ABSTRACT

Title of Dissertation: EXAMINING THE RELATIONSHIP BETWEEN HEALTH CENTER PROGRAM FINANCING, MEDICAL SERVICES UTILIZATION AND CONTROLLED HYPERTENSION AMONG MARYLAND COMMUNITY HEALTH CENTERS FROM 2008 AND 2013

Sherese M. Warren, Doctor of Public Health, May 2019

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Using a conceptual model adapted from the Aday and Andersen's (1974) framework, this study aims to examine the relationship between health center program financing, medical services utilization, and controlled hypertension among Maryland Community Health Centers (CHCs) in 2008 and 2013 calendar years. This study also examines other covariates in the model such as Maryland's CHCs characteristics and characteristics of Maryland's CHCs population at risk. There are three hypotheses in this study. First, there is a linear relationship between controlled hypertension and medical services utilization. Next, the average controlled hypertension rate among Maryland CHCs is significantly different between measurement years 2008 and 2013. Finally, the

dependent variable (controlled hypertension) is linear related to the independent variables as a group.

This was a cross-sectional study using calendar years 2008 and 2013 Uniform Data System (UDS) data as well as the UDS Mapper. The sample size included 15 Maryland CHCs in 2008 and 2013 calendar years that totaled 30 data points. The study found a significant, positive relationship between controlled hypertension and medical services utilization. However, medical services utilization was no longer a predictor for controlled hypertension when race and income was controlled. Maryland CHCs' mean controlled hypertension rate in 2013 was significantly greater than 2008 calendar year. Lastly, while Maryland CHCs' Bureau of Primary Health Care grants had a unexpected negative relationship to controlled hypertension, it also shared a significant, linear relationship to controlled hypertension when medical services utilization, White race, and incomes 151–200% above the Federal Poverty Guidelines were constant.

Conclusions from the study includes the following key points. Not addressing the other interactions and interrelations of variables in which health policy/financing influences may indeed have unintended impacts on community health outcomes. Medical services utilization, as an independent variable is a significant predictor for controlled hypertension in Maryland CHCs. However, it does not uniquely explain controlled hypertension among Maryland CHCs. While Maryland CHCs in this study sample exceeded both the national average and Healthy People 2020 goals for controlled hypertension, further work is warranted to address the sociodemographic and socioeconomic disparities found within Maryland CHCs' hypertensive patients.

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by

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February 2019

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DEDICATION

I dedicate this dissertation to my beloved grandmother who as the matriarch of my family pushed each generation to do better than the one before. As an educator, she stressed the importance of higher education as a tool and resource to combat generational curses and improve life circumstances.

ACKNOWLEDGEMENT

I kindly thank my dissertation chair, Dr. Bronner for her patience, understanding, and continuous support throughout this dissertation process. I warmly thank Dr. Williams who as a supervisor not only allowed me the bandwidth to fulfill this life goal while working full time but also as a mentor who provided countless guidance, counseling, and emotional support. I affectionately, thank Dr. Odia who provided invaluable resources and advice in support of this dissertation. I also thank Dr. Barrett whose previous knowledge and expertise around the subject matter proved to be beneficial and essential. I also thank the entire faculty of Morgan State University School of Community Health & Policy as the education and knowledge gained from this program prepared and propelled me to achieve a fulfilling professional career in public health. I appreciate all the support, encouragement, and prayers from my family, friends, and coworkers as they played an instrumental role in my overall mental, spiritual, and physical wellbeing. Lastly, I will like to acknowledge that this dissertation is my own autonomous work and does not represent the views of the Health Resources and Services Administration or the United States Government.

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Chapter 1: Introduction

Problem Statement

The Health Center Program's (HCP) fiscal year (FY) 2018 annual funding has tripled from the $1.3 billion reported budget in FY 2002 (Congressional Research Service [CRS], 2018). According to the U.S. Department of Health and Human Services (HHS) *FY 2018 Budget in Brief* (2017), $5.1 billion was appropriated in FY 2018 for Health Centers to provide affordable and quality health care services to nearly 27 million patients nationwide (Health Resources and Services Administration [HRSA], 2018a, 2017a). This funding increase has been greatly due to the Patient Protection and Affordable Care Act (ACA), signed into law in 2010, which established the Community Health Center Fund (CHCF) which was due to expire in FY 2015 (CRS, 2018). As made evident by recent legislation, the HCP continues to attain bipartisan support. In fact, the Bipartisan Budget Act of 2018 extended the CHCF for two-years and will now expire in FY 2019 (CRS, 2018). Consequently, assessing and reporting on the return of this federal investment to improve community health outcomes and decrease health disparities are important public health and health policy issues.

