to have significantly different mean scores, $p = 0.02$, between the two groups of RNs.

Research Question 2: Multiple Regression Analysis

Research question 2: What factors predict perceptions of team climate for RNs who work with CHWs? Multiple regression analysis was used to evaluate the factors that might impact TCI scores for RNs who work in states with CHW certification programs and states without CHW certification programs. Organizational size, team size, organizational type (i.e., for-profit, not-for-profit, etc.), and team tenure have all been shown to impact primary health care teams (Bower et al., 2003; Heponiemi et al., 2011; Howard et al., 2011).

Prior to completing multiple regression, three continuous independent variables—organization size (OrgSize), team size (TeamSize), and number of CHWs on team (NumCHWonTeam)—were transformed to natural logs due to extreme outliers in the responses to these questions. The transformed variables were near normally distributed (see Table 6.F, Appendix F). Categorical independent variables were transformed into dichotomous level or dummy coded variables. These variables were (a) RN race (i.e., White or non-White), (b) RN ethnicity (i.e., Not Hispanic or other ethnicity), (c) RN education (i.e., Bachelor’s degree or above, or no Bachelor’s degree), (d) RN nursing education (i.e., BSN or no-BSN), (e) CHW race (i.e., White or non-White), (f) CHW ethnicity (i.e., Not Hispanic or other ethnicity), (g) organizational type, and (h) metropolitan or rural worksite (i.e., 1 million or more residents, or less than 1 million residents). Because no RNs from states without CHW state certification reported working

in for-profit organizations, the organizational type dichotomous variables examined state, county or local government health programs or not-for-profit health organizations.

Correlation analyses were then completed for TCI survey and TCI subscale scores and all independent variables. Correlations between independent variables and TCI survey and subscale scores are shown in Table 19.

Table 19

Correlation Analysis of TCI Survey and TCI Subscale for Independent Variables

Independent Variable	TCIall	TCIpartn	TCIsuppt	TCIobject	TCIstyle
CHWcert	0.04	-0.06	0.02	0.06	0.07
Gender	-0.05	-0.07	0.04	-0.09	-0.03
Ageyears	0.03	-0.05	0.09	0.03	0.02
Workyears	-0.14*	-0.21**	-0.05	-0.09	-0.14*
TeamTen	-0.16*	-0.18**	-0.08	-0.18**	-0.11
RNracedich	0.02	-0.07	0.07	0.02	0.04
RNethnicdich	-0.02	-0.03	0.01	-0.01	-0.04
RNeducatdich	0.01	0.05	-0.05	-0.01	0.03
RNnurEducd~h	0.01	0.10	-0.04	-0.01	0.00
Orgtypedich	-0.12*	-0.07	-0.15*	-0.08	-0.11
CHWtypedich	-0.06	0.06	-0.01	-0.12*	-0.09
TeamMembdich	-0.13*	0.03	-0.01	-0.21**	-0.19**
logOrgSize	0.05	-0.01	0.16*	0.01	0.03
logTeamSize	0.11	0.05	0.14*	0.09	0.10
logNumCHWo~m	0.01	-0.11	-0.09	0.08	0.08
CHWracedich	-0.01	0.00	-0.06	0.02	0.00
CHWethnicd~h	-0.08	-0.15*	-0.03	-0.03	-0.07
MetroRurdich	0.16*	0.24**	0.15*	0.12*	0.10

** $p < 0.05$, * $p < 0.20$

Multiple regression analyses for TCI survey scores and TCI subscale scores were completed using the following predictors: state certification of CHWs (CHWcert) and independent variables that have been shown to impact adoption of innovations and which may impact team climate; these variables include organizational size (logOrgSize), organizational type (Orgtypedich), and RN team tenure (TeamTen). Independent

variables with a regression coefficient (r^2) greater than 0.20 were included in the regression analysis where appropriate. The analysis was completed using the heteroscedasticity consistent covariance matrix method (i.e., vce hc3 in Stata) for the regression models to help correct for heteroscedasticity (Long & Ervin, 2000).

Regression results for TCI overall scores and independent variables found R^2 = 0.06, $F(4, 150) = 2.42$, $p = 0.05$, with organizational type (Orgtypedich) as a significant predictor, $b = -1.20$, 95% CI= (-3.06 – - 0.18), $p = 0.03$. Subscale regression results included TCI partnership (TCIpartn), $R^2 = 0.10$, $F(4, 150) = 1.96$, $p = 0.08$, with no significant predictors; TCI support (TCIsuppt) $R^2 = 0.04$, $F(4, 150) = 2.15$, $p = 0.08$, with organizational type as a significant predictor, $b = -0.38$, 95% CI= (-0.76 – - 0.01), p = 0.04; TCI objectives (TCIobject), $R^2 = 0.09$, $F(4, 150) = 2.94$, $p = 0.01$, with team member type (TeamMembdich) as a significant predictor, $b = -0.43$, 95% CI= (-0.79 – - 0.07), $p = 0.02$; and TCI style (TCIstyle) $R^2 = 0.03$, $F(4, 150) = 1.73$, $p = 0.15$, with no significant predictors. The complete regression are found in Appendix F (see Tables 8.F, 10.F, 12.F, 14.F, and 16.F, in Appendix F).

Post Regression Testing

Post regression testing for multicollinearity was completed by assessing the variance inflation factor (VIF) for independent variables (see Table 9.F, 11.F, 13.F, 15.F, 17.F, 19.F, and 21.F in Appendix F). None of the post regression VIF results were larger than 10 or 1/VIF is less than 0.10, which would indicate that multicollinearity may be an issue (Acock, 2012).

In addition, post regression residual-versus-fitted plot (i.e., rvfplots) were developed to assess for homoscedasticity (see Figures 28.F – 34.F, Appendix F).

Residual-versus-fitted plot graphs for overall TCI score does not appear to have any linear pattern of residuals; however, linear patterns denoting homoscedasticity do begin to appear in residual graphs for TCI subscale scores. Additional post regression testing (Breusch-Pagan/Cook-Weisberg test) for heteroskedasticity found significant evidence of heteroskedasticity for overall TCI survey (TCIall), TCI partnership (TCIpartn) and TCI objectives (TCIobject) subscale (see Table 20).

Table 20

Postregression Test for Heteroskedasticity for Overall TCI (TCIall) and TCI Subscale Variables

Variables: fitted values of TCIall	
chi2(1) =	10.75
Prob > chi2 =	0.001**
Variables: fitted values of TCIpartn	
chi2(1) =	10.08
Prob > chi2 =	0.002*
Variables: fitted values of TCIsuppt	
chi2(1) =	0.63
Prob > chi2 =	0.43
Variables: fitted values of TCIobject	
chi2(1) =	4.05
Prob > chi2 =	0.04*
Variables: fitted values of TCIstyle	
chi2(1) =	5.06
Prob > chi2 =	0.02*

* $p < 0.05$, ** $p < 0.001$

CHAPTER 5

DISCUSSION

This research on the perceptions of team climate among RNs who work in states with CHW certification programs and states without CHW certification programs was completed to see if state certification has an impact on team climate as measured by the Team Climate Inventory (TCI)-short form. TCI factors measure the perceptions of team members on how they work together, share a single vision, are open to new ideas, and if they feel safe and supported by other team members (Waite & Nichols, 2002). Team climate can act as a mediator on patient care outcomes (Goh & Eccles, 2009), and it may impact the innovativeness and ability of health care teams and organizations to adopt new ways of delivering health care (Ross et al., 2000). This study provides preliminary evidence on the possible impact of state certification of CHWs on the delivery of health care services at both the individual level (i.e., RNs) and team level.

Discussion of Findings

RN Survey Participant Demographics

The online recruitment of RNs through emails and snowball sampling resulted in 196 qualified study participants from 16 different states. The overwhelming majority of RNs who participated in the survey reported their gender as female, and their race as White. When compared with national RN and PHN workforce data (HRSA, 2013; UMCEPHS, 2013), the study sample had a lower proportion of RNs with associate degrees or diplomas, and a lower proportion of RNs who reported their race as Asian. A larger proportion of RNs in the study reported advanced degrees in nursing (i.e., Master's

Degree or higher), and there was a higher proportion of multiracial and Hispanic RNs in this study (see Table 21).

Table 21

Comparison of Study Sample with National Workforce Data for RNs and PHNs

	Study Sample n = 196	UM CEPHS PHN Survey n = 2,672	HRSA National RN Survey n = 90,000
Female	95.4%	98.0%	90.9%
Male	4.6%	2.0%	9.1%
Average Age	48.7	49.6	44.6
Race			
White	78.4%	87.5%	75.4%
Black or African American	6.2%	8.0%	9.9%
Asian	1.3%	3.7%	8.3%
American Indian or Alaska Native	0.0%	1.3%	0.4%
Multiple or Other Race	7.7%	N/A	1.3%
Hispanic Ethnicity			
Not Hispanic or Latino	79.2%	96.0%	95.2%
Hispanic or Latino[a]	13.5%	4.0%	4.8%
Education			
RN Diploma	6.6%		6.9%
Associate's Degree	12.2%	44.7%[b]	37.9%
Bachelor's Degree	53.6%	49.7%	44.6%
Master's and Doctoral	23.5%	11.0%	10.6%

[a] Study sample combined categories: Hispanic, Latino, or of Spanish origin; Mexican, Mexican American, or Chicano; Another Hispanic, Latino, or Spanish origin; Cuban; Puerto Rican.

[b] UM CDPHS PHN Survey education combined RN Diploma and Associate Degree in Nursing.

The most striking differences between survey data and national data for RNs and PHNs is the higher proportion multiracial and Hispanic or Latino RNs, and the higher proportion of RNs who reported having a master's or doctorate degree in Nursing. The higher proportion of Hispanic RNs in this survey is likely due to the proportion of survey responses from RNs in California and Texas, 45.9%, which have large Hispanic and Latino populations (Humes, Jones, & Ramirez, 2010). The higher proportion of survey

respondents with advanced degrees in nursing may be a reflection of a higher number of advanced practice nurses working within primary care compared to other organizational settings.

Analysis and Interpretation of RN Survey Demographic Variables

Analysis of demographic survey data found significant differences between RNs in states with CHW certification programs and RNs who work in states without CHW certification programs in reported race, with RNs from non-CHW certification states having a higher proportion of Asian and multiracial survey participants. Significant differences were also found in the level of education reported by RNs and the highest level of nursing education, with RNs in CHW certification states reporting higher rates for Associate Degrees' and Diplomas in nursing (see Chapter 4, Table 8). Interpretation of the analysis of differences in race and education should be viewed with caution because the chi-square analysis had cell sizes with fewer than five responses, and therefore it is unclear what impact if any these differences may have on the research questions.

A difference the type of organization the RNs reported working for (i.e., non-profit, or government) was found between the RNs in the two survey groups. RNs from CHW certification states were significantly, $p < 0.001$, more likely to report working for a non-profit organizations (see Chapter 4, Table 11). This difference may be due to recruitment of RNs from CHW certification states who work in smaller primary health care clinics, such as Federally Qualified Health Centers (FQHCs). Initial recruitment efforts in CHW certification states (i.e., Ohio and Texas) resulted in few responses from

RNs who work in state, county or local health departments. Subsequent recruitment efforts focused on FQHCs and primary health care clinics in these states.

Significant differences between the two study group in organization and team size were also found. Over half, 54.5%, of RNs from certification states reported working in organizations with fewer than 100 employees, while 48.2% of RNs from non-CHW certification states reporting they worked in organizations with between 100 and 499 employees. The majority of RNs from both groups reported they worked in teams with less than 20 people. Studies have shown that larger organizations and teams can have a positive effect on innovation, the adoption of innovations, and team climate (Bower et al., 2003; Greenhalgh et al. 2004a). However, the differences in organization and team size in this survey should be viewed with caution as the samples were significantly skewed and leptokurtic, with significant levels of variance for organizational size between the two groups (see Table 6.E – 8.E, Figures 7.E-12.E, Appendix E).

Significant differences, $p < 0.01$, in the race and ethnicity of CHWs, and the types of CHWs that the RNs in the two groups work with were also found. A higher proportion of RNs from CHW certification states reported working with Black or African American CHWs, and a higher proportion of RN from non-CHW certification states reported working with Hispanic or Latino CHWs (see Chapter 4, Table 13). These results should also be viewed with caution as the CHWs race and ethnicity was reported by the RN, so it is unknown how the CHWs themselves would answer the questions regarding their race and ethnicity.

There was a significant difference, $p < 0.01$, in the type of CHWs that RNs reported working with as part of their current health care team (see Chapter 4, Table 14).

A higher proportion of RNs from non-CHW certification states reporting they worked with Community Health Workers or Promotores – 48.7% of RNs from non-CHW certification states – compared to 35.4% of RNs from CHW certification states. This difference may have influenced the testing of the differences in the mean TCI and TCI subscale scores between the two different groups, as the central research question deals with the certification of CHWs. If an RN is working with an unlicensed staff member who is not considered to function in the role of a CHW under state certification requirements (i.e., peer educators, lay health advisors, etc.) the impact of state certification of CHWs on team climate might not be a factor.

Research Question 1: Mean testing of TCI survey and TCI subscales

Research question 1: Is there a difference in perception of team climate for RNs who work in states with CHW certification programs and RNs who work in states without CHW certification programs?

The survey results showed there were no significant differences found between RNs from states with CHW certification and states without CHW certification in the overall mean TCI survey score or mean scores for TCI subscale variables.

Two survey questions that attempted to determine RNs' perceptions of state certification on their confidence in working with CHWs (i.e., question 24: State certification of CHWs increases or would increase my confidence in working with them), and the ability of their team to provide quality care (i.e., question 25: State certification of CHWs increases or would increase the ability of my team to provide quality care) were analyzed for differences in mean scores between the two groups. A significant difference, $p < 0.02$, was found in the mean score of nurses to survey question 25, with RNs from

states with CHW certification having a higher mean score, 3.90, when compared to RNs from non-CHW certification states, 3.56 (see Figure 7).

It would appear from the results of question 25 that state certification of CHWs does impact the perceptions of RNs who work with them to some degree, but not to the extent that it impacts overall team climate as measured by the Team Climate Inventory survey. Further research in on the question of perceived quality of care and CHW certification is needed.

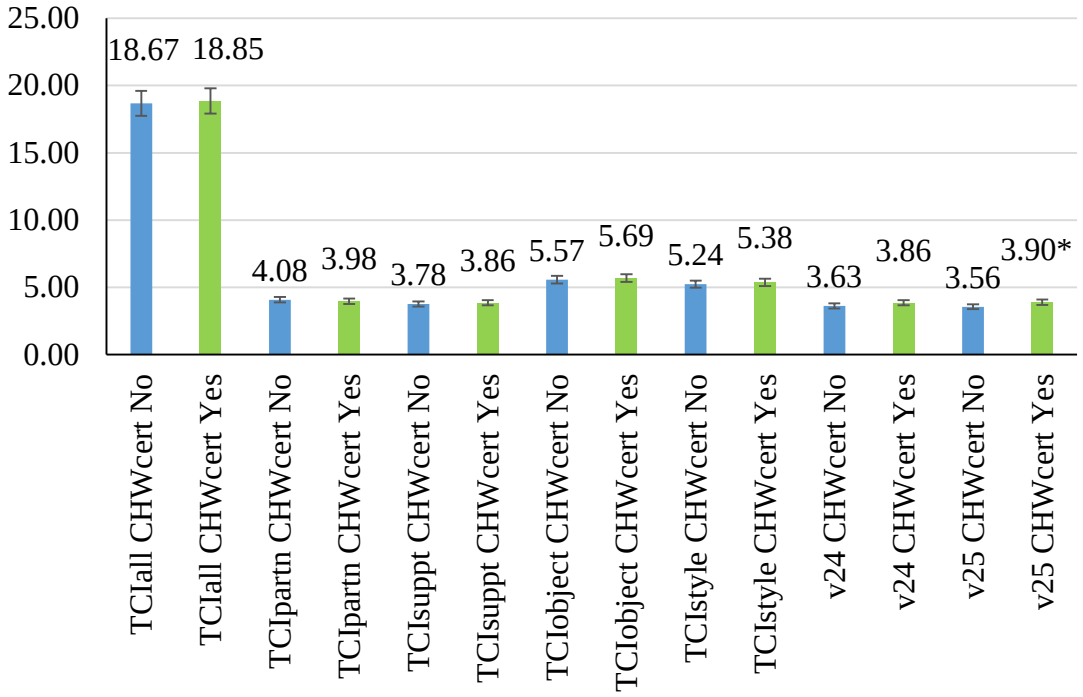

Figure 7. Mean values of TCI score, TCI subscale scores, and survey questions 24 & 25 by state certification of CHWs with 95% confidence intervals.
*$p < 0.05$.

Research Question 2: Multiple regression analysis of TCI survey and TCI subscales

Research question 2: What factors predict perceptions of team climate for RNs who work with CHWs.

A decision was made to include three independent variables: organizational size, organizational type, and team tenure, along with CHW certification in the multiple regression model for dependent variables, overall mean TCI score, mean TCI subscale scores (i.e., partnership, support, objectives, and style), and mean scores for survey questions 24 and 25. The decision to include these three independent variables was based on previous research findings on organizational innovation and change, team climate, and team work (Bower et al., 2003; Greenhalgh et al., 2004a; Heponiemi et al., 2011; West, 2004). A second set of independent variables was selected based on correlational analysis of all independent variables with overall TCI scores, TCI subscale scores, and survey questions 24 & 25. Independents variables with a Pearson's correlation coefficient of greater than 0.20 were included in the multiple regression models where appropriate (see Chapter 4, Table 19). The correlation coefficient of 0.20 was chosen because a larger correlation coefficient (i.e., 0.30) would have limited the number of additional independent variables in the regression model to only the original four (i.e., CHW certification, team size, organizational size, and organizational type). Using a smaller correlation coefficient (i.e., 0.10) would have increased the number of additional independent variables in the regression model without adding to the ability of the model to predict influences on dependent variables. Results from multiple regression models for overall TCI and TCI subscale with significant independent variables (IV) are shown in below (see Table 22).

Organizational type (i.e., state, county, or local health program or not-for-profit health organizations) was found to have a significant but small negative influence for TCI overall scores ($p = 0.03$, $\beta = -1.62$), and TCI Support subscale score ($p = 0.04$,

β = - 0.38); metropolitan or non-metropolitan work site was found to have a significant but small positive influence on of TCI Partnership subscale scores ($p = 0.03$, β = 0.28); team member type (i.e., CHW or non-CHW) was found to have a significant but small negative influence of TCI Objectives subscale scores ($p = 0.02$, β = - 0.43). No significant predictors were found in the regression models for TCI style subscale or survey questions 24 & 25.

Table 22

Significant Results from Multiple Regression for TCI overall and TCI subscales

TCI Scale or Subscale Independent Variable (IV)	Coef.	Std. Err.	t	P>t	95% CI	
TCI overall score (0-24 scale) IV: Organizational type	-1.62	0.73	-2.23	0.03*	-3.06	-0.18
TCI Partnership score (0-5 scale) IV: Metro or Rural worksite	0.28	0.13	2.22	0.03*	0.03	0.53
TCI Support score (0-5 scale) IV: Organizational type	-0.38	0.19	-2.03	0.04*	-0.76	-0.01
TCI Object score (0-7 scale) IV: Type of CHW on Team	-0.43	0.18	-2.39	0.02*	-0.79	-0.07

* $p < 0.05$

The type of organization nurses work in has been shown to influence team climate in previous research. Previous research found significant differences in the perceptions of team climate between nurses who worked in for-profit and not-for-profit long-term-care facilities in Finland (Heponiemi et al., 2011). In this survey, only four RNs reported working in for-profit health care organizations, and all of these nurses were from states with CHW certification programs. Because only four RNs, 2.2% of the study sample, reported working in for-profit institutions a decision was made to dichotomize the variable for organizational type for the regression analysis into two categories: state, county, or local health programs, 79.8% of the study sample, and not-for-profit

organizations, 18.0% of study sample. Because the of the overwhelming majority nurses in the study worked for state, county or local health departments it is unclear on what impact working in other types of organizations may have on team climate.

A similar issue arose with the location of RN worksites (i.e., metropolitan or non-metropolitan). The majority RNs who participated in the survey reported their work site location being in a metropolitan area. This designation was assigned by correlating the zip codes of the RNs worksites with Rural Urban Continuum Codes (RUCC). The US Department of Agriculture (2013) classifies counties into two categories, metropolitan or non-metropolitan, with nine different sub-categories under the RUCC. The overwhelming majority, 95.4%, of RNs in the current survey worked in metropolitan areas as defined by the USDA, so it is difficult to tell what impact worksite setting has on team climate from the current study.

Team member type (i.e., CHW, promotora, peer health educator) was a significant predictor for the TCI Objectives subscale score. The team member type variable was dichotomized into Community Health Workers and non-Community Health Workers. The TCI Objectives subscale is designed to measure individual understanding of the team's objectives, with higher scores representing agreement of vision or coherence in team objectives among team members. The significant but small negative influence (p = 0.02, β = - 0.43) that team member type had on the TCI Objectives subscale would appear to show that state CHW certification had less of an impact on team objectives than the job classification of the team member (i.e., CHW or non-CHW). Without further research into team member roles and job classifications within the team it is difficult to determine how different team member type impacts team climate and the delivery of

interdisciplinary health care. The classification of team members as CHWs and their role on the health care team is critical to the central research question of the influence of state certification on team climate.

While previous research on innovation has shown that organizational size and team size can have a positive impact on innovation and team performance through increased resources and diversity (Greenhalgh et al., 2004a; Bower et al., 2003), neither independent variable was not found to be a significant predictor of team climate scores or subscale scores in this study. Because of large variations in the size of organizations and team sizes reported by study participants, the variables were transformed using natural logarithm. This may have affected the results of the regression analysis, and the transformation may have resulted in the very small effect of organizational size and team size.

The overall regression model using the independent variables, CHW certification, organizational size, organizational type, and team tenure, along with independent variables with a correlation of 0.2 or higher, explained only 10% or less of the variation in the TCI overall score, TCI subscale score, and survey questions 24 & 25 (see Table 23).

The small effect of CHW certification on team climate may be a result of the complexities in providing team based care with CHWs who work primarily in the community. A previous study using the Primary Health Care Team Questionnaire (PHCTQ), a precursor to the TCI, that examined team climate among members of primary health care teams found the greatest differences in PHCTQ scores between clinically based team members and community home visitors, with clinically based

providers having a higher PHCTQ score (Ross et al., 2000). The current study only examined the team climate of RNs and not CHWs. RNs who work primarily in clinical settings may feel more closely associated with team goals, objectives, tasks, and other team members. Further research is needed into the perceptions of team climate and the impact of state certification from the perspective of CHWs.

Table 23

Summary of Multiple Regression for Overall TCI score, TCI subscale scores, Questions 24 & 25, CHW Certification Coefficient, and probability

Dependent variable	R^2	CHWcert Coefficient	P>|t|
TCI overall score	0.06	-0.17	0.80
TCI Partnership subscale	0.10	-0.12	0.46
TCI Support subscale	0.04	0.03	0.82
TCI Object subscale	0.09	-0.08	0.72
TCI Style subscale	0.03	0.04	0.88
Question 24	0.10	0.17	0.31
Question 25	0.10	0.31	0.08

Implications

The results of this study provides information on the impact of state certification of CHWs on RNs perceptions of team climate as measured by the Team Climate Inventory short form questionnaire. No differences in mean overall TCI scores and TCI subscale scores were found between RNs who work with CHWs in states with CHW certification programs and those in states without CHW certification programs. This study did not assess the impact of state certification of CHWs on the patient care or health outcomes, and assessed only one factor, team climate, in the complex system of interdisciplinary team based health care delivery.

Previous research on team climate has shown it is affected by a variety of internal and external factors not assessed in this study including: leadership, electronic health

record capability, organizational culture, organizational tenure, support from new roles, and professional role conflicts (Bower et al., 2003; Howard et al., 2011; Ross et al., 2000). In addition, the survey questions did not address potential mediating and moderating variables including: payment options available for CHW services (Martinez et al., 2011), team training, and resources available for innovation and adoption of new models of health care delivery.

Multiple regression analysis that included state certification of CHWs as a predictor variable found no significant predictive value of CHW certification in multiple regression models for overall TCI score and TCI subscale scores. The only independent variables to show a significant but small negative influence on overall TCI scores was organizational type. Organizational type was dichotomized into state, county, or local health departments (i.e., equal to 1) or other (i.e., for-profit, not-for-profit, etc. equal to zero), and therefore it is difficult to determine the true impact of organizational types on team climate other than a small decrease in TCI score based on this survey.

Implications for public policy.

While this research did not find any significant differences in TCI scores between RNs who work in states with CHW certification programs and RNs who do not, or a significant predictive correlation between TCI scores and CHW certification, there are a number of other reasons policy makers and health care organizations may want to adopt CHW certification programs. In a recent review of state laws and policies affecting CHWs (CDC, 2013), the authors identified four areas where state policies can help to increase the integration of CHWs into primary health care programs: “creating supportive

infrastructure, addressing professional identity, and developing workforce and financing mechanisms" (CDC, 2013, p. 2).

Two different policy models have been developed to try and increase CHW participation in health care: (1) state certification programs (i.e., Massachusetts, Ohio, and Texas) and (2) certificate program (i.e., Minnesota). Massachusetts, Ohio, and Texas have passed certification legislation which requires a state entity, such as the Board of Certification of CHWs in Massachusetts or the Board of Nursing in Ohio, develop and administer a CHW certification program which sets standards for continuing education, and establish minimum criteria for CHW education, and determines if an individual meets that minimum qualifications certification (Ann. Laws of Massachusetts, 13§108, 2013). Texas' CHW certification program is voluntary for CHWs who are unpaid and mandatory for CHWs who are reimbursement for their services (Tex. Health & Safety Code § 48.052, 2013)

In Minnesota a consortium of health care organizations and advocates for CHWs developed a certificate program where individuals who complete an approved CHW training program through a Minnesota State University or College are granted a certificate, and they are eligible to for Medicaid reimbursement if they work under a licensed health care professional (CDC, 2011). CHWs who have worked for five years under the direction of a health care professional are also eligible for a certificate (Minn. Statute § 256B.0625, 2010). The certificate program developed in Minnesota provides documentation to the employer that an individual has completed an approved training program, but there is not a state board that oversees the certification of CHWs as in Minnesota (Rush, 2012).

Implications for health care practice.

While there is an increase in efforts to integrate CHW into health care teams, there remains a lack of consensus on the role that state certification programs have in the dissemination of the CHWs into health care teams. Some health care delivery organizations have moved to develop CHW programs that meet the needs of their communities. The University of New Mexico Health Sciences Center (UNMHSC, n.d.) Pathways Patient Navigator program is one example of an organizational innovation that has worked to increase the integration of CHWs into the current health care system. According to the UNMHSC Pathways website the goal of the program is:

> to reduce unmet needs, address health inequities, and improve the overall health of the residents of Bernalillo County. It focuses on positive health outcomes by utilizing community health navigators as care coordinators who connect at-risk residents to resources and follow their progress toward improved health outcomes (UNMHSC, n.d.)

Whether the state certification of CHWs will promote or inhibit dissemination of CHWs into current health care systems is unclear. This research provides some evidence that state certification of CHWs does not impact the perceptions of team climate among the RNs surveyed. However, the research did find that RNs who work in states with CHW certification programs were more likely to believe that state certification of CHWs improved the ability of their health care team to deliver quality care. health and prevent disease increases, more research on effective models of integrating CHWs into health care programs will also be needed.

Limitations

This research has a number of limitations. Large differences in the proportion of RNs in the survey who reported having an Associate Degree's in Nursing, an advanced degree in nursing (i.e., Master's Degree or higher), and Hispanic ethnicity were seen between RNs who participated in the survey and PHNs and RNs who participated in two recent national surveys (HRSA, 2013; UM CEPHS, 2013), and therefore the results of the impact of state certification of CHWs cannot be generalized.

While the independent *t*-test is robust to deviations from normal distribution (Cohen, Welkowitz, & Lea, 2012; Skovlunda, & Fenstadb, 2001), testing for skeweness and kurtosis, showed significant differences from normal distributions for TCI subscale variables (see Appendix F, Table 3.F). Test results for parametric tests were reported, but non-parametric tests (i.e., Mann-Whitney) were also completed for overall TCI, TCI subscale, and survey questions 24 and 25 variables but not reported in the results. Non-parametric testing also found no significant differences between the two study groups in all variables with exception of survey question 25 (i.e., State certification of CHWs increases or would increase the ability of my team to provide quality care) which provides additional validity for parametric test result and significant results for question 25. A larger sample size may have improved the normality of the distribution of the TCI survey scores. However, because the overall TCI and TCI subscales are based on Likert scale some degree of non-normality (i.e., left skewed and leptokurtic) may be more likely when surveying RNs who work with CHWs.

Very few nurses in the study, 4.8%, reported working in rural or non-metropolitan areas. The use of CHWs in urban areas, which may have higher rates of diversity (i.e, ethnic, racial, education, and income) among residents, may be one factor that explains

the lack of response from nurses in rural areas. A second factor, may be the lack of primary health care and public health nursing services in many rural areas. A recent report by the National Association of County and City Health Officials (NACCHO, 2013) found that 41% of county and local health departments have reduced staff and closed programs due to decreased public funding in the past year.

The type of CHWs that the RNs reported working with may have influenced the outcome of this analysis. Because of the broad range of titles that CHWs work under, it is difficult to determine if the state certification of CHWs impacts other unlicensed assistive personal whose jobs are classified differently (i.e., peer educators, lay health advisors, etc.). Finally, the changes in health care as a result of the implementation of the Patient Protection and Affordable Care Act that were ongoing during the research project may have influenced the results. Federal policies that promote the use of CHWs by health care organizations and administrative policies that help to define a role or CHWs in health promotion and disease prevention activities may have influenced study participants views of CHWs in their organization.

Future Research

This research involved RNs who work with CHWs, and the impact of state certification on team climate among CHWs was not assessed. RNs perception of team climate is only one aspect of the complex health care delivery system. State certification of CHWs may also impact the way they are perceived by other members of the health care team and, importantly, the quality of care they provide. The RNs surveyed in this study who work in states with CHW certification programs perceived CHW certification

to have a significantly greater impact on the quality care delivered by their health care team when compared to other RNs survey participants (i.e., survey question 25).

It would be important to assess the perspective of CHWs, who are impacted directly by state certification programs, in a follow-up study to provide additional information on the influence of state CHW certification programs. The research may provide information on dissemination efforts that successfully or unsuccessfully integrated CHWs in primary health care programs. Additional research at the team level examining difference in team climate for teams who work in states with and without CHW certification programs would allow direct comparison for a number of outcomes, including patient care outcomes.

Research on different models of integration of CHWs into the current health care system is also needed. Minnesota has a CHW certificate program that allows CHWs to obtain a certificate after completion of a CHW training program recognized by the state. Texas' CHW certification program is voluntary, but requires provider organizations in the state to use certified CHWs. Some organization (e.g., Hildago Medical Systems in New Mexico) have moved forward with developing independent training programs for CHWs to meet the needs of their communities and health care systems. In New Mexico these efforts have been aided by online training program for primary health care teams that include CHWs through the University of New Mexico's project ECHO (University of New Mexico, n.d.; Uyttebrouck, 2013).

Conclusion

Innovations to improve access to quality health care while decreasing the cost of health care in the U.S. will become even more important as millions of previously

uninsured Americans enroll in private health insurance, and where available Medicaid, as part of the Patient Protection and Affordable Care Act of 2010 (PPACA) (Pub. Law 111-148, 2010). Efforts to clarify the role that CHWs will have in the delivery of health care services, including legislative and policy efforts to certify CHWs, continue to be debated (Martinez et al., 2011). In July 2013, the U.S. Centers for Medicaid and Medicare Services (CMS) released a statement on the legislative language contained in the PPACA on the types of providers who can provide preventive care services:

> Both section 1905(a)(13) of the Act and Affordable Care Act provide for a more robust set of preventive services than the current regulations, in allowing a broader pool of providers to deliver such services. In making this change in the final rule, we are aligning our regulation with the statutory coverage provision. States will continue to have some flexibility to determine the scope of covered preventive services in their state...(DHHS, 2013, p. 42227).

This clarification of the federal regulations has increased interest in the integration of CHWs into primary health care teams according to one CHW program director in New Mexico (D. Smith, personal communication, September 30, 2013), and New Mexico's Governor, Susana Martinez, announced in November 2013 that she will be requesting $500,000 from the New Mexico Legislature in 2014 to fund a CHW certification and training to help meet the demands on primary health care in the state (Boyd, 2013). The U.S. Health Resources and Services Administration (2011) reports that a number of other states are working on developing CHW certification programs, while other states and regions, including Arizona, southern California, Nevada, North Carolina, and Virginia

are developing CHW certificate programs or state standardized education and training programs.

The ability of health care teams to adopt new ideas can influence the diffusion of CHWs programs by health care organizations. The conceptual model for the diffusion and dissemination of innovations in health and service organizations proposed by Greenhalgh et al., (2004b), describes the inner and outer contexts related to adoption decisions (see Figure 8). Team climate fits into the inner context of organizational change, including "...receptive context for change in general, absorptive capacity for new knowledge, and tension for a particular change" (p. 321).

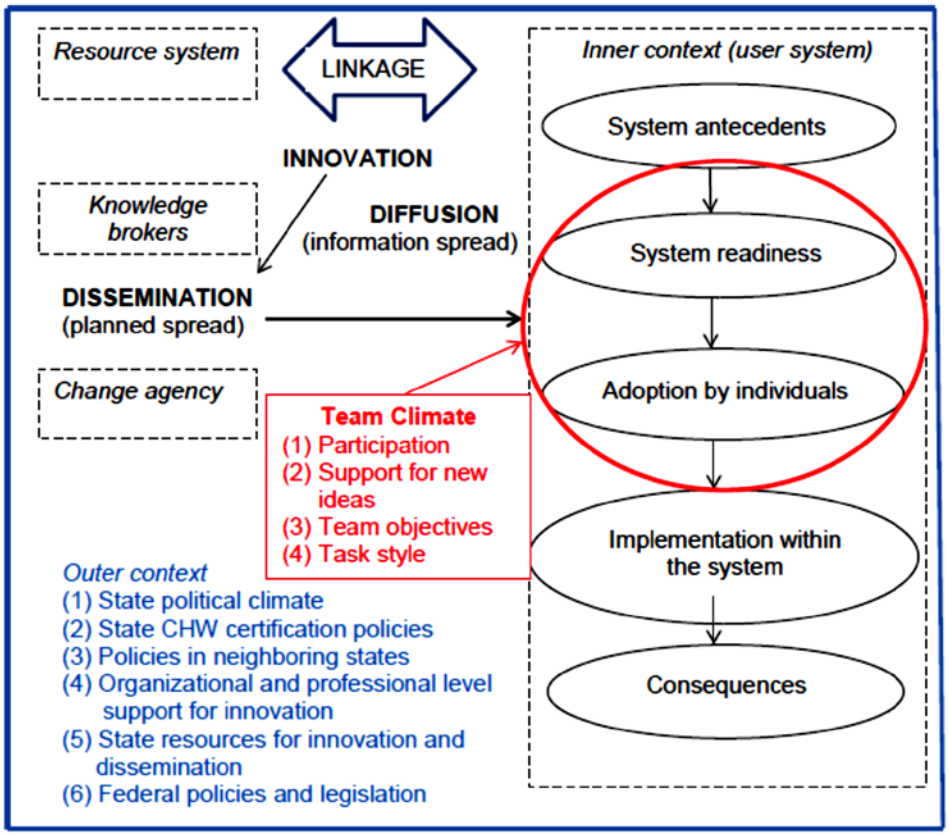

Figure 8. Model for dissemination of innovations in health organizations (adapted from Greenhalgh et al. 2004b.).

As health care teams within organizations adapt and innovate to the policy level changes in health care, including an increased emphasis on health promotion and disease prevention under PPACA (2010), health care organizations may then advocate for policies that support these innovative health care delivery models. The inner context of individual and organizational adoption decisions (i.e., the adoption of CHWs into health care programs) are linked with and can influence outer context policy innovation and adoption of state and federal policies.

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Appendix A

University of New Mexico Team Climate Inventory Survey for Registered Nurses working with Community Health Workers.

1. I am a Registered Nurse with a valid license to practice in the U.S.

   □ Yes □ No

2. I have not responded to this survey before.

   □ Yes □ No

3. I have worked with Community Health Workers as part of my primary work role during the past year.

   □ Yes □ No

4. I have read and understand the information contained in the consent letter.

   □ Yes □ No

Team Climate Inventory

The following questions ask about how you perceive the team climate of your work group that includes Community Health Worker(s), Promotora(s), Lay Health Workers, etc. Team climate is defined as the perceptions of team members on how they work together, share a single vision, are open to new ideas, and if they feel safe and supported by other team members.

Participation in the team

This part concerns how much participation there is in your team. Please choose the most appropriate response for each question.

To what extent do you agree with the following?

PARTICIPATION		Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
5.	We have a "we are in it together" attitude. □ Choose not to answer	□	□	□	□	□
6.	People keep each other informed about work-related issues in the team. □ Choose not to answer	□	□	□	□	□

7.	People feel understood and accepted by each other. □ Choose not to answer	☐	☐	☐	☐	☐
8.	There are real attempts to share information throughout the team. □ Choose not to answer	☐	☐	☐	☐	☐
9.	There is a lot of give and take. □ Choose not to answer	☐	☐	☐	☐	☐
10.	We keep in touch with each other as a team. □ Choose not to answer	☐	☐	☐	☐	☐

Support for new ideas

This part deals with attitudes towards change in your team. Please indicate how strongly you agree or disagree with each of the following statements as a description of your team by choosing the appropriate response.

To what extent do you agree with the following?

	SUPPORT FOR INNOVATION	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
11.	This team is always moving toward the development of new answers. □ Choose not to answer	☐	☐	☐	☐	☐
12.	This team is open and responsive to change. □ Choose not to answer	☐	☐	☐	☐	☐
13.	People in this team are always searching for fresh, new ways of looking at problems. □ Choose not to answer	☐	☐	☐	☐	☐
14.	Members of the team provide and share resources to help in the application of new ideas. □ Choose not to answer	☐	☐	☐	☐	☐
15.	Team members provide practical support for new ideas and their application. □ Choose not to answer	☐	☐	☐	☐	☐

Team Objectives

The following statements concern your understanding of your team's objectives. Choose the appropriate response to indicate how far each statement describes your team.

Objectives	Not at all			Somewhat		Completely	
16. How clear are you about what your team's objectives are? □ Choose not to answer	☐	☐	☐	☐	☐	☐	☐
17. How far are you in agreement with these objectives? □ Choose not to answer	☐	☐	☐	☐	☐	☐	☐
18. To what extent do you think other team members agree with these objectives? □ Choose not to answer	☐	☐	☐	☐	☐	☐	☐
19. To what extent do you think members of your team are committed to these objectives? □ Choose not to answer	☐	☐	☐	☐	☐	☐	☐

Task Style

The questions below concern how you feel the team monitors and appraises the work it does. Consider to what extent each of the following questions describes your team. Please choose the response which you think best describes your team.

Task Orientation

	To a very little extent			To some extent		To a very great extent	
20. Do your team colleagues provide useful ideas and practical help to enable you to do the job to the best of your ability? □ Choose not to answer	☐	☐	☐	☐	☐	☐	☐
21. Are team members prepared to question the basis of what the team is doing? □ Choose not to answer	☐	☐	☐	☐	☐	☐	☐
22. Does the team critically appraise potential weaknesses in what it is doing in order to achieve the best possible outcome? □ Choose not to answer	☐	☐	☐	☐	☐	☐	☐
23. Do members of the team build on each other's ideas in order to achieve the highest possible standards of performance? □ Choose not to answer	☐	☐	☐	☐	☐	☐	☐

To what extent do you agree with the following?

		Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
24.	State certification of CHWs would increase my confidence in working with them. □ Choose not to answer	☐	☐	☐	☐	☐
25.	State certification of CHWs would increase the ability of my team to provide quality care. □ Choose not to answer	☐	☐	☐	☐	☐

Demographic Questions:

26. What is your gender? □ Male □ Female

27. What is your Race:
□ White
□ Black or African American
□ American Indian or Alaska Native
□ Asian
□ Native Hawaiian or Other Pacific Islander
□ Some Other Race
□ Multiracial
□ Other (please specify)

28. Which best describes your ethnicity?
□ Not Hispanic, Latino, or of Spanish origin
□ Hispanic, Latino, or of Spanish origin
□ Mexican, Mexican American, or Chicano
□ Another Hispanic, Latino, or Spanish origin.
□ Cuban
□ Puerto Rican
□ Other (please specify)

29. In what year were you born?

30. What is the highest level of education you have completed?
□ Associate Degree
□ Bachelor's Degree
□ Master's Degree
□ Doctorate or professional (e.g., J.D., DNP, DNSc, PhD)
□ Other (please specify)

31. What is the highest educational degree in nursing?
□ Associate Degree in Nursing
□ Diploma in Nursing
□ Bachelor's Degree Nursing
□ Master's Degree Nursing
□ Doctorate in Nursing (DNSc, DNP, or PhD)
□ Other (please specify)

32. What is the job title for your current position:_____

33. About how long have you been in your current position:___Years ___months

34. In what state do you work (includes the District of Columbia)?

35. What is the nine digit zip code where you work? _____

36. Which best describes your current place of work:
□ For profit health care organization
□ Not-for-profit health care organization
□ Tribal health care organization
□ State, county, or city health care organization
□ Other (please specify)

37. Which of the following have you worked with during the past year (Check all that apply):
□ Community Health Workers (CHW)
□ Promotoras(as)
□ Community Health Advisors
□ Outreach Educators
□ Peer Health Educators
□ Community Health Representatives
□ Doulas
□ Lay Health Advocates
□ Peer Health promoters
□ Other (please specify)

38. Which of the following do you consider as part of the team that you work with in your health care organization (Check all that apply):
□ Community Health Workers (CHW)
□ Promotoras(as)
□ Community Health Advisors
□ Outreach Educators
□ Peer Health Educators
□ Community Health Representatives
□ Doulas
□ Lay Health Advocates
□ Peer Health promoters
□ Other (please specify)

39. How long have you worked on a team that includes a CHW(s), promotoras(as), or other Lay health advocates listed in questions above: ___Years ___months

40. About how many employees work at your organization?

41. How many people work with you on your health care team or work group?

42. How many different Community Health Workers do you work with in your work team or group?

43. What do you believe best describes the race of the Community Health Workers that you most frequently work with:
□ White
□ Black or African American
□ American Indian or Alaska Native

□ Asian
□ Native Hawaiian or Other Pacific Islander
□ Some Other Race
□ Multiracial
□ Other (please specify)

44. What do you believe best describes the ethnicity of the Community Health Workers that you most frequently work with:

□ Not Hispanic, Latino, or of Spanish origin
□ Hispanic, Latino, or of Spanish origin
□ Mexican, Mexican American, or Chicano
□ Another Hispanic, Latino, or Spanish origin.
□ Cuban
□ Puerto Rican
□ Other (please specify)

Thank you for completing the survey on perception of team climate for Registered Nurses who work with Community Health Workers. Once you click the "Done" button, your survey response will be submitted. As compensation for your time in completing the survey you are eligible to receive a $10 gift coupon from Amazon.com. University of New Mexico employees are not eligible for the $10 gift coupon. To receive you gift coupon copy the link below and open the gift coupon distribution survey:

You will be required to enter your name and email address in the second survey to receive your gift coupon. The team climate research team does not have access to the information from the gift card distribution survey. The information you provide will only be used for financial accounting purposes

Appendix B

GPower© Power Analysis

1. **GPower© t-tests - Means: Difference between two independent means (two groups)**

t-tests - Means: Difference between two independent means (two groups)
Analysis: A priori: Compute required sample size

Input: Tail(s)	=	Two
Effect size d	=	0.5
α err prob	=	0.05
Power (1-β err prob)	=	0.80
Allocation ratio N2/N1	=	1
Output: Noncentrality parameter δ	=	2.83
Critical t	=	1.98
Df	=	126
Sample size group 1	=	64
Sample size group 2	=	64
Total sample size	=	128
Actual power	=	0.80

2. **GPower© Linear multiple regression**

F tests - Linear multiple regression: Fixed model, R^2 deviation from zero
Analysis: A priori: Compute required sample size

Input: Effect size f^2	=	0.15
α err prob	=	0.05
Power (1-β err prob)	=	0.80
Number of predictors	=	2
Output: Noncentrality parameter λ	=	10.20
Critical F	=	3.13
Numerator df	=	2
Denominator df	=	65
Total sample size	=	68
Actual power	=	0.80

Appendix C

Preliminary Email Survey

Subject: Survey of Registered Nurses who work with Community Health Workers

The University of New Mexico, College of Nursing is interested in the surveying Registered Nurses who work with of Community Health Workers as part of a health care team in a community setting. Community Health Workers (CHWs) are members of the community who provide interpretation and translation services, provide culturally appropriate health education and information, assist people in receiving the care they need, give informal counseling and guidance on health behaviors, advocate for individuals and community health needs, and provide some direct services.

If you are a Registered Nurse and you currently work with CHWs as part of your health care team in a community setting including: primary health care clinic, state health program, or home health program you are eligible to take the survey at (link to survey instrument here). **Individuals who complete the survey are eligible to receive a $10 dollar coupon to Amazon.com.**

This survey has been approved by the University of New Mexico Human Research Review Committee. If you have questions this survey please contact Geoff Shuster, DNSc, RN, Associate Professor at gshuster@salud.unm.edu or Mark Siemon, RN, APHN-BC, MPH, PhDc, at msiemon@salud.unm.edu

Please complete the survey by May 31, 2013. Thank you for your help.