National studies have consistently shown that dollars invested in community health centers (CHCs) lowers health care costs, reduces emergency room visits and hospital stays, and decreases acute care utilization. (HRSA, 2018a; Mid-Atlantic Association of Community Health Centers [MACHC], 2016; Reeter, Braithwaite, Ipakchi, & Johnsrud, 2009; Shin, 2016). CHCs have also shown to increase access to care and improve community health outcomes (HRSA, 2018a; Jones, Lebrun-Harris,

Sripipatana, & Ngo-Metzger, 2014; Jones et al., 2013; Payán et al., 2017). Furthermore, data on the quality of care delivered by CHCs have shown promising results (Chien, Walters, & Chin, 2007; Hicks et al., 2006; Shin, Sharac, & Rosenbaum, 2013). Therefore, any major federal shift from supporting the CHCs as a national health care safety net would likely have dramatic effects on medical services utilization and in the management of chronic care diseases such as hypertension.

Despite primarily serving patients in underserved communities who are at greater risk for poorer health outcomes and who experience greater health disparities, in 2017, approximately 63% of hypertensive patients utilizing medical services at CHCs had their hypertension under control (HRSA, 2018a). This exceeded the national average of 48.3% (Fryar, Ostchega, Hales, Zhang, & Kruszon-Moran, 2017) and Healthy People 2020 goal of 61.2% (Office of Disease Prevention and Health Promotion [ODPHP], 2018a). According to the Centers for Disease Control and Prevention (Merai et al., 2016) having hypertension increases the risk for heart disease and stroke, which are leading causes of death in the U.S. Consequently, CHCs' ability to treat and control hypertension remains a significant economical and public health issue.

Background and Overview

Within the Health Resources and Services Administration (HRSA), the Bureau of Primary Health Care (BPHC) oversees the HCP, a national network of CHCs serving primarily disadvantaged rural and urban, racial and ethnic minority, and low-income populations. In addition, a subset of CHCs specifically target special populations such as migrant/seasonal farmworkers and their families; persons experiencing homelessness;

and/or residents of public housing. The HCP dates back to 1965 and began with just two CHCs, "one serving a rural population in the Mississippi Delta and another serving a public housing project in Boston" (Geiger, 2005). As shown in Figure 1.1., the HCP funding now supports 1,400 CHCs in more than 11,000 sites in every U.S. state, the District of Columbia, Puerto Rico, the Virgin Islands, and the Pacific Basin (HRSA, 2017a, 2017b).

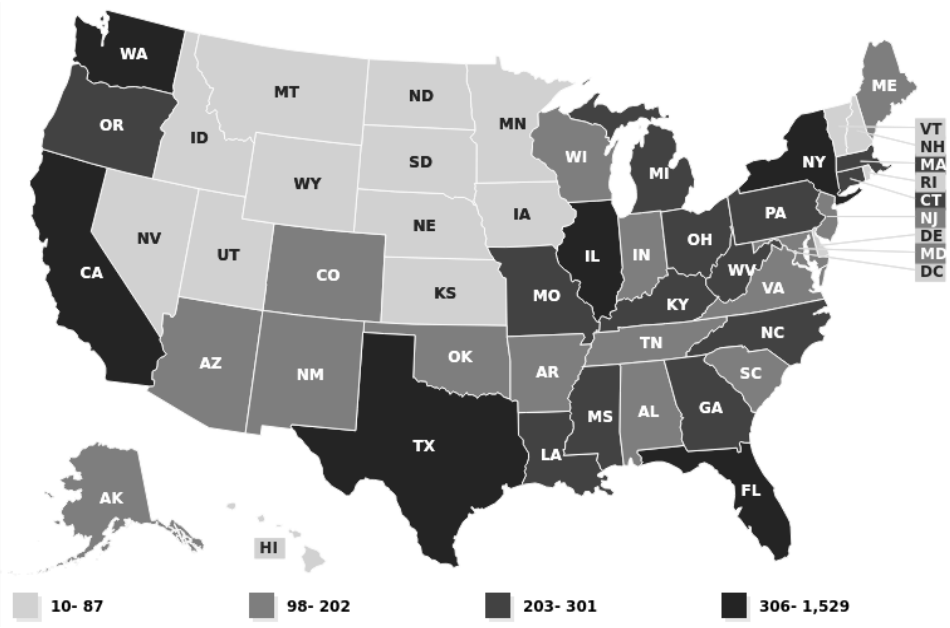

Figure 1.1. Community Health Centers service delivery sites, 2016. This map illustrates the quantity of service delivery sites by state. Data from the Henry J. Kaiser Family Foundation's State Health Facts, 2016a.