Appendix D

Study Consent Letter

University of New Mexico Health Sciences Center
Informed Consent Cover Letter for Anonymous Surveys

STUDY TITLE

Registered Nurses working with CHWs perceptions of Team Climate

Geoff Shuster, DNSc, RN, and the investigative team from the College of Nursing, is conducting a research study. The purpose of the study is to examine the perception of Registered Nurses who work with Community Health Workers (CHWs) on team climate.

You are being asked to participate in this study because you have indicated that you are a Registered Nurse who works with Community Health Worker(s), Promotora(s), Lay Health Workers, or other members of the community who provide interpretation and translation services, provide culturally appropriate health education and information, assist people in receiving the care they need, give informal counseling and guidance on health behaviors, advocate for individuals and community health needs, and provide some direct services.

Your participation will involve completing a survey of demographic questions regarding your work, your job title, the number of years you have worked with CHWs, and your educational background. A second survey will ask you questions about your work climate which include perceptions of organizational policies, practices and procedures. The survey will last approximately 15 minutes to complete.

Your involvement in the study is voluntary, and you may choose not to participate. There are no names or identifying information associated with this survey. However, individuals who answer all of the survey questions are eligible for a $10 gift voucher redeemable at Amazon.com. Personal identifying information requested for the gift voucher will not be published, and it will be destroyed after the gift voucher has been delivered. The survey includes questions such as: (1) How clear are you about what your team's objective are? (2) People keep each other informed about work-related issues in the team. You can refuse to answer any of the questions at any time. There are no known risks in this study, but some individuals may experience discomfort when answering questions. The survey responses will be collected via a secure computer server at the University of New Mexico Clinical and Translational Science Center (CTSC). Survey data will be stored at the University of New Mexico, College of Nursing on a secure computer, and it will be destroyed after 5 years.

The findings from this project will us to better understand how Registered Nurses perceive working with Community Health Workers and the impact of State credentialing

programs for CHWs on team climate. If published, results will be presented in aggregate form only.

If you have any questions about this research project, please feel free to call Mr. Mark Siemon at (505) 272-3074 (msiemon@salud.unm.edu) or Dr. Geoff Shuster, DNSc, RN, Associate Professor at (505) 272-5612 (gshuster@salud.unm.edu).

If you have questions regarding your legal rights as a research subject, you may call the University of New Mexico Health Sciences Center (UNMHSC) Office of Human Research Protections at (505) 272-1129. By completing the survey you will be agreeing to participate in the above described research study.

Thank you for your consideration.
Sincerely,

Geoff Shuster, DNSc, RN
Associate Professor of Nursing
HRRC#
Version Date

Appendix E: Analysis of Independent Variables

Table 1.E

Analysis of Missing Values Pattern for Independent Variables by CHW State Certification

CHWcert No Percent	CHW ethnic	CHW race	Comb Race	Comb Educat	Comb Ethnic	OrgCat	Metro Rural
85%	1	1	1	1	1	1	1
3%	1	1	1	1	1	0	1
3%	1	1	1	1	1	1	0
3%	1	1	1	1	0	1	1
2%	1	1	1	0	1	1	1
<1%	0	1	1	1	0	1	0
<1%	1	0	1	1	1	1	1
<1%	1	1	0	1	1	1	1
<1%	1	1	1	1	1	0	0

CHWcert No Percent	NumCHW onTeam	Team Size	Age years	Org Size	Work years	Team Tenure
81%	1	1	1	1	1	1
4%	1	1	1	1	0	0
3%	1	1	1	1	1	0
3%	1	1	0	1	1	1
2%	1	0	1	1	1	1
2%	1	1	1	0	1	1
2%	1	1	1	1	0	1
<1%	0	0	1	0	0	0
<1%	0	1	0	0	0	1
<1%	0	1	1	1	1	1
<1%	1	1	1	0	1	0

CHWcert Yes Percent	CHW type5	Comb Race	CHW ethnic	Team Memb5	Metro Rural	Org Cat
79%	1	1	1	1	1	1
10%	1	1	1	1	1	0
4%	1	1	1	1	0	1
2%	1	1	1	0	1	1
1%	0	1	1	1	1	1
1%	1	0	1	1	1	1
1%	1	1	0	1	0	1
1%	1	1	0	1	1	1

Table 1.E (cont.)

CHWcert Yes Percent	NumCHW onTeam	Org Size	Team Size	Age years	Work years	Team Ten
80%	1	1	1	1	1	1
5%	1	1	1	1	0	0
5%	1	1	1	1	1	0
4%	1	1	1	0	1	1
1%	0	0	0	0	0	0
1%	0	1	1	1	0	0
1%	1	0	1	1	1	0
1%	1	1	0	1	1	0
1%	1	1	0	1	1	1

Table 2.E

Skewness and Kurtosis Testing (sktest[a]) for Continuous Independent Variables by CHW State Certification

sktest	Obs	Pr(Skewness)	Pr(Kurtosis)	joint adj chi2(2)	joint Prob>chi2
Ageyears All	188	0.10	0.00**	19.50	0.00
Ageyears CHWcert Yes	77	0.20	0.01*	7.23	0.03
Ageyears CHWcert No	111	0.12	0.00**	17.58	0.00
Workyears All	181	0.00**	0.05	26.22	0.00
Workyears CHWcert Yes	75	0.00**	0.34	11.26	0.00
Workyears CHWcert No	106	0.00**	0.05	18.36	0.00
TeamTen All	173	0.00**	0.00**	31.07	0.00
TeamTen CHWcert Yes	69	0.00**	0.05	13.08	0.00
TeamTen CHWcert No	104	0.00**	0.03*	18.09	0.00

[a] "In Stata the sktest command tests the skewness and kurtosis of the variable with a null hypothesis that the variable is normally distributed." (Pevalin & Robson, 2009, p. 140)
* $p < 0.05$
** $p < 0.01$

Table 3.E

Variance Ratio Test (sdtest) for Independent Variables by CHW State Certification

RN Age	Obs	Mean	*SE*	*SD*	95% CI
Ageyears CHWcert Yes	77	50.31	1.57	13.80	47.18 - 53.44
Ageyears CHWcert No	111	47.66	1.11	11.65	45.47 - 49.85
combined	188	48.74	0.92	12.61	46.93 - 50.56
ratio = *sd*(No) /*sd*(Yes) *f* =	0.71				
Ha: ratio != 1 2*Pr(*F*< *f*) =	0.10				

Table 3.E (cont.)

RN Years in Current position	Obs	Mean	*SE*	*SD*	95% CI
Workyear CHWcert Yes	75	7.70	0.80	6.94	6.10 - 9.29
Workyears CHWcert No	106	8.15	0.71	7.27	6.75 - 9.55
combined	181	7.96	0.53	7.12	6.92 - 9.01
ratio = *sd*(No) /*sd*(Yes) *f* =	1.10				
Ha: ratio != 1 2*Pr(*F*< *f*) =	0.68				
RN Years on Current Team	Obs	Mean	*SE*	*SD*	95% CI
TeamTen CHWcert Yes	69	6.39	0.64	5.28	5.12 - 7.66
TeamTen CHWcert No	104	8.13	0.68	6.89	6.80 - 9.47
combined	173	7.44	0.48	6.34	6.49 - 8.39
ratio = *sd*(No) /*sd*(Yes) *f* =	1.70				
Ha: ratio != 1 2*Pr(*F*< *f*) =	0.02*				

* $p < 0.05$

Table 4.E

Homogeneity of variance Levene's test with robost estimations (robvarb test), for independent variables by CHW state certification

RN Age years by State CHW Certification	Freq.	Mean	*SD*
Ageyears CHWcert No	111	47.66	11.65
Ageyears CHWcert Yes	77	50.31	13.80
W0 = 2.87 *df*(1, 186) Pr > *F* = 0.09			
W50 = 1.76 *df*(1, 186) Pr > *F* = 0.19			
W10 = 2.52 *df*(1, 186) Pr > *F* = 0.11			
RN Work years by State CHW Certification	Freq.	Mean	*SD*
Workyears CHWcert No	106	8.15	7.27
Workyears CHWcert Yes	75	7.70	6.94
W0 = 0.02 *df*(1, 179) Pr > *F* = 0.89			
W50 = 0.09 *df*(1, 179) Pr > *F* = 0.77			
W10 = 0.03 *df*(1, 179) Pr > *F* = 0.86			
RN Team Tenure by state CHW Certification	Freq.	Mean	*SD*
TeamTen CHWcert No	104	8.13	6.89
TeamTen CHWcert Yes	69	6.39	5.28
W0 = 4.29 *df*(1, 171) Pr > *F* = 0.04*			
W50 = 3.06 *df*(1, 171) Pr > *F* = 0.08			
W10 = 3.24 *df*(1, 171) Pr > *F* = 0.07			

[a] "W0 = the equality of variances between the groups defined with two statistics proposed by Brown and Forsythe that replace the mean in Levene's formula with alternative location estimators. W50 = replaces the mean with the median. W10 = replaces the mean with the 10% trimmed mean" (StataCorp, 2011, Stata help file: sdtest Variance-comparison tests).
* $p < 0.05$

Table 5.E

Two Sample t-test RN Age, RN Work years, RN Team Tenure

RN Age	Obs	Mean	*SE*	*SD*	95% CI
Ageyears CHWcert No	111	47.66	1.11	11.65	45.47 - 49.85
Ageyears CHWcert Yes	77	50.31	1.57	13.80	47.18 - 53.44
combined	188	48.74	0.92	12.61	46.93 - 50.56
diff		-2.65	1.87		-6.33 - 1.03
diff = mean(No)-mean(Yes) t =	-1.42				
degrees of freedom =	186				
Ha: diff != 0 Pr(|T| > |t|) =	0.16				
RN Work years	**Obs**	**Mean**	***SE***	***SD***	**95% CI**
Workyears CHWcert No	106	8.15	0.71	7.27	6.75 - 9.55
Workyears CHWcert Yes	75	7.70	0.80	6.94	6.10 - 9.29
combined	181	7.96	0.53	7.12	6.92 - 9.01
diff		0.45	1.08		-1.67 - 2.58
diff = mean(No)-mean(Yes) t =	0.42				
degrees of freedom =	179				
Ha: diff != 0 Pr(|T| > |t|) =	0.67				
RN Team Tenure[a]	**Obs**	**Mean**	***SE***	***SD***	**95% CI**
TeamTen CHWcert No	104	8.13	0.68	6.89	6.80 - 9.47
TeamTen CHWcert Yes	69	6.39	0.64	5.28	5.12 - 7.66
combined	173	7.44	0.48	6.34	6.49 - 8.39
diff		1.74	0.93		-0.09 - 3.57
diff = mean(No)-mean(Yes) *t* =	1.88				
Satterthwaite's degrees of freedom =	167.33				
Ha: diff != 0 Pr(|T| > |t|) =	0.06				

[a] *t-test* with unequal variances

Table 6.E

Descriptive Measures for Independent Variables Organizational Size (OrgSize), Team Size (TeamSize), and Number of CHWs on Team

Variable	Mean	*N*	*SD*	Variance	*SE*(mean)	Skewness	Excess kurtosis
OrgSize all	1079	189	3143	9880696	228	4.12	17.91
OrgSize CHWcert Yes	1558	79	4079	16600000	458	3.13	9.57
OrgSize CHWcert No	734	110	2202	4849538	209	5.36	31.87
TeamSize All	17.98	190	23.17	537.04	1.68	4.53	27.27
TeamSize CHWcert Yes	14.83	78	20.17	406.92	2.28	4.94	27.86
TeamSize CHWcert No	20.18	112	24.91	620.31	2.35	4.32	25.90

Table 6.E (cont.)

Variable	Mean	*N*	*SD*	Variance	*SE*(mean)	Skewness	Excess kurtosis
NumCHWonTeam All	7.61	191	16.74	280.28	1.21	8.64	91.31
NumCHWonTeam CHWcert Yes	10.11	79	23.87	569.56	2.69	6.69	49.46
NumCHWonTeam CHWcert No	5.85	112	8.48	71.93	0.80	5.11	31.70

Table 7.E

Skewness and KurtosisTtesting (sktesta) for Continuous Independent Variables by CHW State Certification

sktest	Obs	Pr(Skewness)	Pr(Kurtosis)	joint adj chi2(2)	joint Prob>chi2
OrgSize All	189	0.00**	0.00**	.	0.00
OrgSize CHWcert Yes	79	0.00**	0.00**	52.55	0.00
OrgSize CHWcert No	110	0.00**	0.00**	.	0.00
TeamSize All	190	0.00**	0.00**	.	0.00
TeamSize CHWcert Yes	78	0.00**	0.00**	.	0.00
TeamSize CHWcert No	112	0.00**	0.00**	.	0.00
NumCHWonTeam All	191	0.00**	0.00**	.	0.00
NumCHWonTeam CHWcert Yes	79	0.00**	0.00**	.	0.00
NumCHWonTeam CHWcert No	112	0.00**	0.00**	.	0.00

** $p < 0.01$

Table 8.E

Variance Ration Test (sdtest) for Independent Variables by CHW State Sertification

Variance ratio test (sdtest)	Obs	Mean	*SE*	*SD*	95% CI
OrgSize CHWcert Yes	79	1558	459	4079	645 - 2472
OrgSize CHWcert No	110	735	210	2202	319 -1151
ratio = *sd*(No) /*sd*(Yes) *f* =	0.29				
Ha: ratio != 1 2*Pr(*F*< *f*) =	0.00**				
Variance ratio test (sdtest)	Obs	Mean	*SE*	*SD*	95% CI
TeamSize CHWcert No	112	20.17	2.35	24.91	15.51 -24.84
TeamSize CHWcert Yes	78	14.83	2.28	20.17	10.28 -19.38
ratio = *sd*(No) /*sd*(Yes) *f* =	1.52				
Ha: ratio != 1 2*Pr(*F*< *f*) =	0.05				

Table 8.E (cont.)

Variance ratio test (sdtest)	Obs	Mean	*SE*	*SD*	95% CI
NumCHWonTeam CHWcert No	112.00	5.85	0.80	8.48	4.26 - 7.44
NumCHWonTeam CHWcert Yes	79.00	10.11	2.69	23.87	4.77 - 15.46
ratio = *sd*(No) /*sd*(Yes) f =	0.13				
Ha: ratio != 1 2*Pr(*F*< *f*) =	0.00**				

** $p < 0.01$

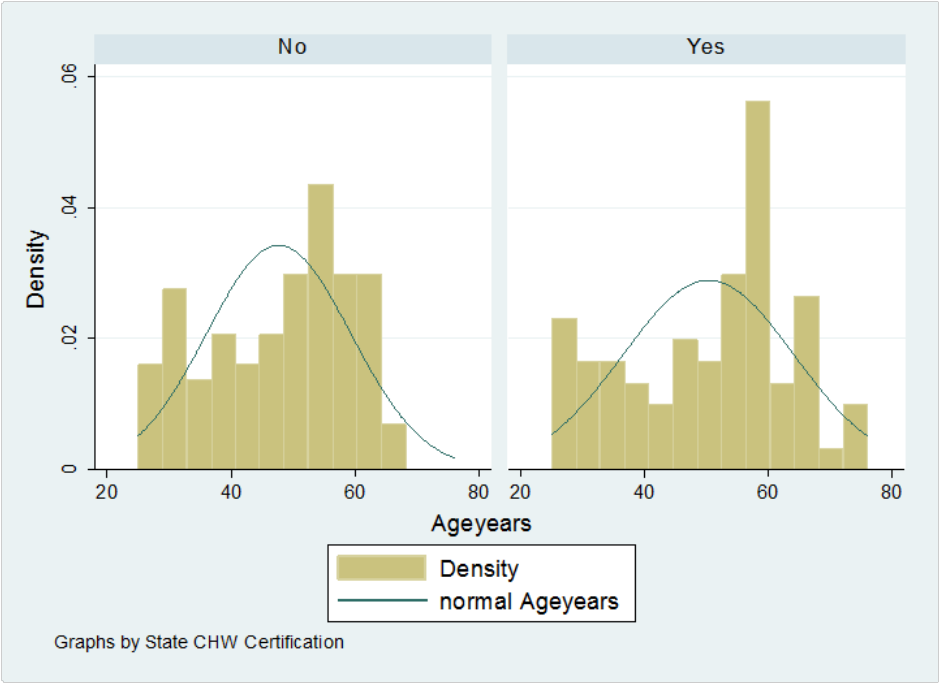

Figure 1.E. Histogram RN age in years by CHW state certification.

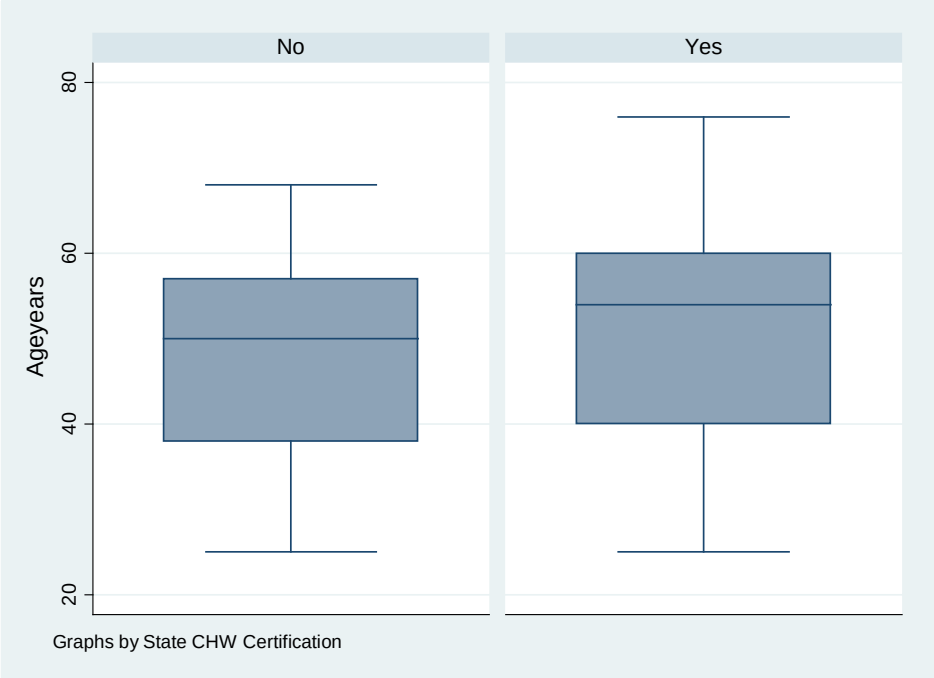

Figure 2.E. Box plots RN age in years by CHW state certification.

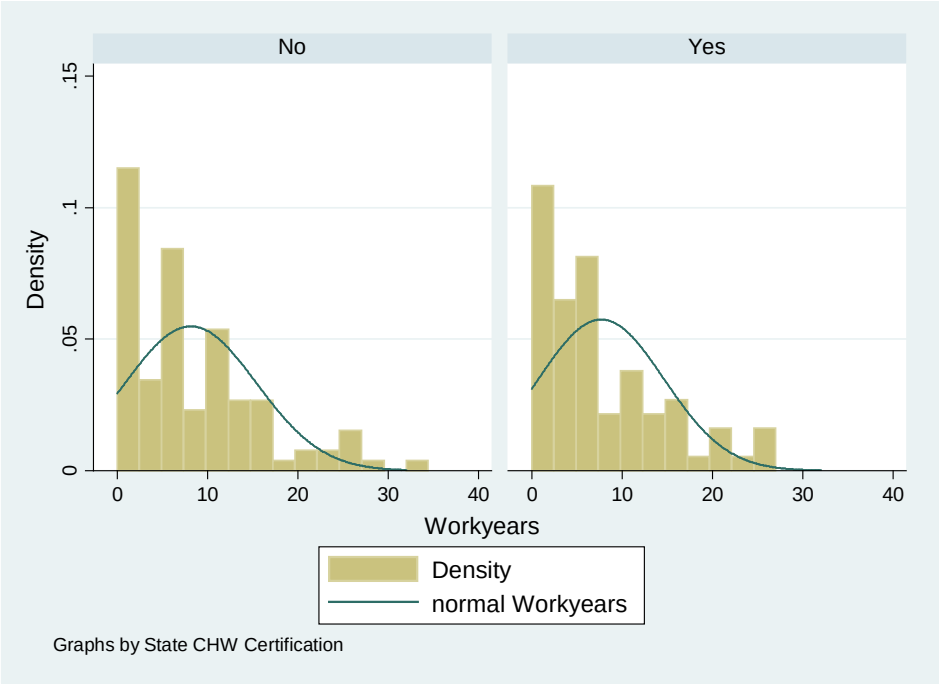

Figure 3.E. Histogram RN work years in current position by CHW state certification.

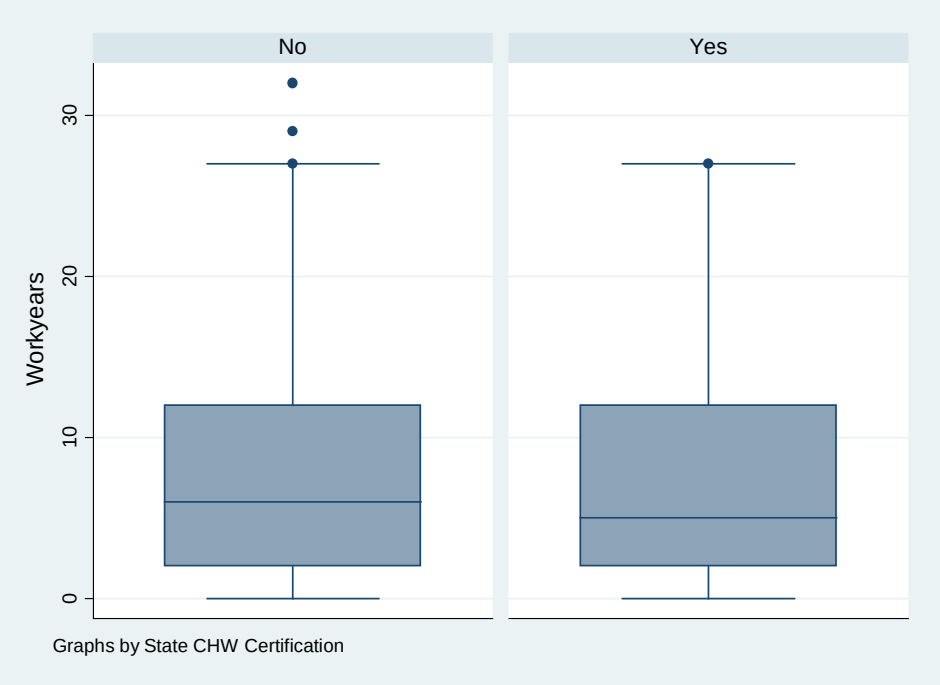

Figure 4.E. Box plots RN work years in current position by CHW state certification.

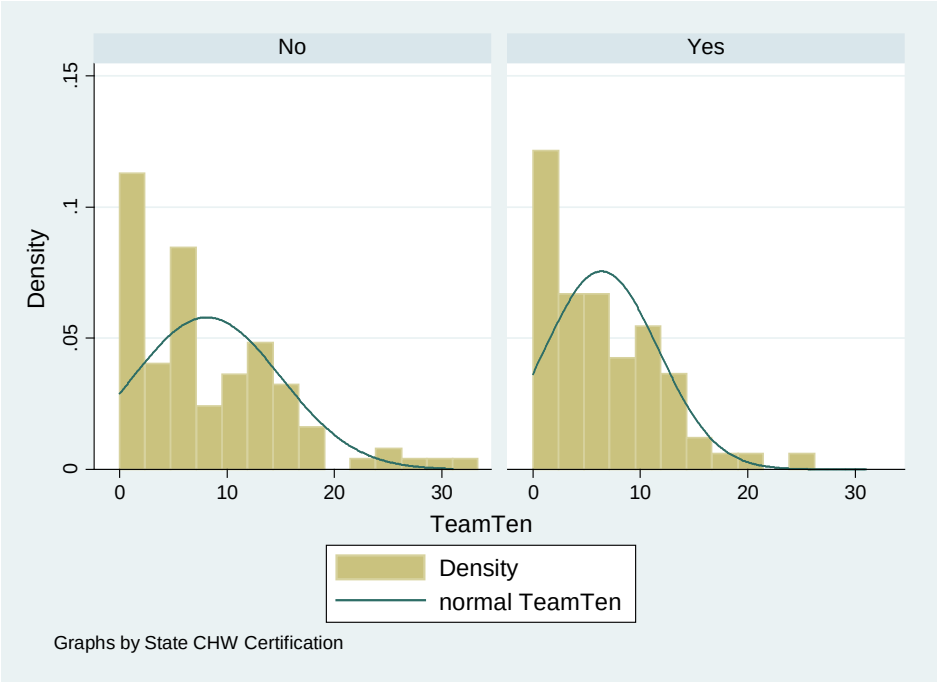

Figure 5.E. Histogram RN years on current team (TeamTen) by CHW state certification.

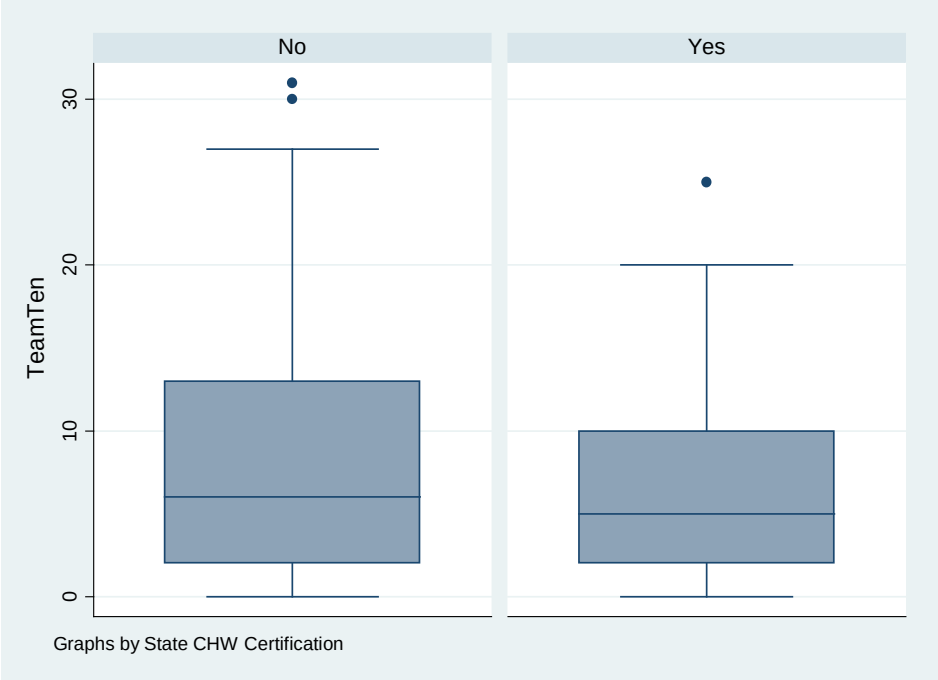

Figure 6.E. Box plots RN years on current team (TeamTen) by CHW state certification.

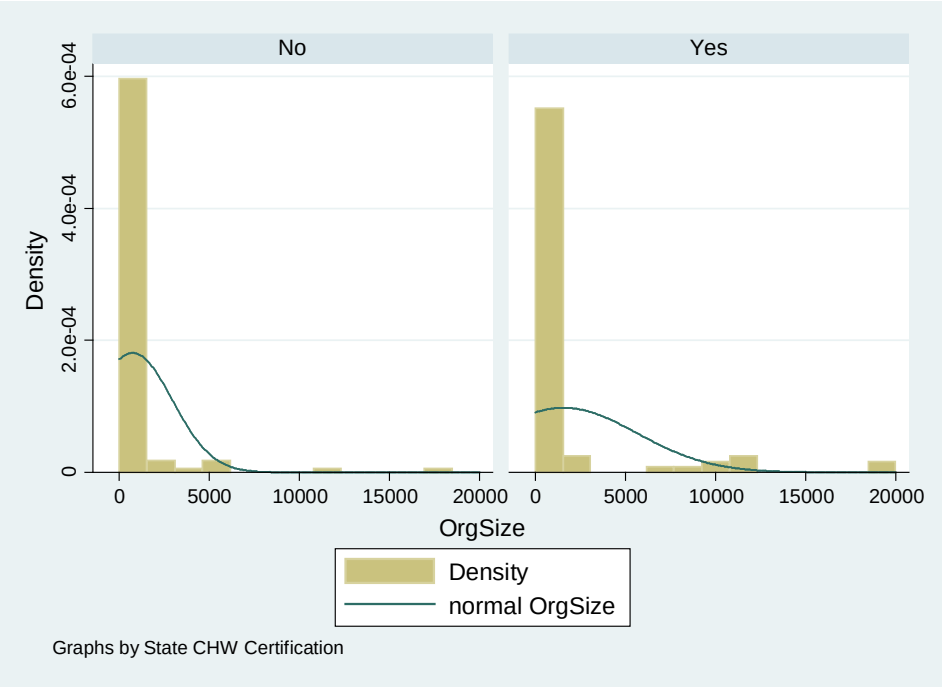

Figure 7.E. Histogram Organizational Size (OrgSize) by CHW state certification.

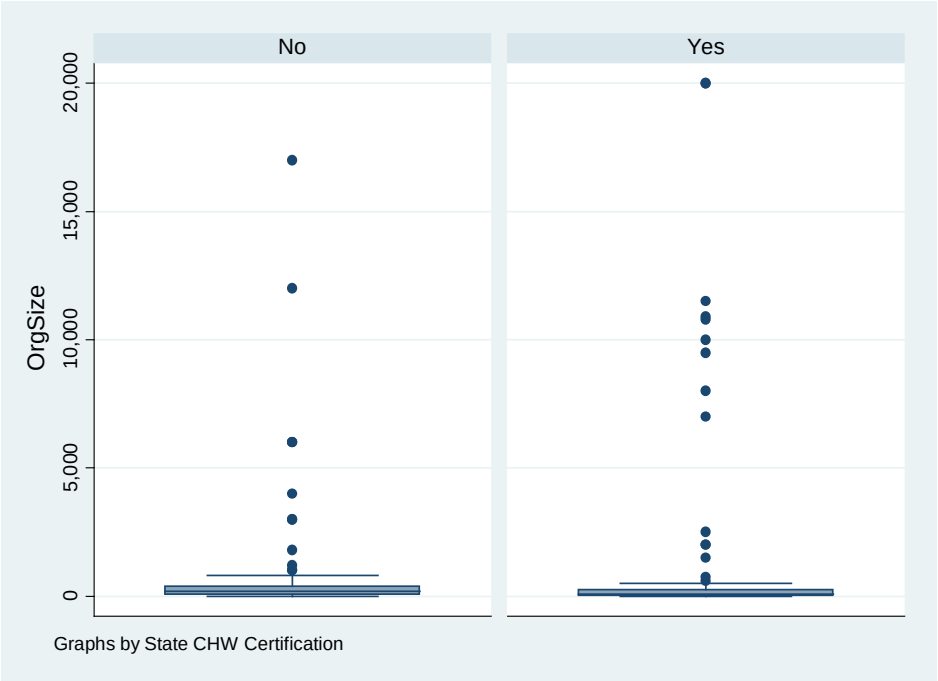

Figure 8.E. Box plots Organizational Size (OrgSize) by CHW state certification.

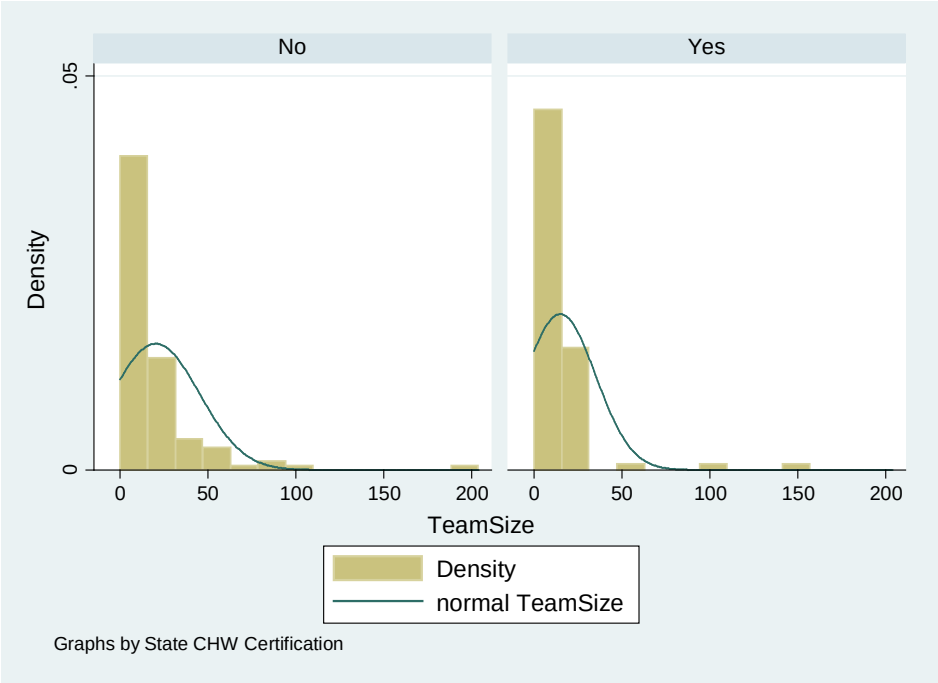

Figure 9.E. Histogram Team Size (TeamSize) by CHW state certification.

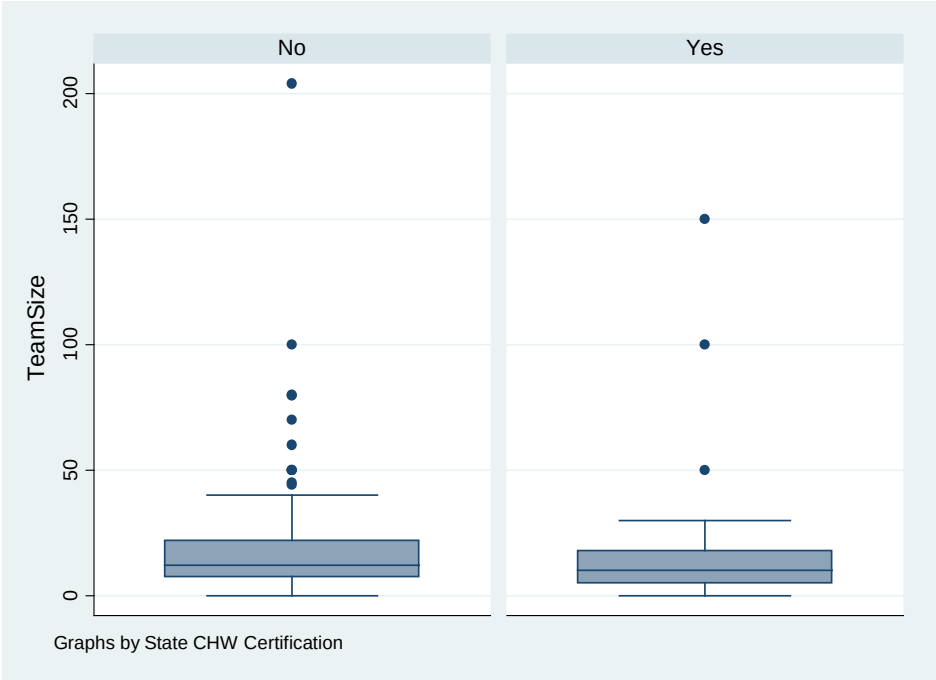

Figure 10.E. Box plots Team Size (TeamSize) by CHW state certification.

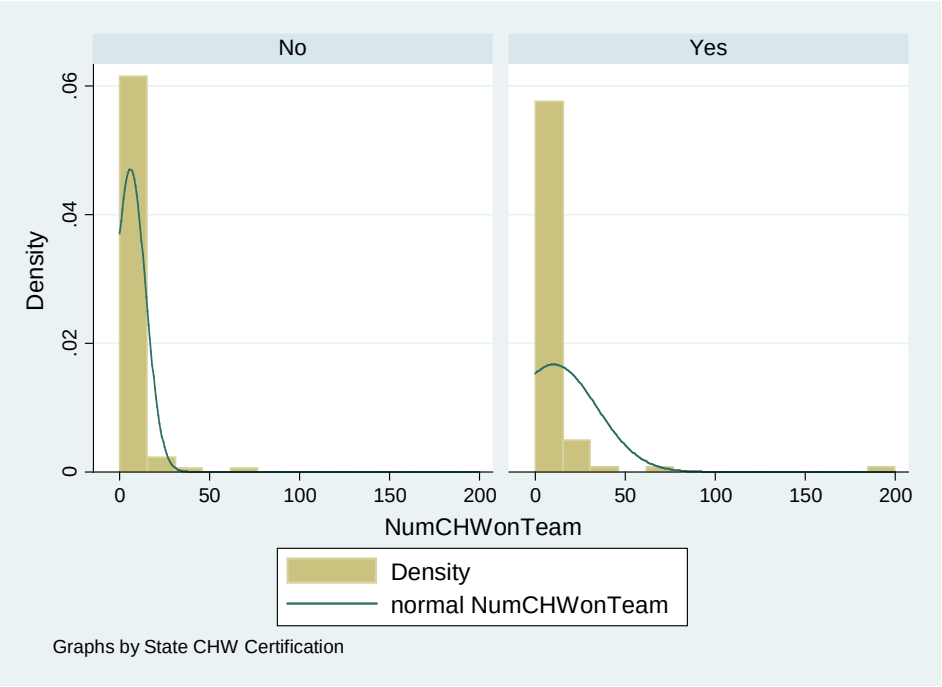

Figure 11.E. Histogram Number of CHWs on Team (NumCHWonTeam) by CHWcert.

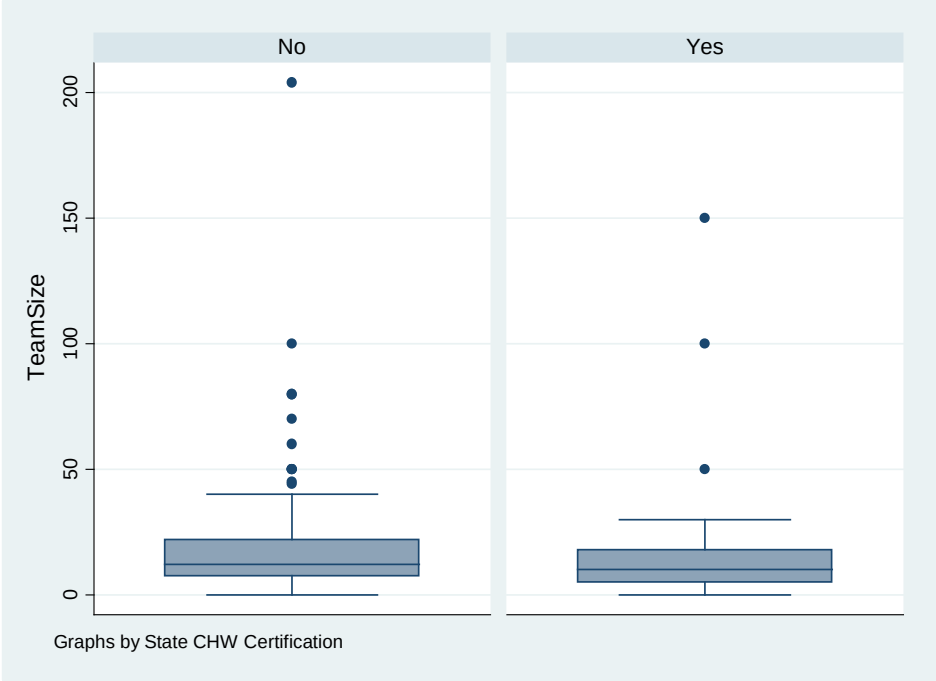

Figure 12.E. Box plots Number of CHWs on Team (NumCHWonTeam) by CHWcert.

Appendix F: Analysis of Team Climate Inventory Variables

Table 1.F

Analysis of Missing Values for TCI Survey Question (v5-v23)

Variable	Missing	Not missing	Unique values	Min	Max
v7	1	195	5	1	5
v12	1	195	5	1	5
v13	1	195	5	1	5
v14	2	194	5	1	5
v15	1	195	5	1	5
v16	1	195	7	1	7
v17	1	195	6	2	7
v18	1	195	6	2	7
v19	1	195	6	2	7
v20	1	195	7	1	7
v21	1	195	7	1	7

Table 2.F

Analysis of Pattern of Missing Values for TCI Survey (v5-v23)

Percent	v16	v17	v18	v19	v12	v13	v15	v20	v21	v7	v14
96%	1	1	1	1	1	1	1	1	1	1	1
<1%	0	0	0	0	1	1	1	1	1	1	1
<1%	1	1	1	1	0	1	1	1	1	1	1
<1%	1	1	1	1	1	0	1	1	1	1	0
<1%	1	1	1	1	1	1	0	1	1	1	0
<1%	1	1	1	1	1	1	1	0	1	1	1
<1%	1	1	1	1	1	1	1	1	0	1	1
<1%	1	1	1	1	1	1	1	1	1	0	1

Table 3.F

Skewness and Kurtosis Testing (sktest[a]) for Dependent Variables by CHW Certification

sktest	Obs	Pr(Skewness)	Pr(Kurtosis)	joint adj chi2(2)	joint Prob>chi2
TCIall	195	0.00*	0.46	12.99	0.00
TCIall CHWcert No	115	0.01*	0.62	6.83	0.03
TCIall CHWcert Yes	80	0.00*	0.54	7.70	0.02
TCIpartn	196	0.00**	0.00**	37.60	0.00
TCIpartn CHWcert No	115	0.00**	0.51	7.70	0.02
TCIpartn CHWcert Yes	81	0.00**	0.01*	22.26	0.00

Table 3. F (cont.)

sktest	Obs	Pr(Skewness)	Pr(Kurtosis)	joint adj chi2(2)	joint Prob>chi2
TCIsuppt	196	0.00**	0.97	9.91	0.01
TCIsuppt CHWcert No	115	0.00**	0.13	10.47	0.01
TCIsuppt CHWcert Yes	81	0.05	0.09	6.31	0.04
TCIobject	195	0.00**	0.76	10.43	0.01
TCIobject CHWcert No	115	0.01*	0.67	7.36	0.03
TCIobject CHWcert Yes	80	0.02*	0.46	5.47	0.06
TCIstyle	196	0.00**	0.23	15.63	0.00
TCIstyle CHWcert No	115	0.00**	0.46	9.23	0.01
TCIstyle CHWcert Yes	81	0.00**	0.17	9.38	0.01
v24	196	0.19	0.00**	10.76	0.00
v24 CHWcert No	115	0.79	0.00**	7.89	0.02
v24 CHWcert Yes	81	0.08	0.52	3.71	0.16
v25	196	0.13	0.03*	6.47	0.04
v25 CHWcert No	115	0.63	0.06	3.88	0.14
v25 CHWcert Yes	81	0.08	0.82	3.23	0.20

* $p < 0.05$, ** $p < 0.001$

Table 4.F

Variance Ratio Test (sdtest) for Dependent Variables by CHW State Certification

TCI All	Obs	Mean	*SE*	*SD*	95% CI
TCIall CHWcert No	115	18.67	0.30	3.20	18.08 - 19.26
TCIall CHWcert Yes	80	18.85	0.43	3.81	18.00 - 19.70
combined	195	18.75	0.25	3.45	18.26 - 19.23
Ha: ratio != 1 2Pr($F< f$) =	0.09				
TCI Partnership	**Obs**	**Mean**	***SE***	***SD***	**95% CI**
TCIpartn CHWcert No	115	4.08	0.07	0.73	3.95 - 4.21
TCIpartn CHWcert Yes	81	3.98	0.11	0.96	3.76 - 4.19
combined	196	4.04	0.06	0.83	3.92 - 4.15
Ha: ratio != 1 2Pr($F< f$) =	**0.01***				
TCI Support	**Obs**	**Mean**	***SE***	***SD***	**95% CI**
TCIsuppt CHWcert No	115	3.78	0.07	0.74	3.64 - 3.91
TCIsuppt CHWcert Yes	81	3.86	0.10	0.88	3.66 - 4.05
combined	196	3.81	0.06	0.80	3.70 - 3.92
Ha: ratio != 1 2Pr($F< f$) =	0.10				
TCI Object	**Obs**	**Mean**	***SE***	***SD***	**95% CI**
TCIobject CHWcert No	115	5.57	0.10	1.07	5.37 - 5.77
TCIobject CHWcert Yes	80	5.69	0.12	1.11	5.44 - 5.94
combined	195	5.62	0.08	1.08	5.47 - 5.77
ratio = sd(No) /sd(Yes) f =	0.57				
Ha: ratio != 1 2Pr($F< f$) =	0.69				

Table 4. F (cont.)