As shown in Figure 1.2, in FY 2017 HRSA funded 17 CHCs with over 130 service delivery sites across Maryland's five regions: Western, Capital, Central, Southern, and the Eastern Shore (HRSA, 2018b). Over the last decade, Maryland's demographic and healthcare landscape has changed rapidly. Poverty has shifted from the urban areas and now dispersed throughout suburban regions. Suburbs have now become

more racially and ethnically diverse, while white residents with higher incomes have increasingly populated urban and inner cities (MACHC, 2011).

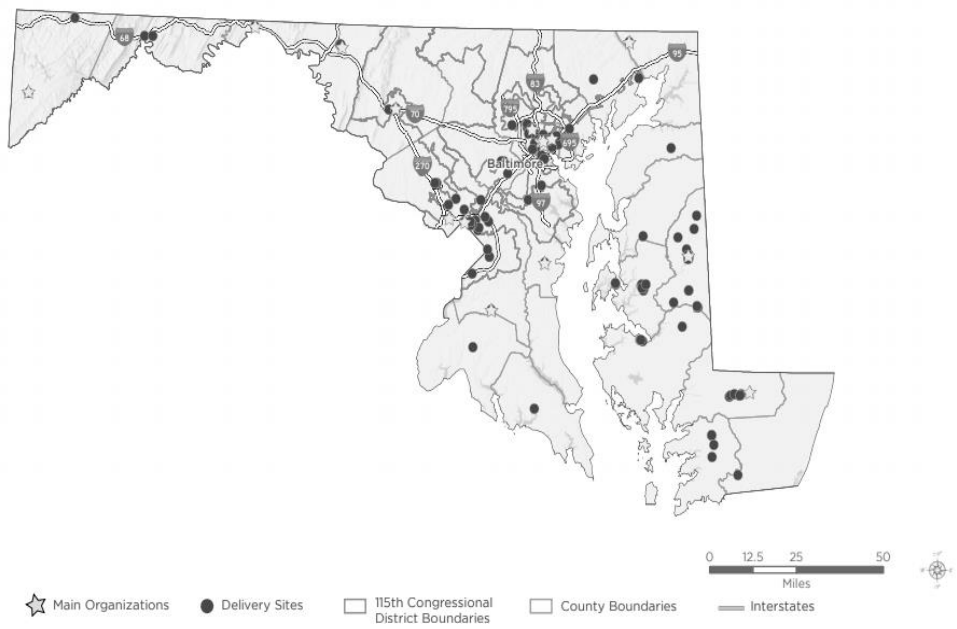

Figure 1.2. Maryland grantees' service delivery sites map. This map shows the location of Maryland's grantees, service delivery sites, county boundaries, and congressional districts. Data from the National Association of Community Health Centers (NACHC), 2017a.

In addition, "Maryland's health care system is going through a period of rapid change" (Kowlessar, Schur, & Zhao, 2014). Consumer incentives and provider networks are now influencing utilization and health care spending. All of these factors hold many implications for CHCs throughout the state. Therefore, a thorough assessment of one aspect of Maryland's CHCs could reveal a myriad of implications for the HCP, medical services utilization, and in the management of chronic diseases such as hypertension.

Similar to many other public health issues, the prevention of hypertension can be very complex as anyone can develop it. However, according to the Centers for Disease Control and Prevention (CDC, 2018a) maintaining healthy living habits can help prevent

high blood pressure. In addition, research has identified many risk factors that increase the likelihood of hypertension. Key risk factors are age, race or ethnicity, being overweight, gender, lifestyle habits, and a family history of high blood pressure (National Heart, Lung, and Blood Institute, 2015). Hypertension costs (i.e. health care services, medications to treat high blood pressure, and missed days of work) the U.S. approximately 48.6 billion dollars each year (CDC, 2015). Therefore, preventing and/or controlling hypertension could save the U.S. billions of dollars in healthcare costs each year.