TCI Style	Obs	Mean	*SE*	*SD*	95% CI
TCIstyle CHWcert No	115	5.24	0.12	1.25	5.01 - 5.47
TCIstyle CHWcert Yes	81	5.38	0.14	1.29	5.09 - 5.66
combined	196	5.30	0.09	1.27	5.12 - 5.48
ratio = *sd*(No) /*sd*(Yes) *f* =	0.93				
Ha: ratio != 1 2Pr(*F*< *f*) =	0.73				
v24	Obs	Mean	*SE*	*SD*	95% CI
v24 CHWcert No	115	3.63	0.09	1.00	3.44 - 3.81
v24 CHWcert Yes	81	3.86	0.11	0.97	3.65 - 4.08
combined	196	3.72	0.07	0.99	3.59 - 3.86
ratio = *sd*(No) /*sd*(Yes) *f* =	1.05				
Ha: ratio != 1 2Pr(*F*< *f*) =	0.82				
v25	Obs	Mean	*SE*	*SD*	95% CI
v25 CHWcert No	115	3.56	0.09	1.01	3.37 - 3.74
v25 CHWcert Yes	81	3.90	0.10	0.93	3.70 - 4.11
combined	196	3.70	0.07	0.99	3.56 - 3.84
ratio = *sd*(No) /*sd*(Yes) *f* =	1.18				
Ha: ratio != 1 2Pr(*F*< *f*) =	0.43				

* $p < 0.05$

Table 5.F

Homogeneity of Variance Levene's Test with Robost Estimations (robvarb test)

TCI All	Freq.	Mean	*SD*
TCIall CHWcert No	18.67	3.20	115
TCIall CHWcert Yes	18.85	3.81	80
W0 = 2.49 *df*(1, 193) Pr > *F* = 0.33			
W50 = 2.14 *df*(1, 193) Pr > *F* = 0.23			
W10 = 2.18 *df*(1, 193) Pr > *F* = 0.20			

TCI partnership subscale	Freq.	Mean	*SD*
TCIpartn CHWcert No	4.08	0.73	115
TCIpartn CHWcert Yes	3.98	0.96	81
W0 = 1.94 *df*(1, 194) Pr > *F* = 0.17			
W50 = 1.67 *df*(1, 194) Pr > *F* = 0.20			
W10 = 1.00 *df*(1, 194) Pr > *F* = 0.32			

TCI support subscale	Freq.	Mean	*SD*
TCIsuppt CHWcert No	3.78	0.74	115
TCIsuppt CHWcert Yes	3.86	0.88	81
W0 = 4.14 *df*(1, 194) Pr > *F* = 0.04*			
W50 = 3.33 *df*(1, 194) Pr > *F* = 0.07			
W10 = 3.06 *df*(1, 194) Pr > *F* = 0.08			

Table 5.F (cont.)

TCI object subscale	Freq.	Mean	*SD*
TCIobject CHWcert No	5.57	1.07	115
TCIobject CHWcert Yes	5.69	1.11	80
W0 = 0.48 *df*(1, 194) Pr > *F* = 0.49			
W50 = 0.34 *df*(1, 194) Pr > *F* = 0.56			
W10 = 0.37 *df*(1, 194) Pr > *F* = 0.54			
TCI style subscale	**Freq.**	**Mean**	***SD***
TCIstyle CHWcert No	5.24	1.25	115
TCIstyle CHWcert Yes	5.38	1.29	81
W0 = 0.19 *df*(1, 194) Pr > *F* = 0.66			
W50 = 0.15 *df*(1, 194) Pr > *F* = 0.70			
W10 = 0.16 *df*(1, 194) Pr > *F* = 0.69			
v24	**Freq.**	**Mean**	***SD***
v24 CHWcert No	3.63	1.00	115
v24 CHWcert Yes	3.86	0.97	81
W0 = 0.93 *df*(1, 194) Pr > *F* = 0.17			
W50 = 1.43 *df*(1, 194) Pr > *F* = 0.20			
W10 = 1.62 *df*(1, 194) Pr > *F* = 0.32			
v25	**Freq.**	**Mean**	***SD***
v25 CHWcert No	3.56	1.01	115
v25 CHWcert Yes	3.90	0.93	81
W0 = 2.46 *df*(1, 194) Pr > *F* = 0.12			
W50 = 1.76 *df*(1, 194) Pr > *F* = 0.19			
W10 = 3.42 *df*(1, 194) Pr > *F* = 0.07			

[b] "W0 = the equality of variances between the groups defined with two statistics proposed by Brown and Forsythe that replace the mean in Levene's formula with alternative location estimators. W50 = replaces the mean with the median. W10 = replaces the mean with the 10% trimmed mean" (StataCorp, 2011, Stata help file: sdtest Variance-comparison tests).

Table 6.F

Transformed Independent Variables Organizational Size (logOrgSize), Team Size (logTeamSize), and Number of CHWs on Team (logNumCHWonTeam).

Variable	Mean	*N*	*SD*	Variance	*SE* (mean)	Skewness	Excess kurtosis
logOrgSize	5.01	189	1.82	3.30	0.13	0.61	0.57
CHWcert Yes	4.79	79	2.16	4.66	0.24	0.83	0.03
CHWcert No	5.16	110	1.51	2.30	0.14	0.41	1.42
logTeamSize	2.50	187	0.86	0.75	0.06	0.21	0.75
CHWcert Yes	2.33	77	0.82	0.67	0.09	0.37	0.89
CHWcert No	2.62	110	0.88	0.77	0.08	0.08	0.83

Table 6.F (cont.)

Variable	Mean	*N*	*SD*	Variance	*SE* (mean)	Skewness	Excess kurtosis
logNumCHWonTeam	1.48	188	0.90	0.80	0.07	0.98	1.75
CHWcert Yes	1.64	77	1.00	1.01	0.11	0.96	1.37
CHWcert No	1.37	111	0.80	0.64	0.08	0.81	1.34

Table 7.F

Skewness and kurtosis testing (sktesta) for Transformed Independent Variables

Variable	Obs	Pr(Skewness)	Pr(Kurtosis)	joint adj chi2(2)	joint Prob>chi2
logOrgSize All	189.00	0.00**	0.11	11.63	0.00
CHWcert Yes	79.00	0.00**	0.69	7.79	0.02
CHWcert No	110.00	0.07	0.02*	8.14	0.02
logTeamSize All	187	0.22	0.06	5.14	0.08
CHWcert Yes	77	0.17	0.10	4.71	0.09
CHWcert No	110	0.71	0.08	3.28	0.19
logNumCHWo~m	188	0.00**	0.00**	26.84	0.00
CHWcert Yes	77	0.00**	0.03*	12.41	0.00
CHWcert No	111	0.00**	0.02*	13.49	0.00

* $p < 0.05$, ** $p < 0.01$

Table 8.F

Multiple Regression Analysis of TCI Overall (TCIall) Score

Number of obs =	154					
F(4, 150) =	2.42					
Prob > *F* =	0.05					
R-squared =	0.06					
Root MSE =	3.34					
TCIall	Coef.	*SE*	*t*	*P>t*	95% CI	
CHWcert	-0.17	0.67	-0.25	0.80	-1.50	1.16
logOrgSize	-0.14	0.15	-0.97	0.34	-0.43	0.15
TeamTen	-0.08	0.05	-1.43	0.16	-0.19	0.03
Orgtypedich	-1.62	0.73	-2.23	0.03*	-3.06	-0.18
_cons	21.40	1.22	17.47	0.00	18.98	23.82

* $p < 0.05$

Table 9.F

Variance Inflation Factor (vif) for TCI Overall (TCIall) Regression Variables

Variable	VIF	1/VIF
Orgtypedich	1.35	0.74
CHWcert	1.25	0.80
logOrgSize	1.12	0.89
TeamTen	1.04	0.96
Mean VIF	1.19	

Table 10.F

Multiple Regression Analysis of TCI Partnership (TCIpartn) Subscale Scores

Number of obs =	147					
F(4, 150) =	1.96					
Prob > *F* =	0.08					
R-squared =	0.10					
Root MSE =	0.74					
TCIpartn	Coef.	*SE*	*t*	*P>t*	95% CI	
CHWcert	-0.12	0.16	-0.74	0.46	-0.44	0.20
logOrgSize	-0.05	0.03	-1.53	0.13	-0.12	0.02
TeamTen	-0.01	0.01	-1.06	0.29	-0.04	0.01
Orgtypedich	-0.25	0.17	-1.50	0.14	-0.58	0.08
Workyears	-0.01	0.01	-1.31	0.19	-0.03	0.01
MetroRurdich	0.28	0.13	2.22	0.03*	0.03	0.53
_cons	4.66	0.29	16.04	0.00	4.09	5.24

* $p < 0.05$

Table 11.F

Variance Inflation Factor (vif) for TCI Partnership (TCIpartn) Regression Variables

Variable	VIF	1/VIF
TeamTen	1.74	0.58
Workyears	1.70	0.59
Orgtypedich	1.42	0.70
CHWcert	1.28	0.78
logOrgSize	1.20	0.83
MetroRurdich	1.04	0.96
Mean VIF	1.40	

Table 12.F

Multiple Regression Analysis of TCI Support Subscale (TCIsuppt)

Number of obs =	155					
F(4, 150) =	2.15					
Prob > *F* =	0.08					
R-squared =	0.04					
Root MSE =	0.79					
TCIsuppt	Coef.	*SE*	*t*	*P>t*	95% CI	
CHWcert	0.03	0.15	0.22	0.82	-0.27	0.34
logOrgSize	0.00	0.04	0.02	0.99	-0.07	0.08
TeamTen	-0.01	0.01	-0.76	0.45	-0.03	0.01
Orgtypedich	-0.38	0.19	-2.03	0.04*	-0.76	-0.01
_cons	4.15	0.32	12.80	0.00	3.51	4.79

* $p < 0.05$

Table 13.F

Variance Inflation Factor (vif) for TCI Support Regression

TCIsuppt	VIF	1/VIF
Orgtypedich	1.34	0.75
CHWcert	1.25	0.80
logOrgSize	1.12	0.89
TeamTen	1.05	0.96
Mean VIF	1.19	

Table 14.F

Multiple Regression Analysis of TCI Objectives (TCIobject) Subscale Scores

Number of obs =	154					
F(4, 150) =	2.94					
Prob > *F* =	0.01					
R-squared =	0.09					
Root MSE =	1.05					
TCIobject	Coef.	*SE*	*t*	*P>t*	95% CI	
CHWcert	-0.08	0.21	-0.37	0.72	-0.48	0.33
TeamTen	-0.03	0.02	-1.51	0.13	-0.06	0.01
logOrgSize	-0.03	0.05	-0.69	0.49	-0.13	0.06
Orgtypedich	-0.41	0.24	-1.73	0.09	-0.88	0.06
TeamMembdich	-0.43	0.18	-2.39	0.02*	-0.79	-0.07
_cons	6.51	0.42	15.4	0	5.68	7.34

*$p < 0.05$

Table 15.F

Variance Inflation Factor (vif) Analysis for TCI Objectives (TCIobject) Subscale

TCIobject	VIF	1/VIF
Orgtypedich	1.37	0.73
CHWcert	1.30	0.77
logOrgSize	1.14	0.88
TeamMembdich	1.09	0.92
TeamTen	1.05	0.95
Mean VIF	1.19	

Table 16.F

Multiple Regression Analysis of TCI Style (TCIstyle) Subscale Scores

Number of obs =	155					
F(4, 150) =	1.73					
Prob > *F* =	0.15					
R-squared =	0.03					
Root MSE =	1.27					
TCIstyle	Coef.	*SE*	*t*	*P>t*	95% CI	
CHWcert	0.04	0.24	0.15	0.88	-0.44	0.51
logOrgSize	-0.04	0.05	-0.73	0.47	-0.14	0.06
TeamTen	-0.02	0.02	-0.96	0.34	-0.06	0.02
Orgtypedich	-0.49	0.26	-1.89	0.06	-0.99	0.02
_cons	5.98	0.41	14.55	0.00	5.17	6.79

Table 17.F

Variance Inflation Factor (vif) Analysis for TCI Style (TCIstyle) Subscale

Variable	VIF	1/VIF
Orgtypedich	1.34	0.75
CHWcert	1.25	0.80
logOrgSize	1.12	0.89
TeamTen	1.05	0.96
Mean VIF	1.19	

Table 18.F

Multiple Regression Analysis of Survey Question 24 (v24) "State certification of CHWs increases or would increase my confidence in working with them"

Number of obs =	146
F(6, 139) =	3.21

Table 18.F (cont.)

Prob > F =	0.01					
R-squared =	0.10					
Root MSE =	0.94					
v24	Coef.	Std. Err.	t	P>t	95% CI	
CHWcert	0.17	0.17	1.02	0.31	-0.16	0.51
logOrgSize	0.08	0.05	1.44	0.15	-0.03	0.18
TeamTen	-0.01	0.02	-0.39	0.70	-0.04	0.03
Orgtypedich	0.08	0.24	0.34	0.74	-0.39	0.55
logTeamSize	0.18	0.10	1.80	0.07	-0.02	0.37
logNumCHWonTeam	0.15	0.10	1.52	0.13	-0.05	0.34
_cons	2.61	0.38	6.85	0.00	1.86	3.36

Table 19.F

Variance Inflation Factor (vif) analysis for Survey Question 24 (v24)

Question 24	VIF	1/VIF
CHWcert	1.34	0.75
Orgtypedich	1.34	0.75
logTeamSize	1.28	0.78
logOrgSize	1.23	0.81
logNumCHWo~m	1.18	0.85
TeamTen	1.05	0.95
Mean VIF	1.24	

Table 20.F

Multiple Regression Analysis of Survey Question 25 (v25) "State certification of CHWs increases or would increase the ability of my team to provide quality care."

Number of obs =	146					
F(6, 139) =	3.30					
Prob > F =	0.00					
R-squared =	0.10					
Root MSE =	0.95					
v25	Coef.	Std. Err.	t	P>t	95% CI	
CHWcert	0.31	0.18	1.74	0.08	-0.04	0.66
logOrgSize	0.06	0.05	1.29	0.20	-0.03	0.16
TeamTen	0.01	0.02	0.44	0.66	-0.03	0.04
Orgtypedich	0.03	0.22	0.16	0.88	-0.41	0.48
logTeamSize	0.15	0.09	1.66	0.10	-0.03	0.34
logNumCHWonTeam	0.16	0.10	1.66	0.10	-0.03	0.36
_cons	2.54	0.38	6.77	0.00	1.80	3.29

Table 21.F

Variance Inflation Factor (vif) analysis for Survey Question 25 (v25)

Question 25	VIF	1/VIF
CHWcert	1.34	0.75
Orgtypedich	1.34	0.75
logTeamSize	1.28	0.78
logOrgSize	1.23	0.81
logNumCHWo~m	1.18	0.85
TeamTen	1.05	0.95
Mean VIF	1.24	

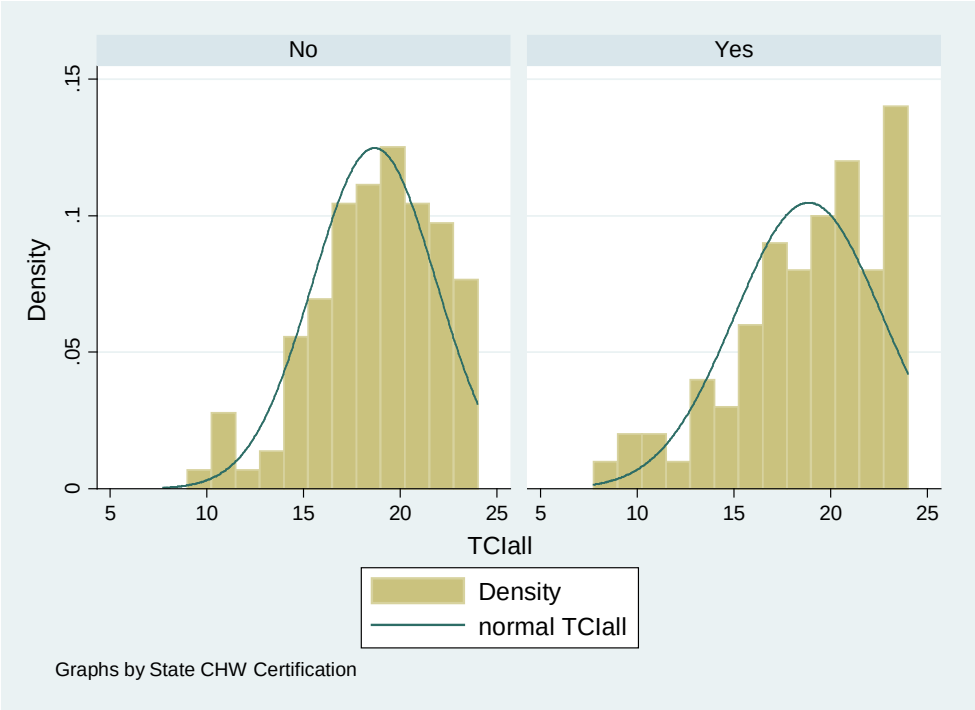

Figure 1.F. Histogram TCI survey, sum of subscale means for TCIpartn, TCIsuppt, TCIobject, and TCIstyle, by CHW state certification.

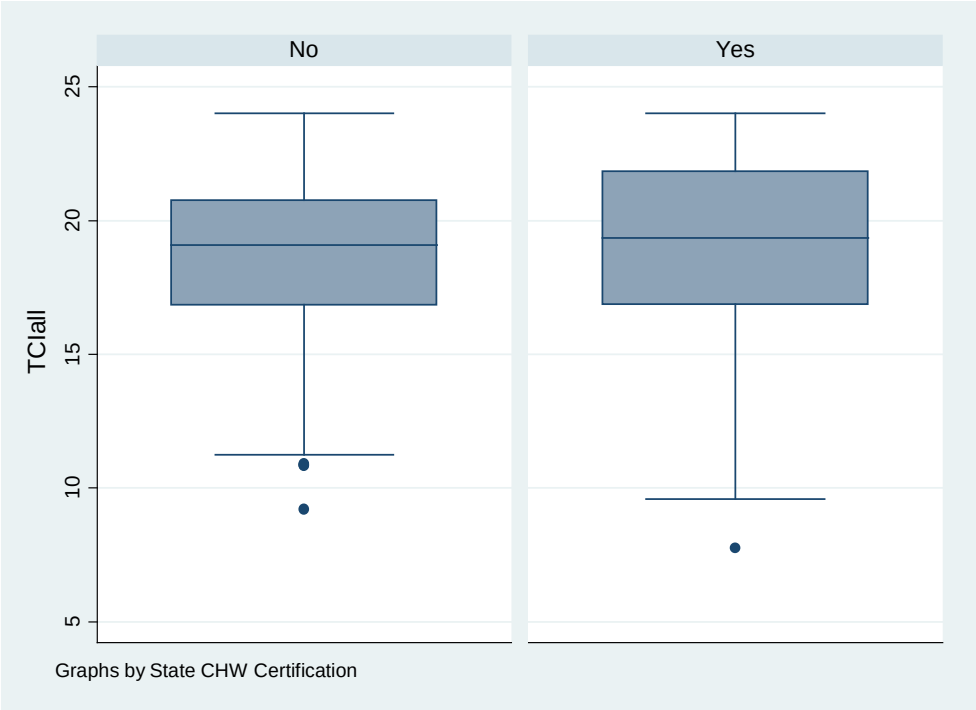

Figure 2.F. Box plots of TCI survey, sum of subscale means for TCIpartn, TCIsuppt, TCIobject, and TCIstyle, by CHW state certification.

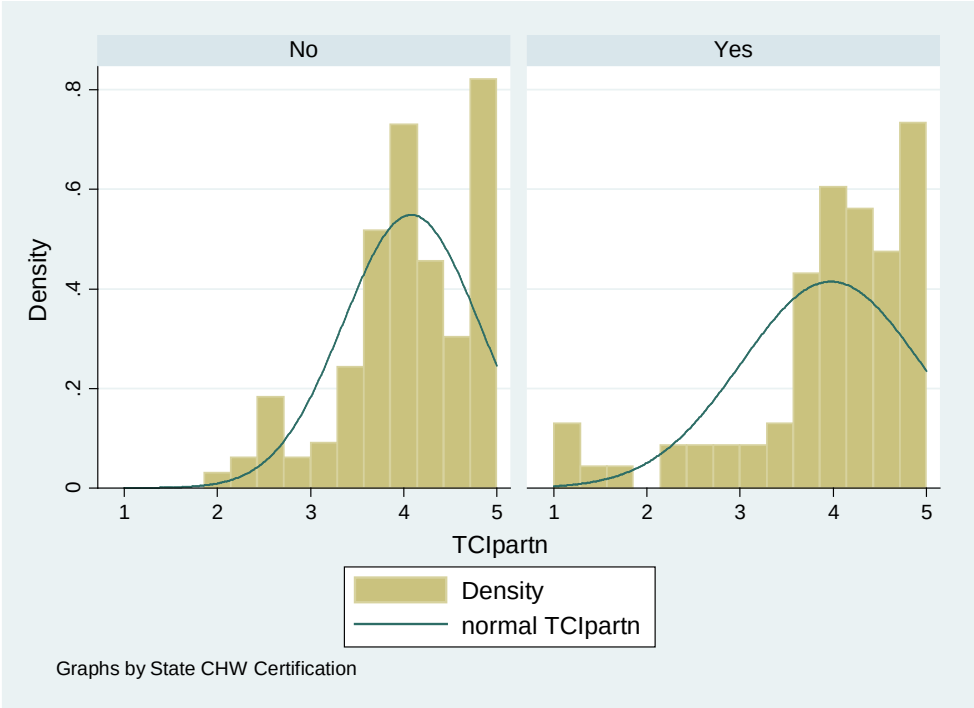

Figure 3.F. Histogram mean values TCI Partnership (TCIpartn) subscale by CHW state certification.

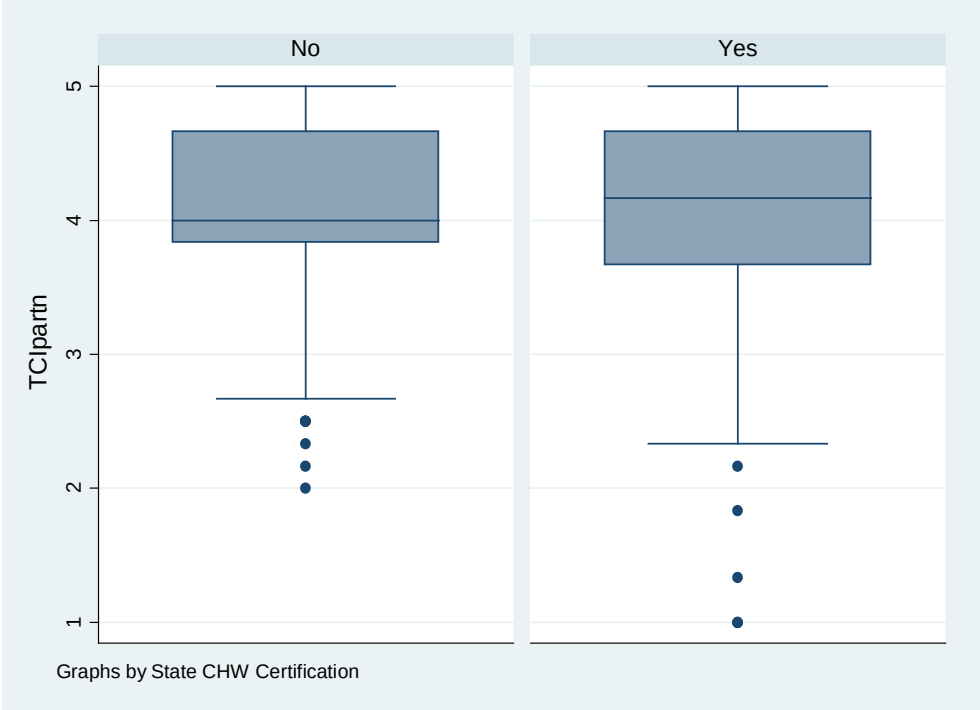

Figure 4.F. Box plots mean values TCI Partnership (TCIpartn) subscale by CHW state certification.

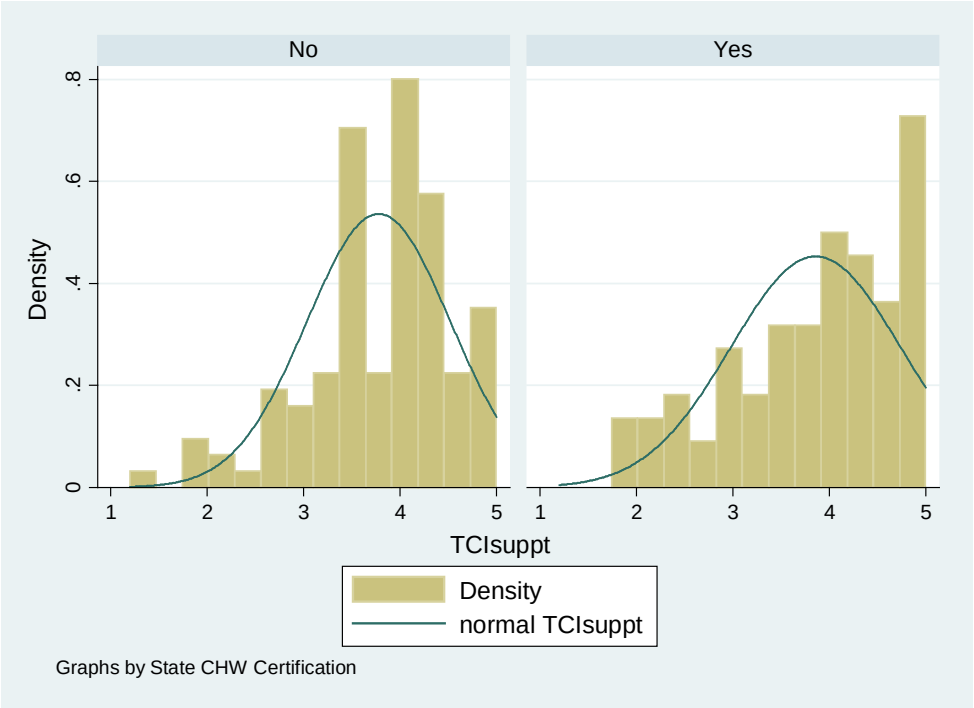

Figure 5.F. Histogram mean values TCI Support (TCIsuppt) subscale by CHW state certification.

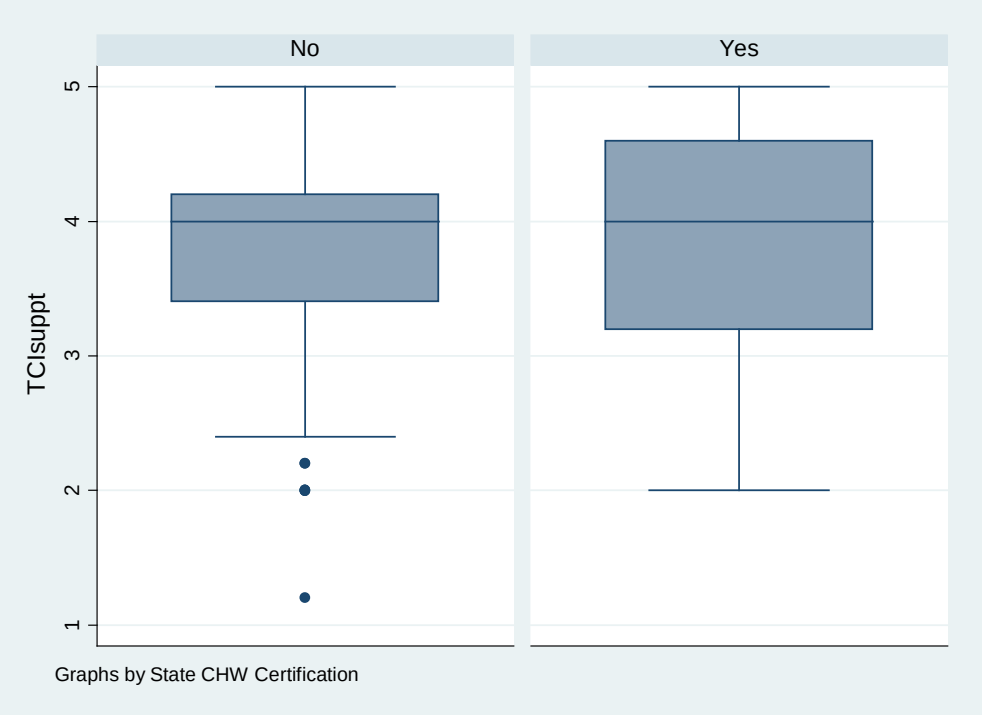

Figure 6.F. Box plots mean values TCI Support (TCIsuppt) subscale by CHW state certification.

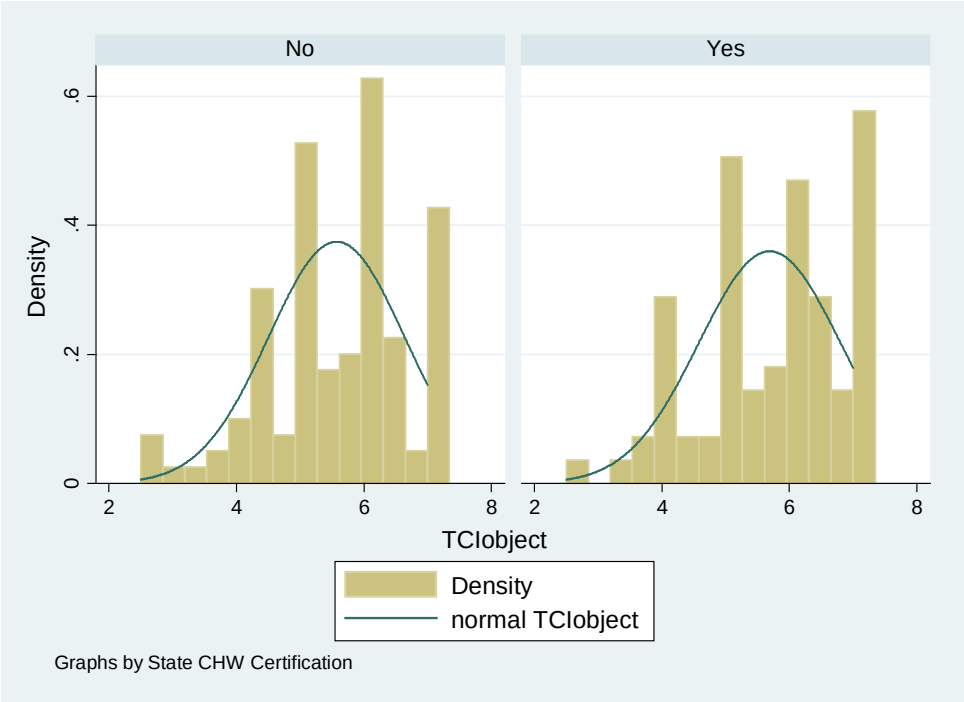

Figure 7.F. Histogram mean values TCI Object (TCIobject) subscale by CHW state certification.

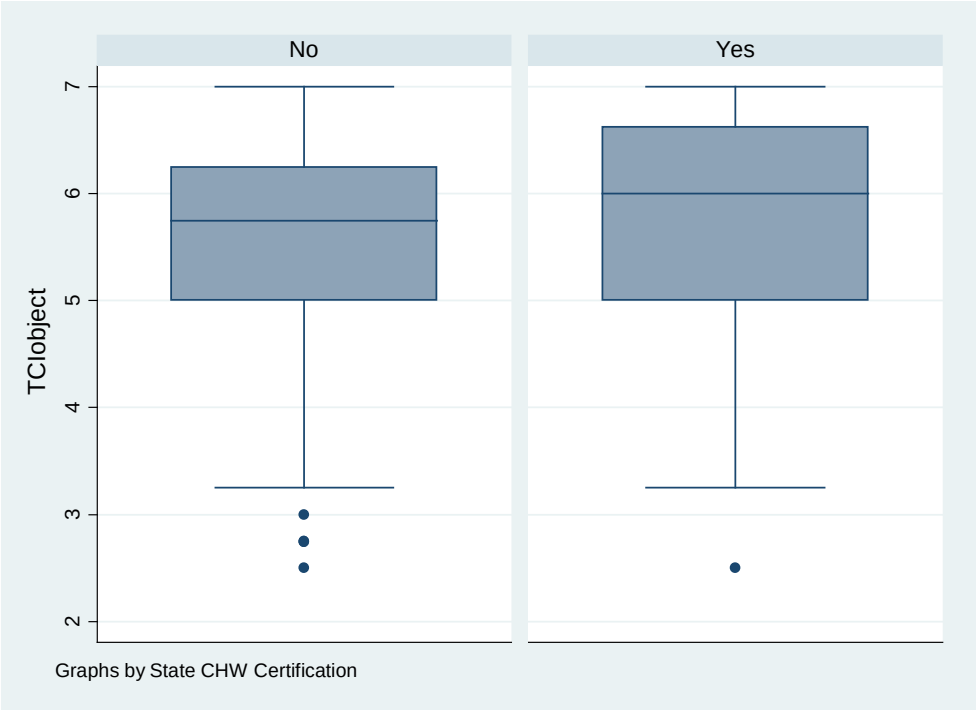

Figure 8.F. Box plots mean values TCI Object (TCIobject) subscale by CHW state certification.

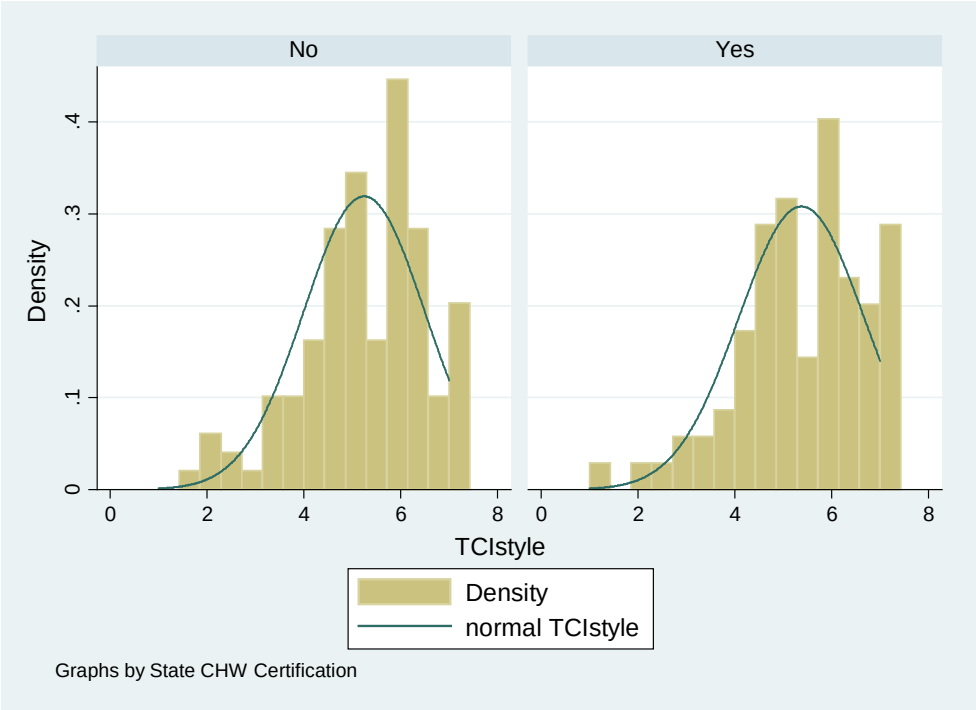

Figure 9.F. Histogram mean values TCI Style (TCIstyle) subscale by CHW state certification.

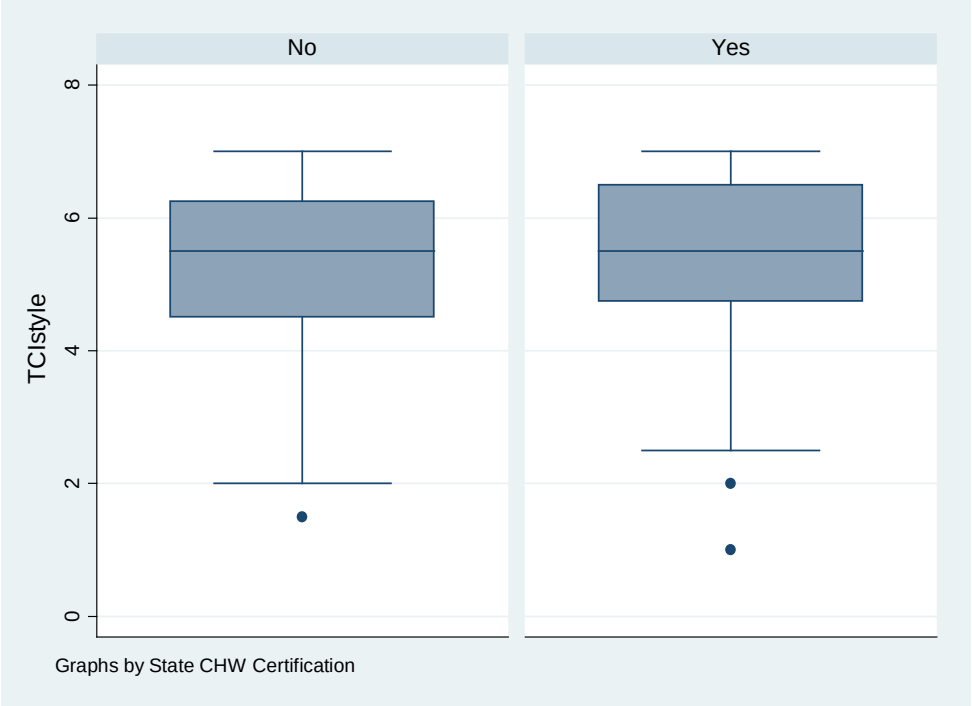

Figure 10.F. Box plots mean values TCI Style (TCIstyle) subscale by CHW state certification.

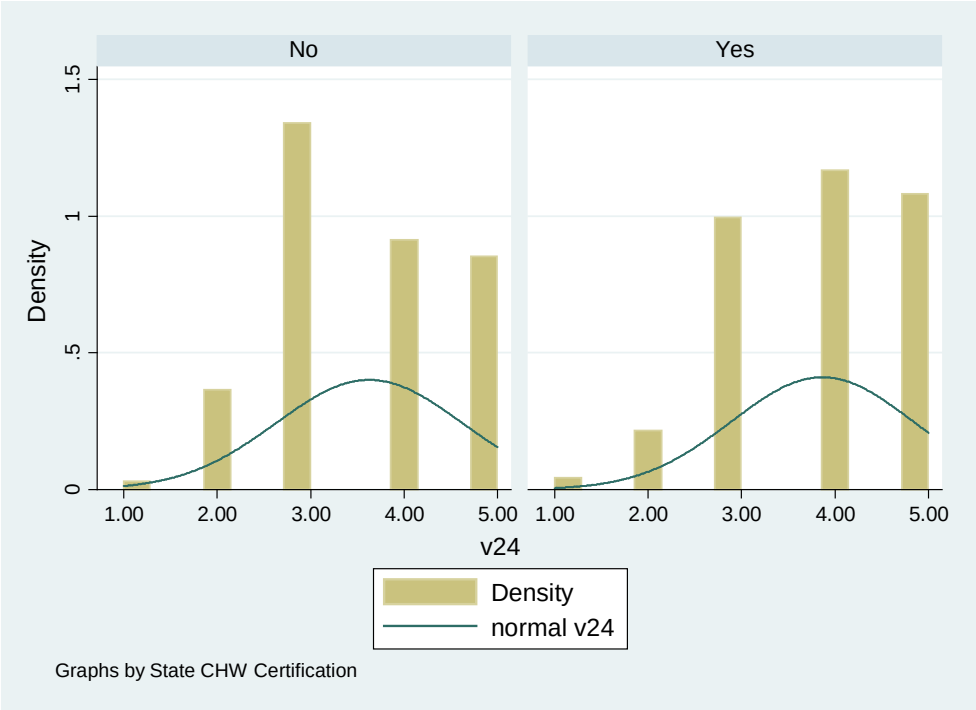

Figure 11.F. Histogram v24, State certification of CHWs increases or would increase my confidence in working with them by CHW state certification.

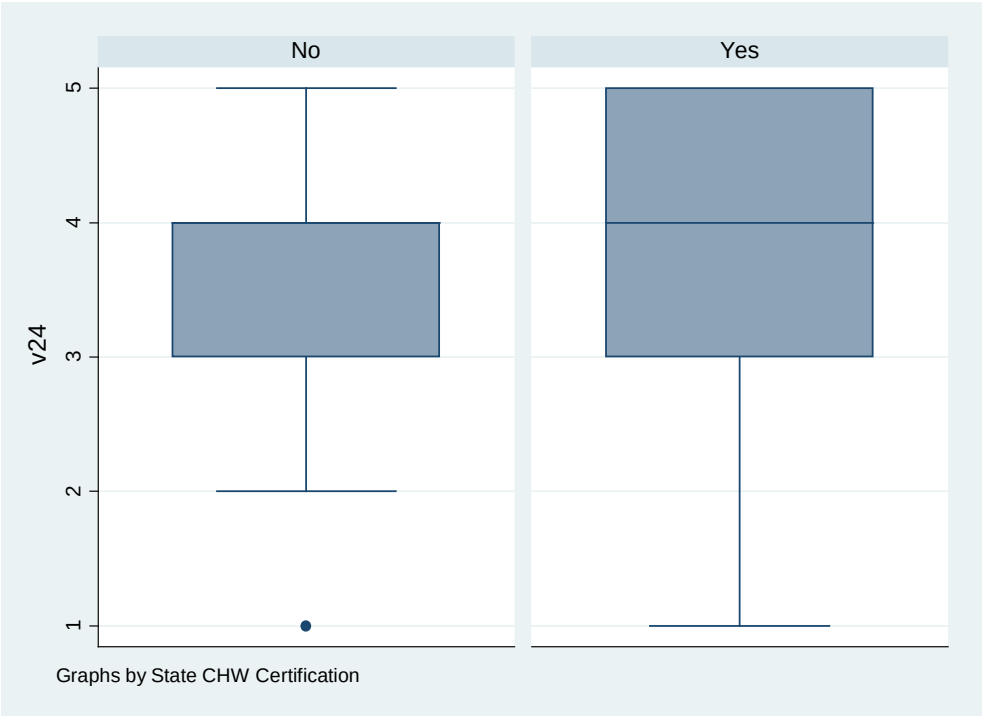

Figure 12.F. Box plots v24, State certification of CHWs increases or would increase my confidence in working with them by CHW state certification.

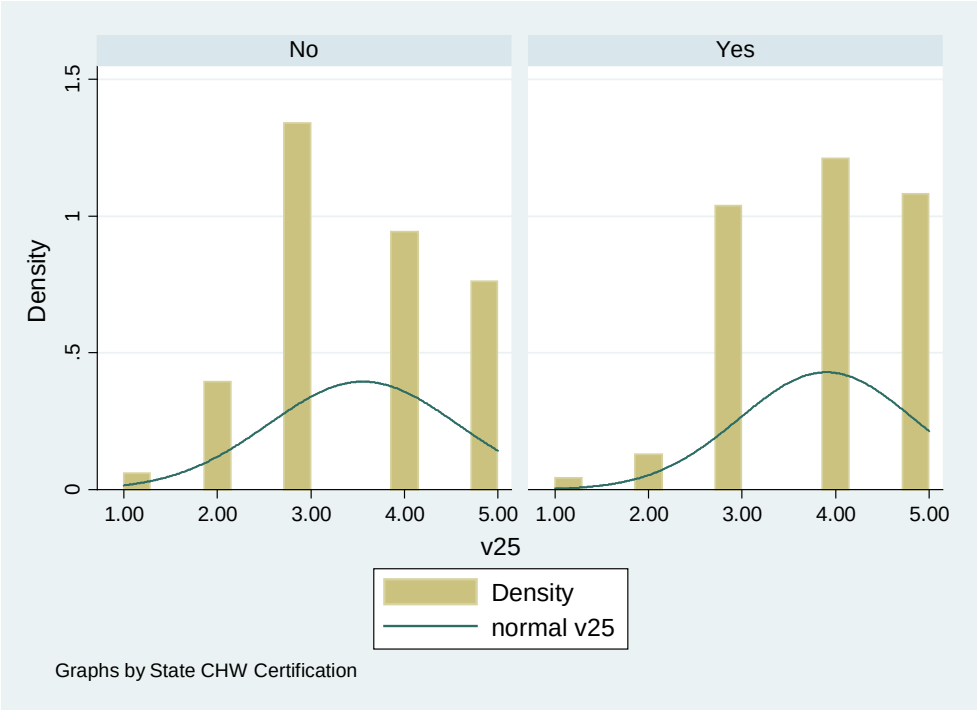

Figure 13.F. Histogram v25, State certification of CHWs increases or would increase the ability of my team to provide quality care by CHW state certification.

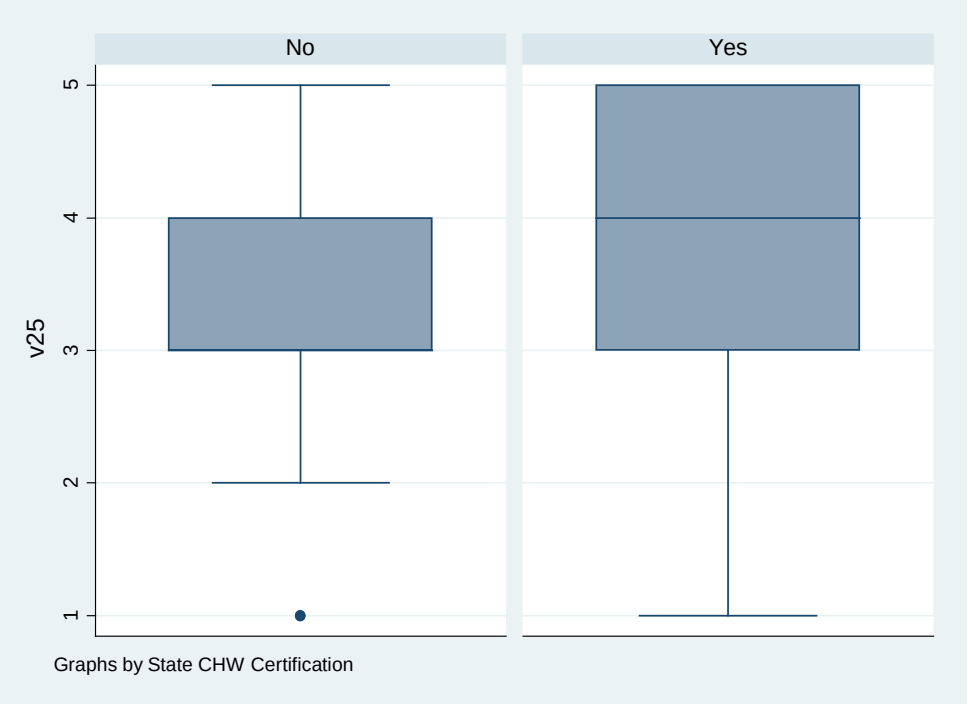

Figure 14.F. Box plots v25, State certification of CHWs increases or would increase the ability of my team to provide quality care by CHW state certification.