The prevalence of hypertension increases with age and is highest among non-Hispanic Black adults (National Center for Chronic Disease Prevention and Health Promotion [NCCDPHP], 2015). Approximately 85.7 million, or 34%, of American adults aged 20 or greater have hypertension (Benjamin et al., 2017). In the U.S., the highest hypertension rate of 46.3% is among non-Hispanic Black females, followed by 45% for non-Hispanic Black males (Benjamin et al., 2017). Non-Hispanic Asian males (28.8%) and non-Hispanic Asian females (25.7%) as well as Hispanic males (28.9%) and females (30.7%) were lowest in terms of hypertension prevalence (Benjamin et al., 2017). Hypertension prevalence remained unchanged from 1999 to 2016 (Fryar, Ostchega, Hales, Zhang, & Kruszon-Moran, 2017)

In Maryland, hypertension is highest among American Indian/Alaskan Native (45.7%), followed by 38.9% for non-Hispanic Blacks (America's Health Rankings, 2017). The prevalence of hypertension among American Indian/Alaskan Native is alarming as American Indian/Alaskan Native only makes up less than 1% of Maryland's

population (United States Census Bureau, 2017). However, according to the 2015 Maryland Behavioral Risk Factor Surveillance System (BRFSS), a telephone based health survey of Maryland adult residents; hypertension prevalence was highest among non-Hispanic Black adults (39.6%; Maryland Department of Health and Mental Hygiene, 2017). The discrepancy in the prevalence of hypertension by race could be due, in part, to how the American Indian/Alaskan Native population identifies their ethnicity. For example, 32.3% of the American Indian/Alaskan Native residents in Maryland reported Hispanic as their ethnicity in the 2010 U.S. Census (Office of Minority Health and Health Disparities, 2013). In reference to gender, hypertension is similar among males (33.6%) and females (31.6%) in Maryland (America's Health Rankings, 2017).

Along with diet and lifestyle changes, one key indicator in the management of hypertension is prescription medication. In fact, "about 7 in 10 U.S. adults with high blood pressure use medications to treat the condition" (Merai et al., 2016). In Maryland, an estimated 80% of hypertensive adults reported taking medication to control their high blood pressure (Maryland Department of Health and Mental Hygiene, 2017). This use of prescription medication to control hypertension is even greater in CHCs. According to the 2014 Health Center Patient Survey, over 90% of CHC patients ages 18 and over were prescribed hypertensive medication to control hypertension and 80% of adult patients who ever had hypertension reported that they were in fact taking medication to control the condition (HRSA, 2014). In addition, one study found that Health Center Medicaid patients were more likely to receive new medication for uncontrolled hypertension when compared to Medicaid patients at private practices (Fontil, Bibbins-Domingo, Nguyen,

Guzman, & Goldman, 2017). Hence, CHCs are important in the continuous monitoring and treatment of high blood pressure, especially among the most vulnerable and at-risk populations. Therefore, utilizing medical services at CHCs can be an essential first step response and effective long-term treatment strategy for monitoring and controlling hypertension among patients of racial and ethnic minority groups that are disproportionately affected (Bovet et al., 2008).

Study Purpose/Specific Aims

The aim of this research paper is to examine the relationship between the main independent variables, HCP financing and medical services utilization, and the dependent variable, controlled hypertension from 2008 and 2013 among Maryland CHCs. This study also examines other covariates in the model such as Maryland's CHCs characteristics and characteristics of Maryland's CHCs population at risk. While research has hypothesized these relationships, this study operationalized the constructs using bivariate and multivariate statistical analysis. The conceptual model for the study of CHCs quality of care/health outcomes, adapted from the Aday and Andersen's (1974) framework, structured the study design and analysis.

Significance of Study

Policymakers face tough decisions in determining federal resources for public health priorities. Consequently, there is an increased interest in utilizing data to link impacts to population health outcomes and to allocate federal funding (Iron Mountain, 2018; National Academies U.S. Committee on Measuring Economic and Other Returns on Federal Research Investments, 2011; U.S. General Services Administration, 2018). In

addition, health services utilization is receiving increasing attention in the U.S. (Andersen & Newman, 1973; Black & Schiller, 2016; Institute of Medicine (IOM) U.S. Committee on the Future Health Care Workforce for Older Americans, 2008). In fact, according to the IOM (2008), projections of health care services utilization all indicate that the demand for services will rise substantially in the coming decades, which will put increasing pressure on U.S. health care delivery system including the capacity of human capital to deliver services.