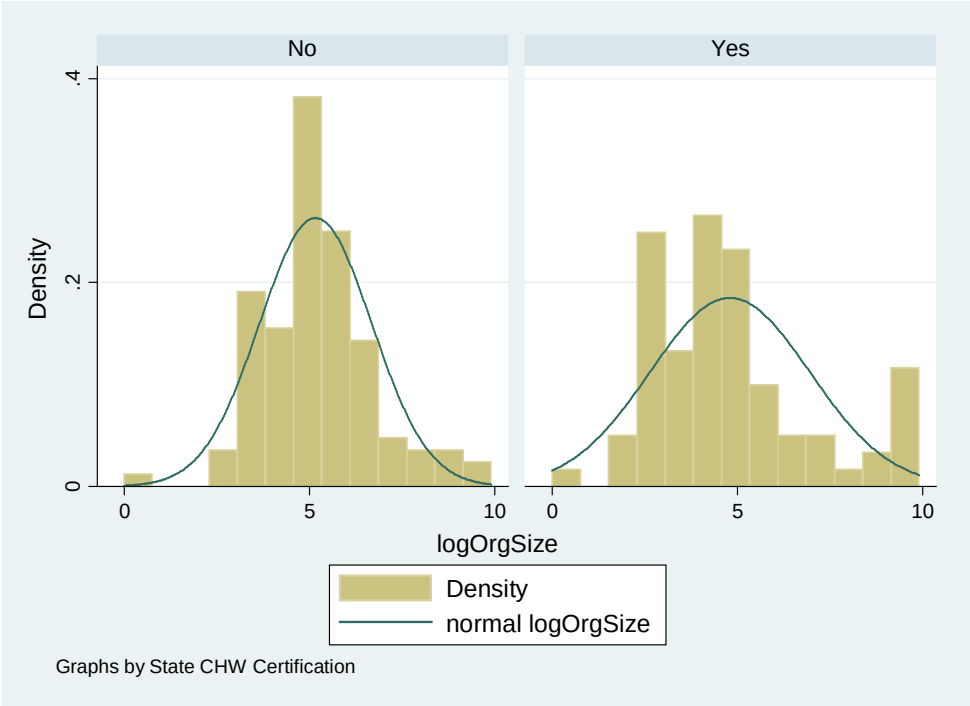

Figure 15.F. Histograms of organizational size variable transformed to natural log by CHW state certification.

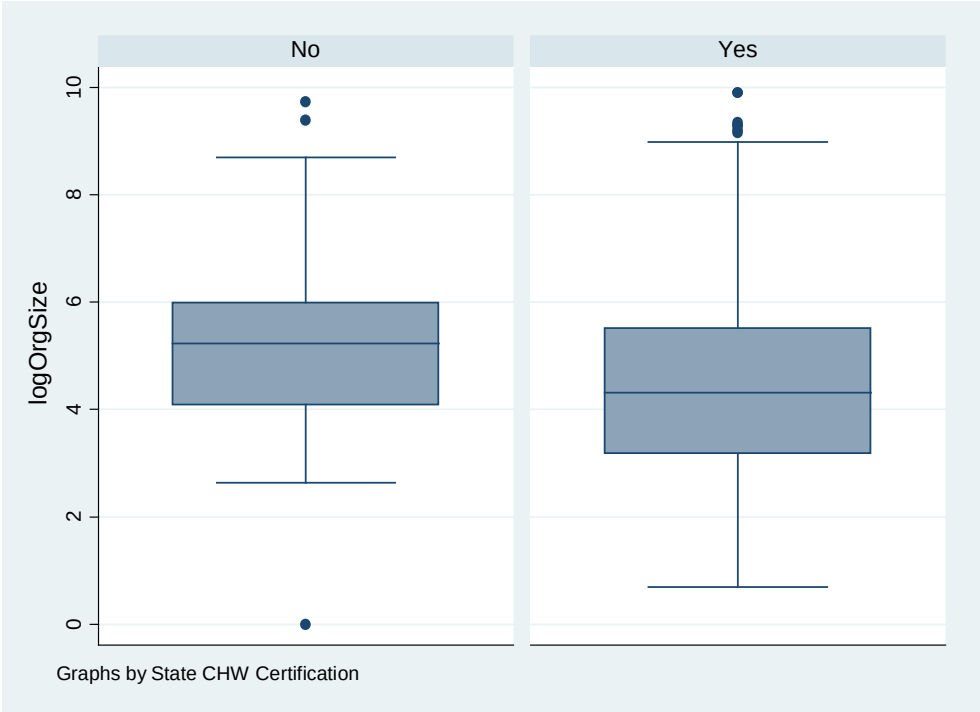

Figure 16.F. Box plots of organizational size variable transformed to natural log by CHW state certification.

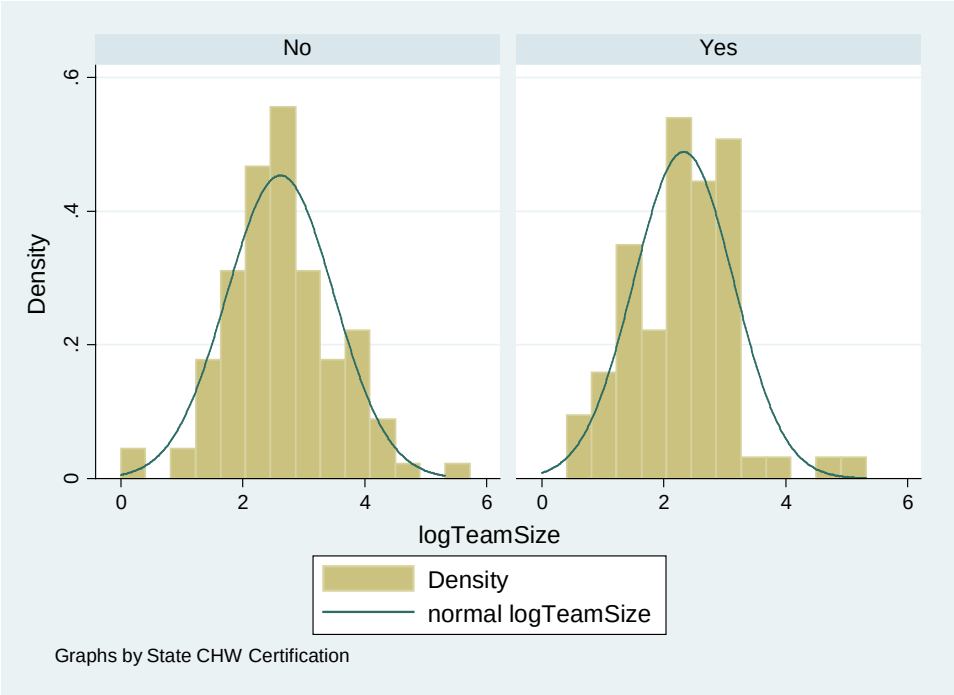

Figure 17.F. Histograms of team size variable transformed to natural log by CHW state certification.

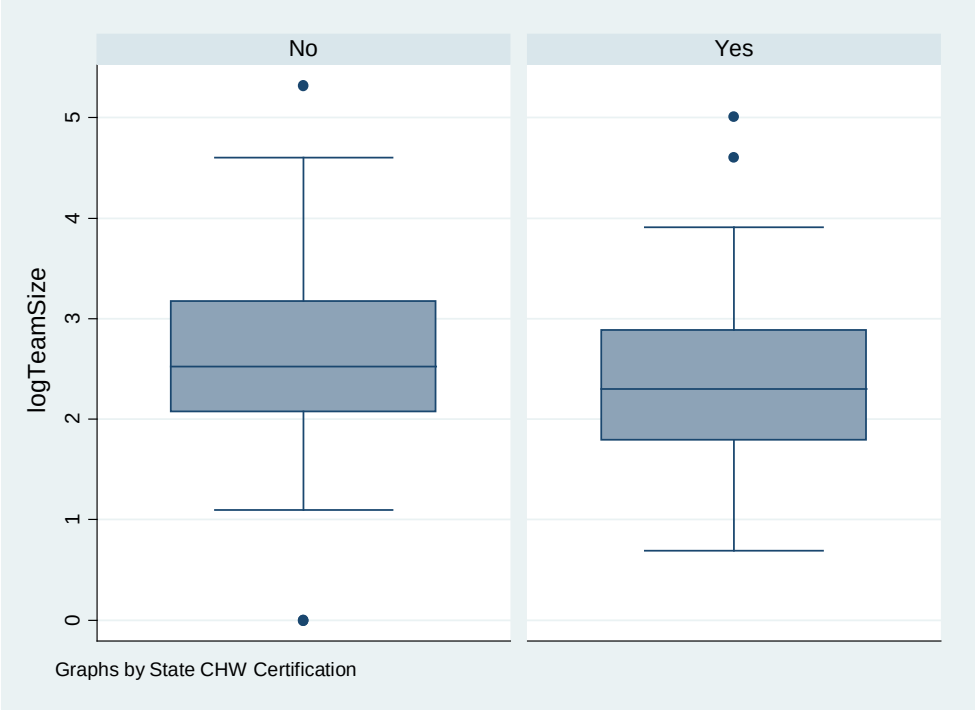

Figure 18.F. Box plots of organizational size variable transformed to natural log by CHW state certification.

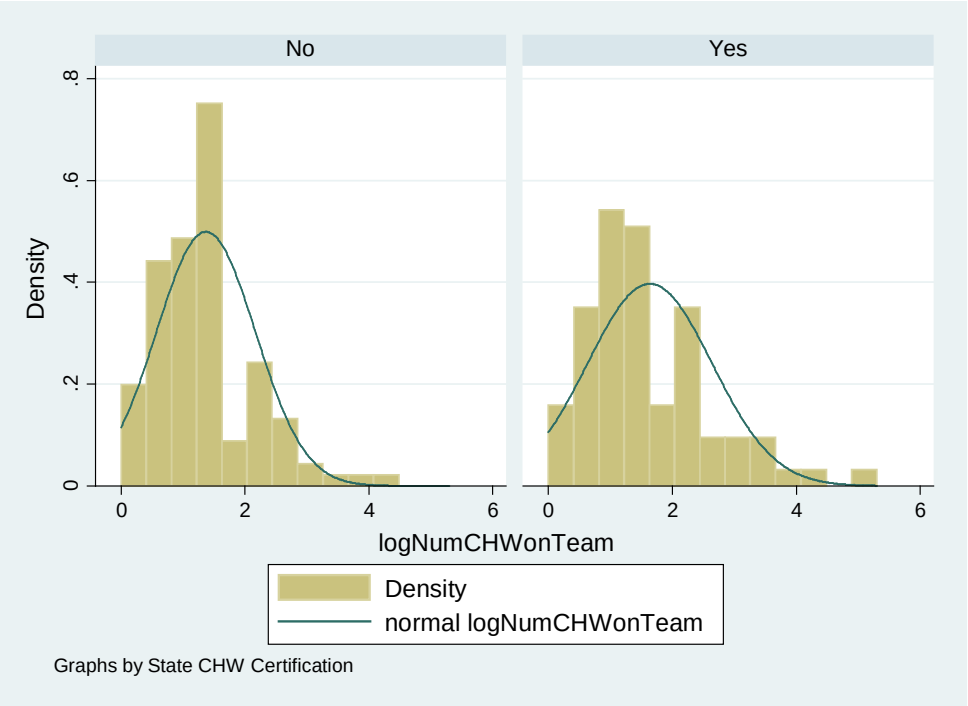

Figure 19.F. Histograms of Number of CHWs on team variable transformed to natural log by CHW state certification.

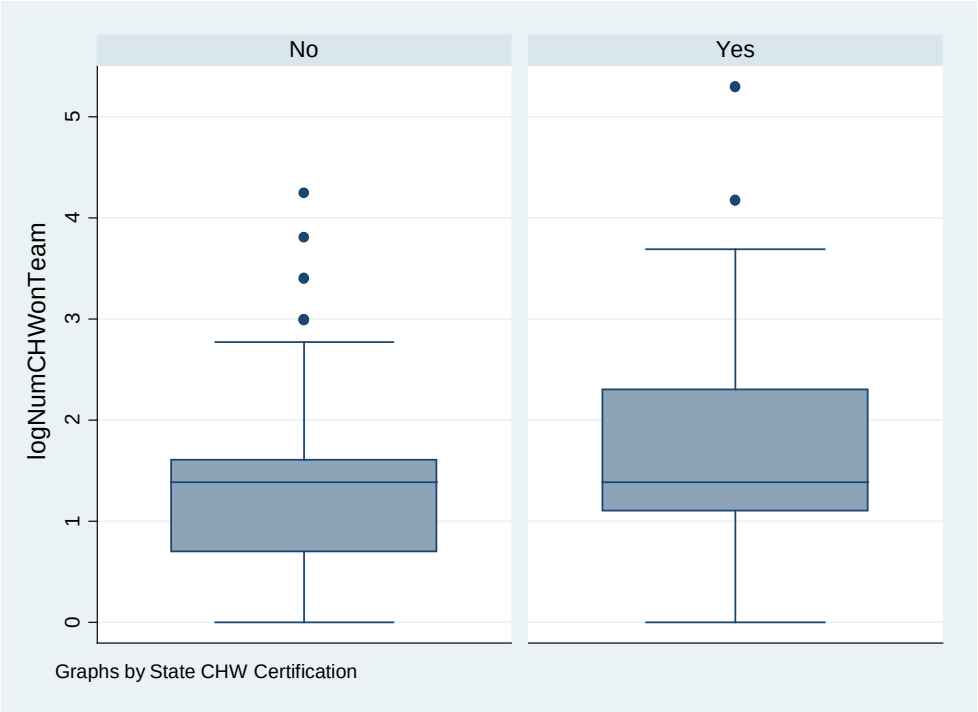

Figure 20.F. Box plots of organizational size variable transformed to natural log by CHW state certification.

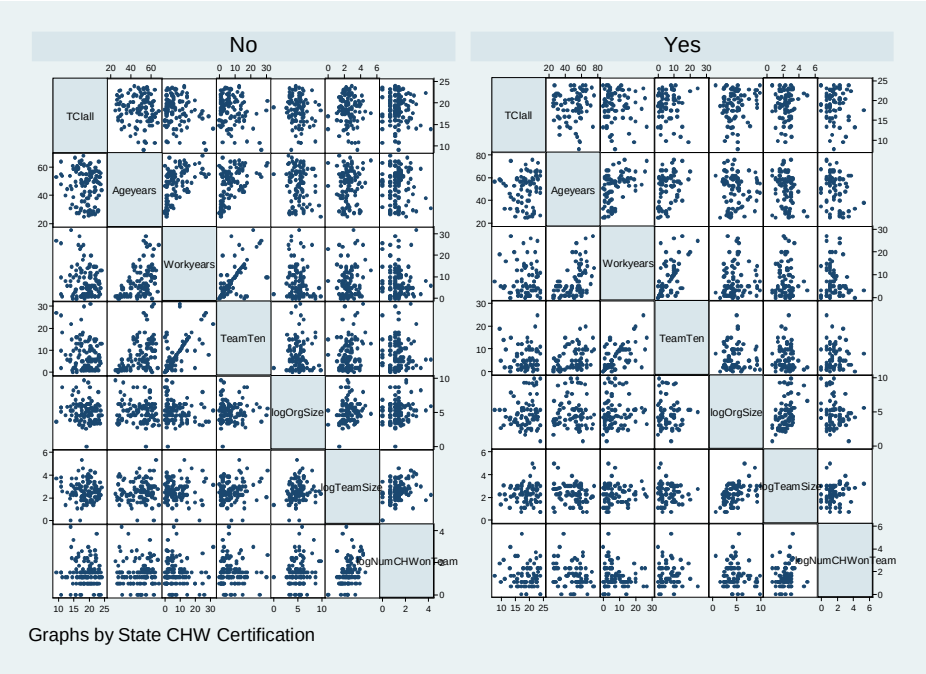

Figure 21.F. Scatter plot matrix with TCIall averages and continuous independent variables: RN age, RN work years, RN team tenure, organizational size (log), team size (log), and number of CHWs on team (log).

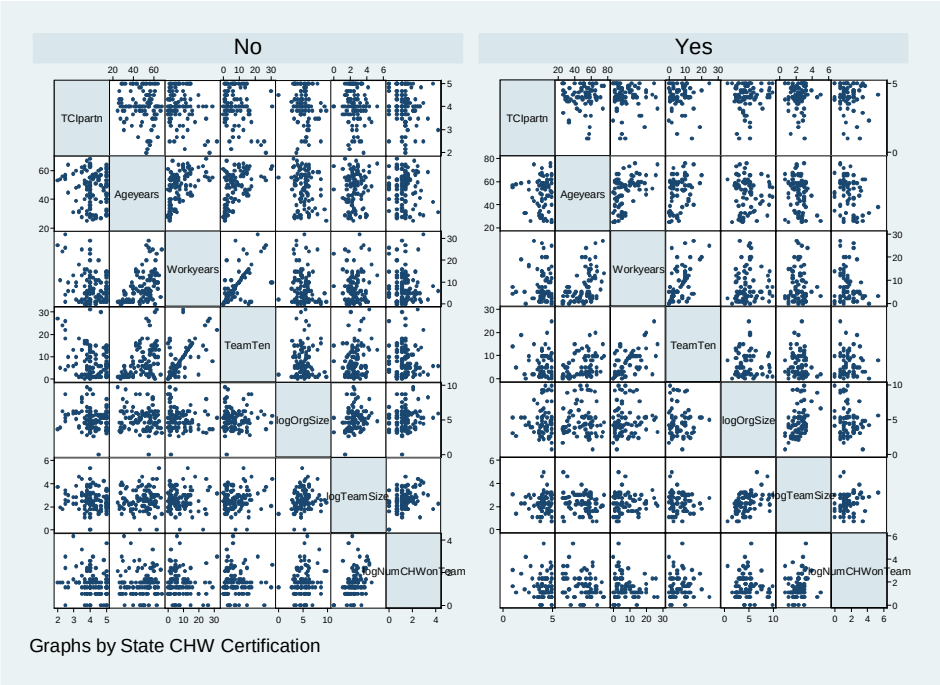

Figure 22.F. Scatter plot matrix with TCIpartn subscale averages and continuous independent variables: RN age, RN work years, RN team tenure, organizational size (log), team size (log), and number of CHWs on team (log).

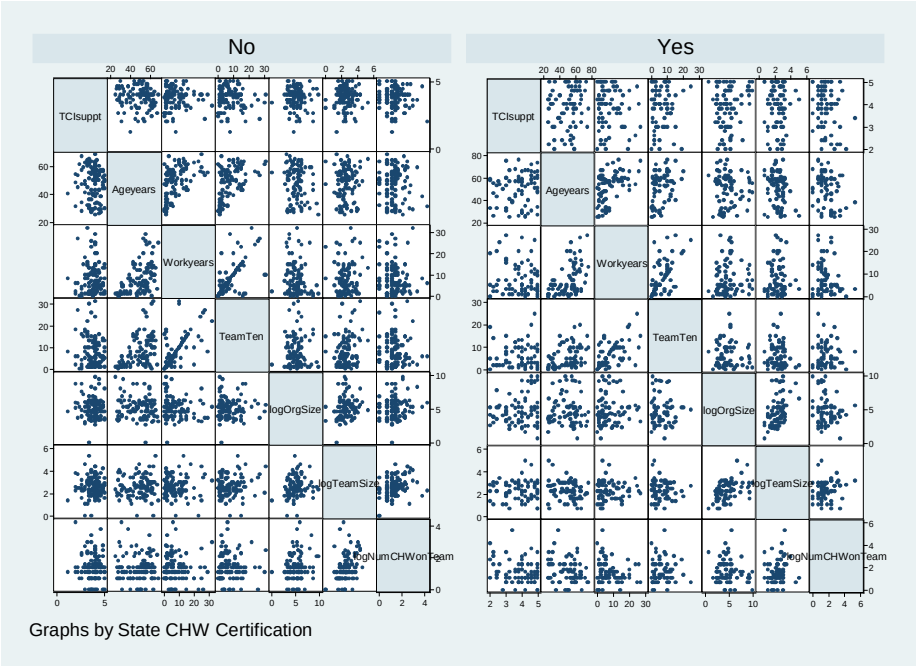

Figure 23.F. Scatter plot matrix with TCIsuppt subscale averages and continuous independent variables: RN age, RN work years, RN team tenure, organizational size (log), team size (log), and number of CHWs on team (log).

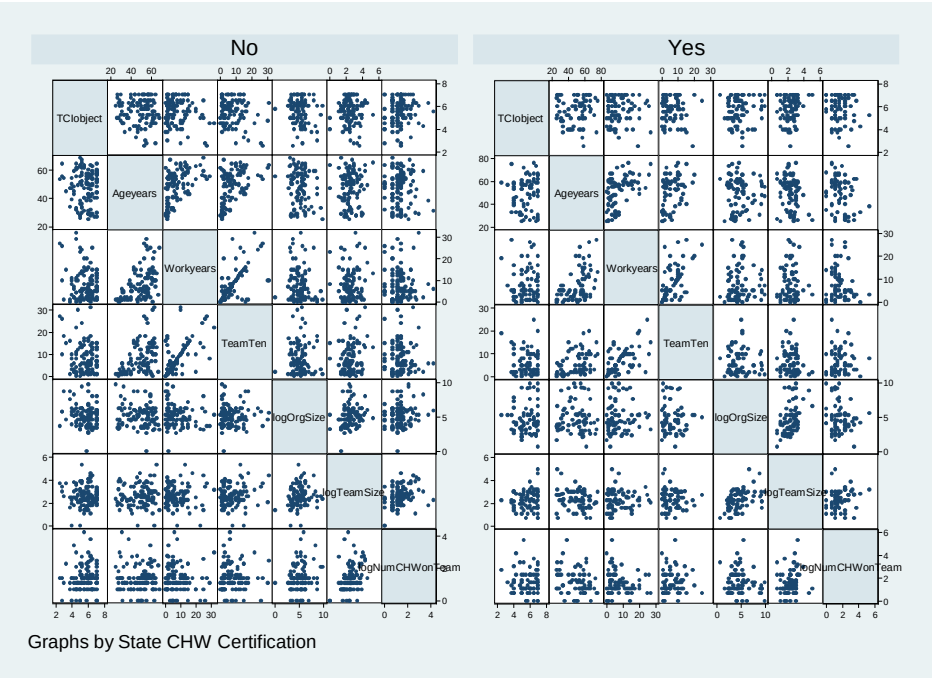

Figure 24.F. Scatter plot matrix with TCIobject subscale averages and continuous independent variables: RN age, RN work years, RN team tenure, organizational size (log), team size (log), and number of CHWs on team (log).