Even more, while U.S. deaths from heart disease and stroke are decreasing, hypertension related deaths due to other deadly conditions such as heart failure or kidney failure are on the rise (American Heart Association [AHA], 2014). Additionally, the comorbidity of diabetes and hypertension are of great concern. In fact, "up to 75% of adults with diabetes also have hypertension" (Long & Jack, 2011). Studies also suggest that diabetic persons have greater uncontrolled hypertension than nondiabetic hypertensive persons (Wang & Vasan, 2005). Therefore, more than ever before, finding evidence based interventions in preventing, treating, and controlling hypertension on the micro, mezzo, and macro levels are critical in combating this chronic disease and reducing disparities. In fact, current trends in the field of public health now emphasize community-based initiatives as the main strategy for achieving population level (Guttmacher, Kelly, & Ruiz-Janecko, 2010; McLeroy, Norton, Kegler, Burdine, & Sumaya, 2003; Merzel & D'Afflitti, 2003). Therefore, this study will not only add to the body of knowledge in community-based interventions but will also operationalize a conceptual model that can be adapted to evaluate existing health policies and/or to predict

the relationships of proposed mechanisms for improving community health outcomes and reducing health disparities (Aday & Andersen, 1974).

Definition of Terms

Blood pressure refers to "the force of blood pushing against the walls of the arteries that carry blood from your heart to other parts of your body" (CDC, 2016). For the purpose of this study, hypertension refers to those that fall in the Stage 2 category. HRSA/BPHC has not updated its hypertension definition to reflect the most current recommendations. See Table 1 for additional blood pressure categories (American College of Cardiology, 2017).

Table 1

Blood Pressure Categories

Blood Pressure Category	Systolic mm Hg (upper number)		Diastolic mm Hg (lower number)
Normal	< 120	and	< 80
Elevated	120–129	and	< 80
High Blood Pressure (Hypertension) Stage 1	130–139	or	80–89
High Blood Pressure (Hypertension) Stage 2	140 or higher	or	90 or higher
Hypertensive Crisis	> 180	and/or	> 120

Note. mmHg is millimeters of mercury: the units used to measure blood pressure. Adapted from AHA, 2017.

Chapter 2: Literature Review

Overview of Chapter

This chapter presents Aday and Andersen's (1974) framework as the theoretical foundation for the study. The review of literature begins with the five domains that comprises the framework (i.e. health policy, characteristics of health delivery system, characteristics of population at risk, utilization of health services, and patient satisfaction). Next, relevant literature about Maryland CHCs, the study's population, is presented. The chapter provides a literature synthesis and analysis of the five constructs (i.e. HCP financing, CHCs characteristics, characteristics of CHCs population at risk, medical services utilization, and controlled hypertension measure) within the adapted conceptual model. This chapter concludes with the identified gaps in the literature and the research questions.

Aday and Andersen's Framework for the Study of Access

In the 1960's Ronald Andersen, PhD, developed the original Behavioral Model (BM) of Health Services Use. The BM is a multilevel model that takes into account individual and societal factors that influences the utilization of medical care (Andersen & Newman, 1973). Since the inception of the original BM, several iterations of the model exist, although the theoretical foundation (i.e. predisposing characteristics, enabling resources, and need influences health behaviors and outcomes) remains constant. In addition, the BM used extensively nationally and internationally serves as a framework for utilization studies of general populations as well as special studies of racial and ethnic

minorities and low-income populations (University of California, Los Angeles [UCLA] Center for Health Policy Research, 2012).

In the 1970's, Andersen developed a model in conjunction with Lu Ann Aday, PhD, a professor, author, and researcher in health services utilization, health care access and health care for vulnerable populations. The first national survey of access to medical care in the U.S. (Aday & Andersen, 1981) applied the Aday and Andersen's framework (Gochman, 1997). In addition, this framework has been applied extensively in evaluating the extent to which services are equitably distributed (Gochman, 1997). The current study is based upon this expanded BM (see Figure 2.1).