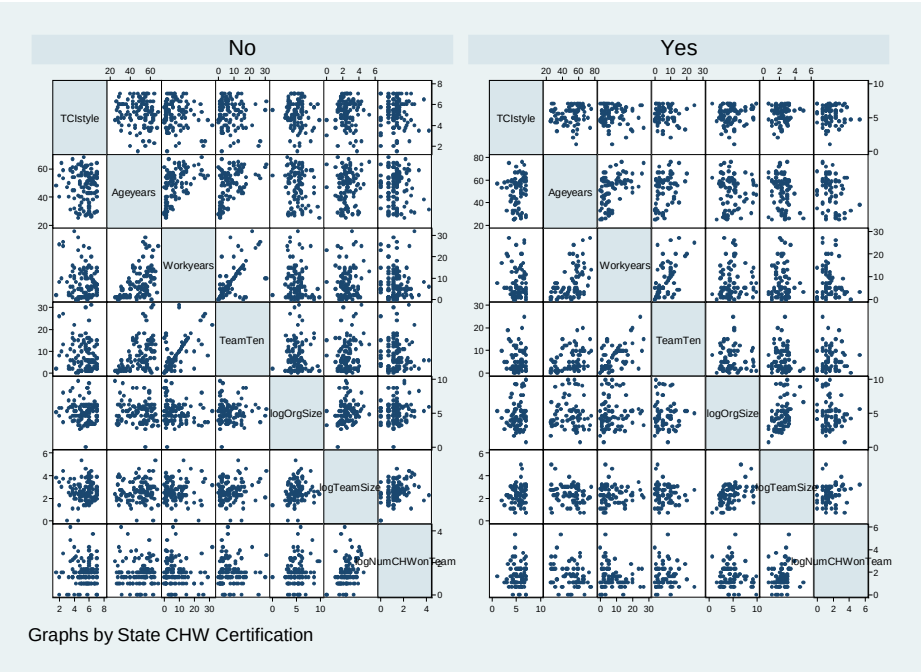

Figure 25.F. Scatter plot matrix with TCIstyle subscale averages and continuous independent variables: RN age, RN work years, RN team tenure, organizational size (log), team size (log), and number of CHWs on team (log).

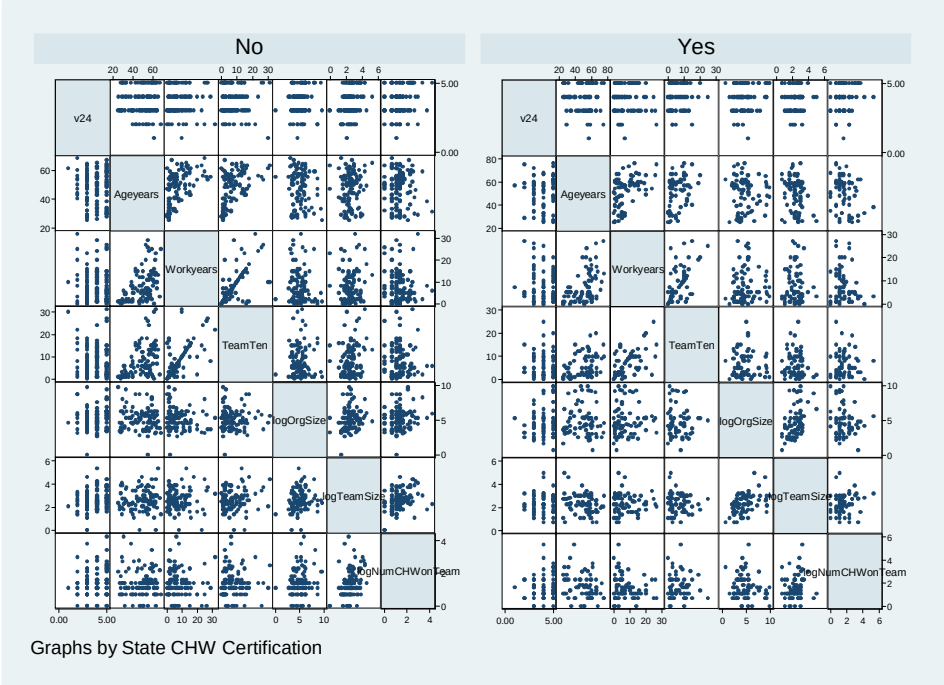

Figure 26.F. Scatter plot matrix with v24 and continuous independent variables: RN age, RN work years, RN team tenure, organizational size (log), team size (log), and number of CHWs on team (log).

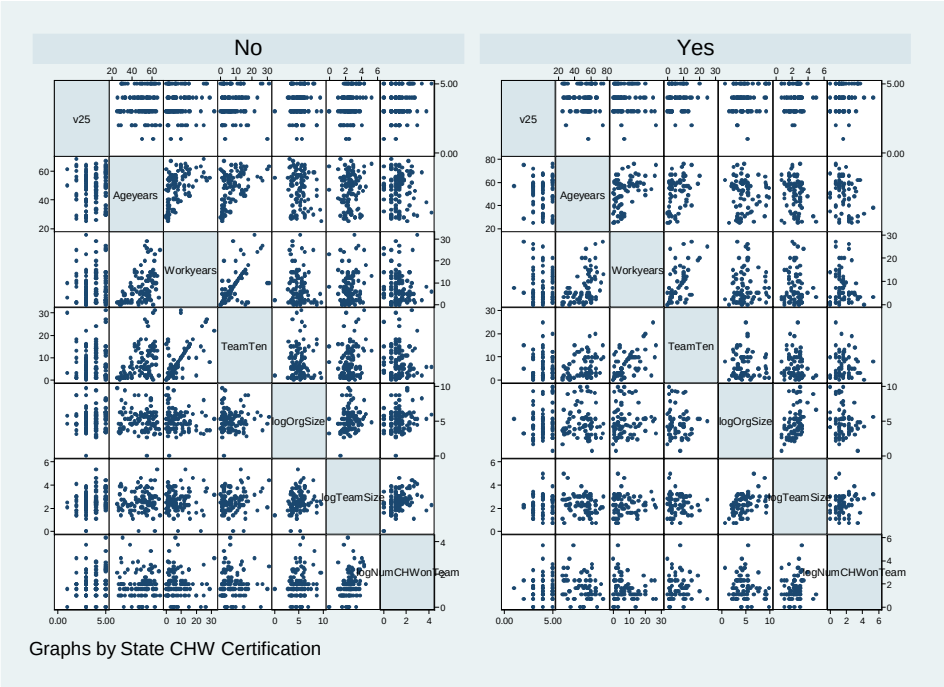

Figure 27.F. Scatter plot matrix with v25 and continuous independent variables: RN age, RN work years, RN team tenure, organizational size (log), team size (log), and number of CHWs on team (log).

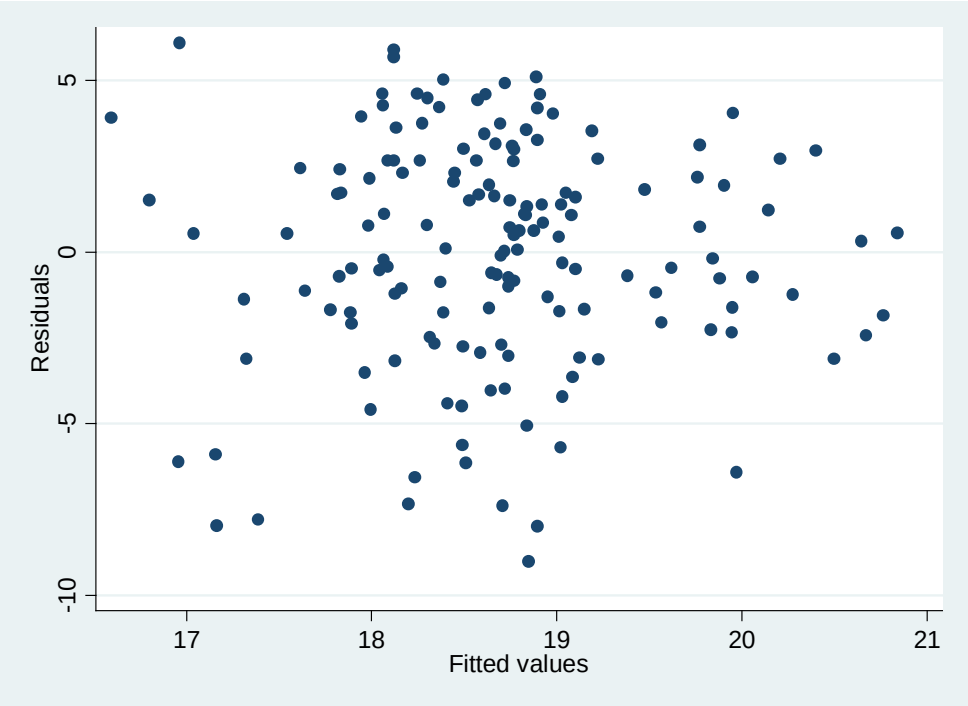

Figure 28.F. Post regression residual-versus-fitted plot (rvfplot) for TCI overall score and CHWcert, logOrgSize, TeamTen, and Orgtypedich.

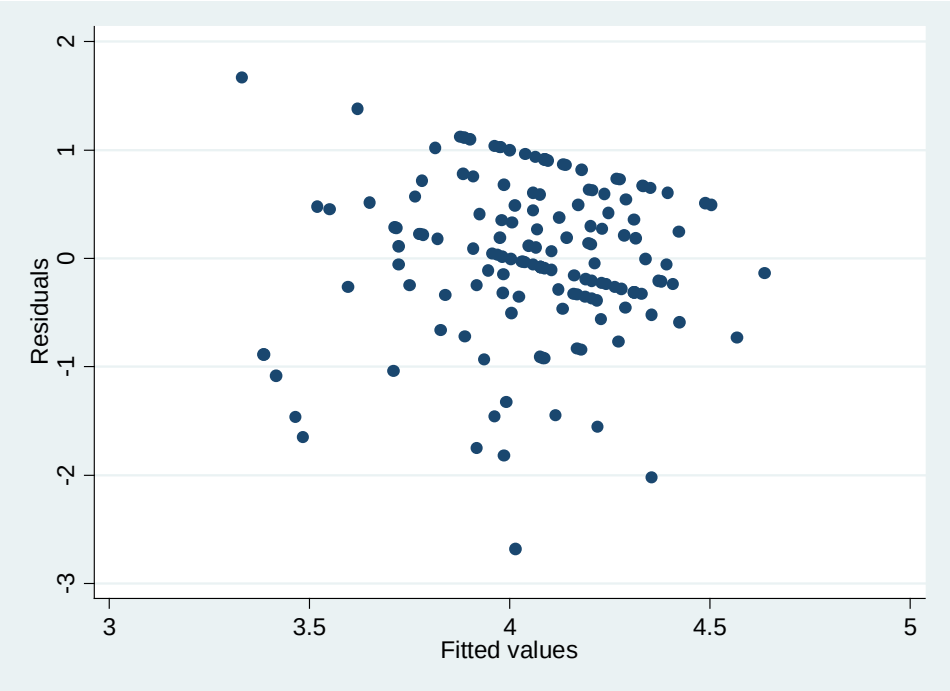

Figure 29.F. Post regression residual-versus-fitted plot (rvfplot) for TCI parntership (TCIpartn) subscale score and CHWcert, logOrgSize, TeamTen. Orgtypedich, RN Workyears, and MetroRurdich.

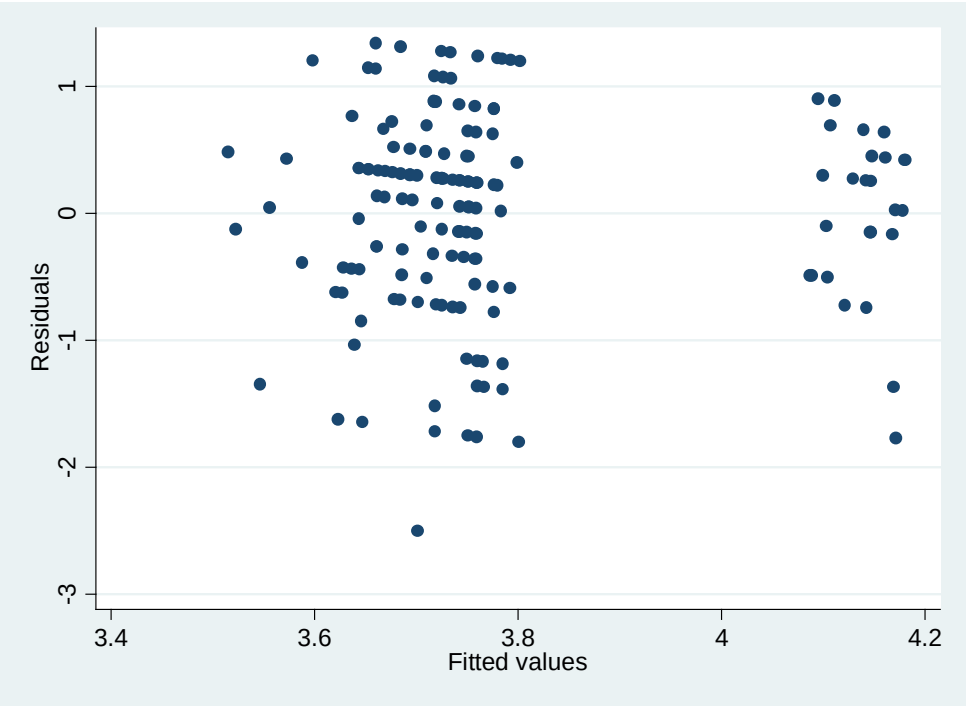

Figure 30.F. Post regression residual-versus-fitted plot (rvfplot) for TCI support (TCIsuppt) subscale score and CHWcert, logOrgSize, TeamTen and Orgtypedich.

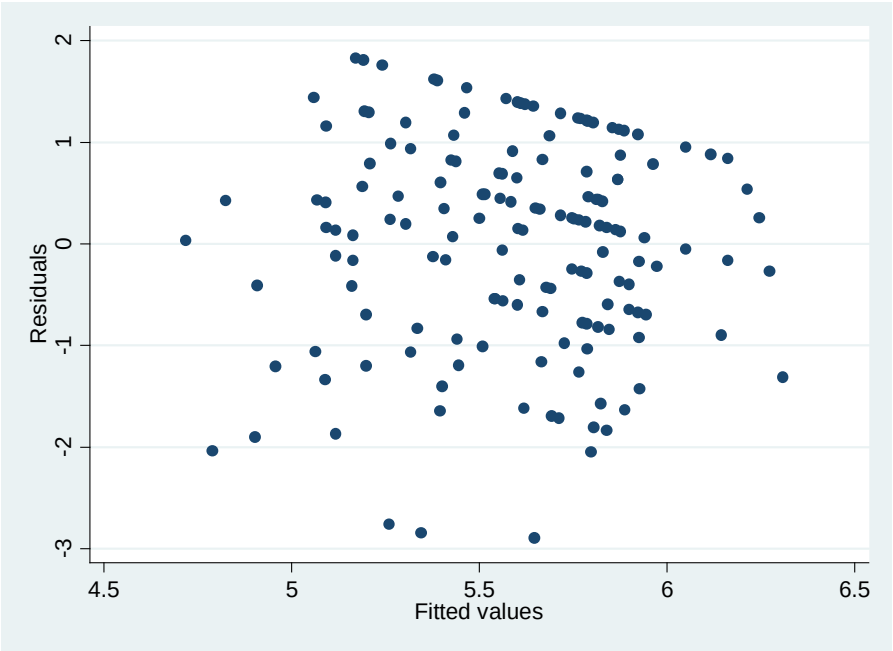

Figure 31.F. Post regression residual-versus-fitted plot (rvfplot) for TCI objectives (TCIobject) subscale score and CHWcert, logOrgSize, TeamTen, TeamMembdich, and Orgtypedich.

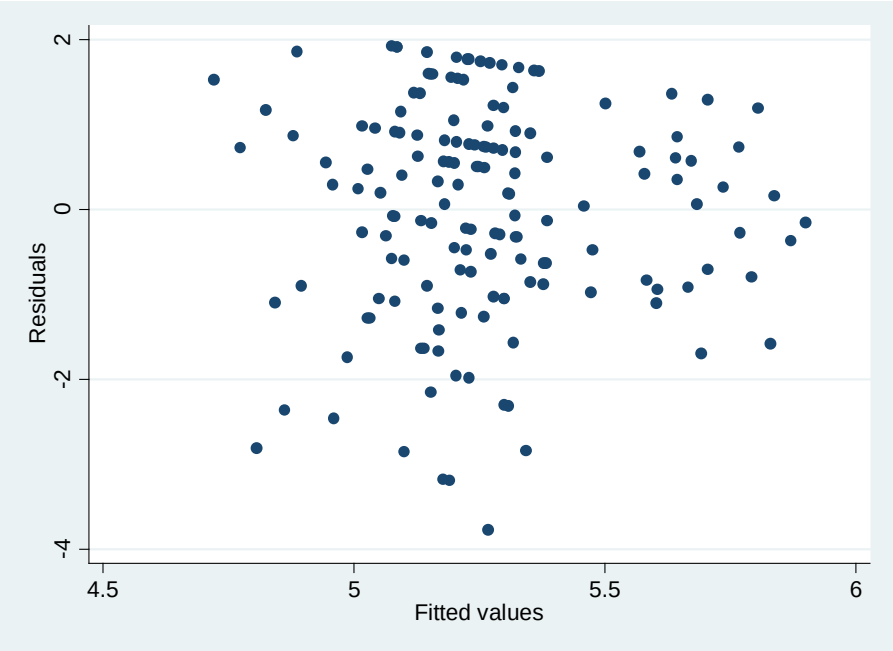

Figure 32.F. Post regression residual-versus-fitted plot (rvfplot) for TCI style (TCIstyle) subscale score and CHWcert, logOrgSize, TeamMembdich, and Orgtypedich.

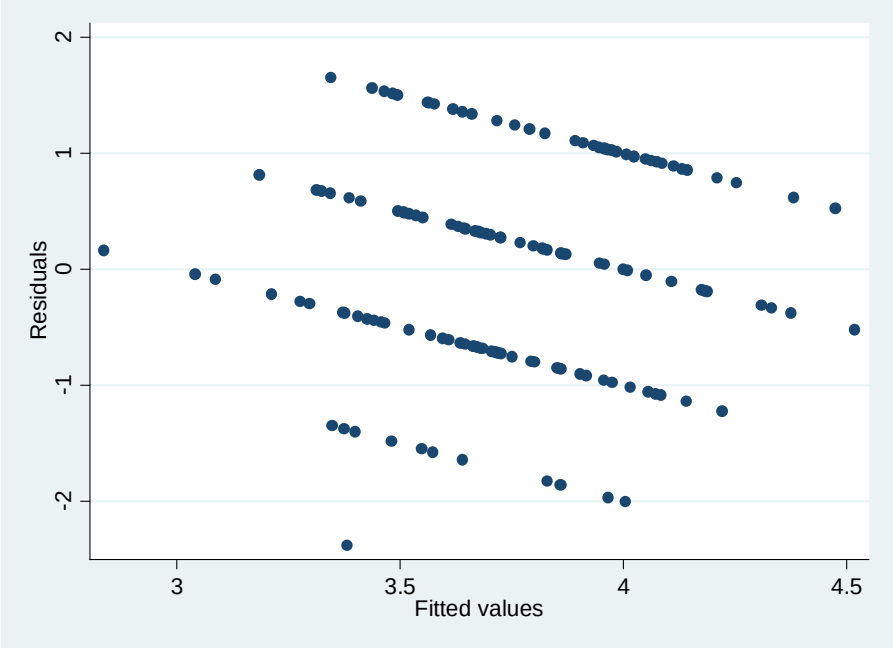

Figure 33.F. Post regression residual-versus-fitted plot (rvfplot) for question 24 subscale score and CHWcert, logOrgSize, TeamTen, Orgtypedich, logTeamSize, logNumCHWonTeam.

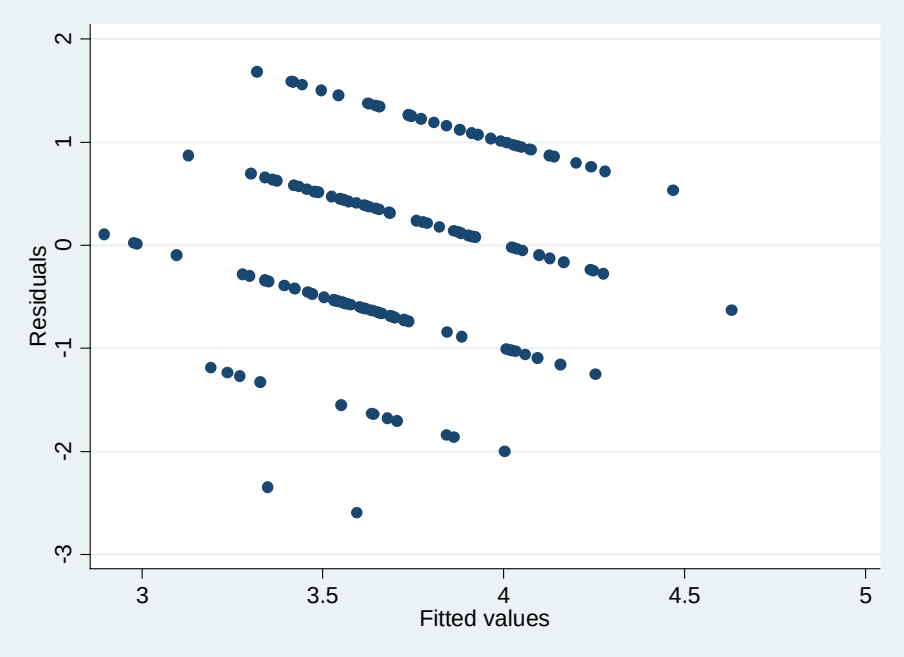

Figure 34.F. Post regression residual-versus-fitted plot (rvfplot) for question 25 subscale score and CHWcert, logOrgSize, TeamTen, Orgtypedich, logTeamSize, and logNumCHWonTeam.