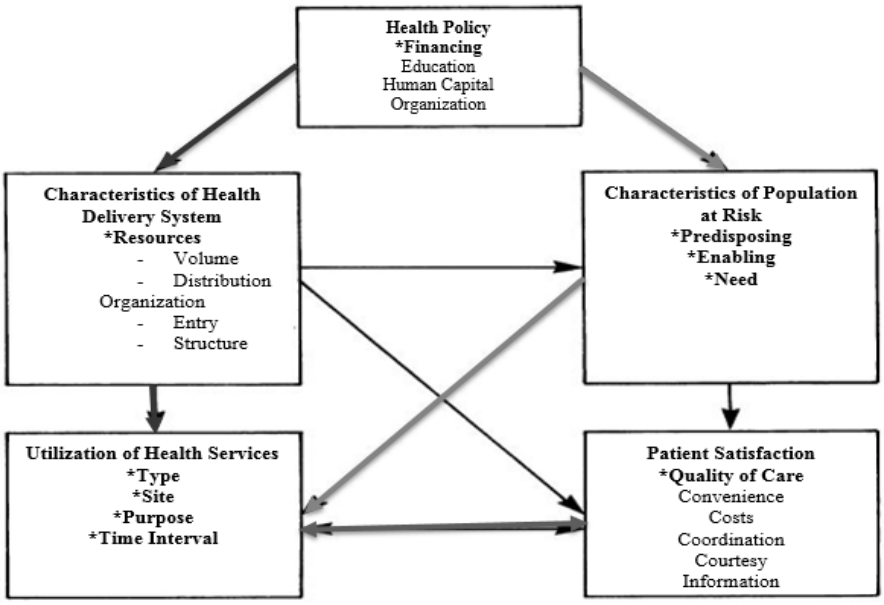

Figure 2.1. Aday and Andersen's (1974) Adapted Framework for the Study of Access. Graphical diagram illustrating the interrelations of variables. Adapted from "A framework for the study of access to medical care." by L. Aday and R. Andersen, 1974, *Health Services Research*, 9, p. 212.
*****Indicates variable of interest for the study.

The Aday and Andersen's framework is the best iteration of the original BM as it includes systematic concepts of health care such as current policy, resources, and

organization and extends the outcome of interest beyond utilization to include an outcome variable (Aday & Andersen, 1974). In addition, Aday and Andersen's framework (1974) examination of contextual determinants, such as policy environment and political priorities can help shape expectations (available resources and targeted populations) to predict outcomes around population health.

According to the World Health Organization (WHO; 2018a), health policy refers to "decisions, plans, and actions that are undertaken to achieve specific health care goals within a society." Heath policies therefore have the ability to affect various aspects of health services, such as coverage, quality, financial, population coverage, and equity; all of which aim to achieve improved health outcomes (Hardee, Irani, MacInnis, & Hamilton, 2012). Linking health policy to improved community health outcomes is not a new concept in public health. "Smoking bans, excise taxes on cigarettes and alcohol, seat belt laws, water fluoridation and restaurant menu labeling" are examples of effective health policies that all have implications on population health (Kindig, n.d). Therefore, Aday and Andersen's (1974) framework for the study of access justifiably considers health policy (financing, education, human capital, and programs) as the starting point to evaluate utilization of health services. It is important to note, health policy without a substantial federal investment will not address health care access, quality, cost issues, and improved community outcomes (Corso, Ingels, Taylor, & Desai, 2014; McKethan et al., 2009; National Institutes of Health, 2010; Nolen, 2017). Therefore, a focus of this study includes health financing.

Health policy plays an important role by influencing the health delivery system, all of which aims for equality in achieving health outcomes (Rice & Smith, 2001). Health delivery system is a term used to describe, how a national, regional, or local health care system is organized, administered, provided, and paid for (Last, 2007). Aday and Andersen's framework describes the health delivery system as encompassing two main components, resources or "availability" (i.e. labor, capital, health personnel, structures, equipment, materials, etc.) and organization or "entry" (i.e. travel time, wait time, etc.; Aday & Andersen, 1974; Gochman, 1997). No mechanism of the health delivery system can be fulfilled without necessary human (i.e. personnel) and non-human resources (i.e. medical technology, health services financing, etc.; Shi & Singh, 2010). In fact, resources are closely intertwined with the utilization of health services. Therefore, this study focuses on the volume of providers and distribution (i.e. geographical) of medical resources in the community (Aday & Andersen, 1974; Andersen & Newman, 1973).

The characteristics of population at risk are the predisposing, enabling, and need components in Andersen's original BM (Gochman, 1997). These are individual determinants of health services utilization (Aday & Andersen, 1974). Attributes such as age, sex, race, or ethnicity include the predisposing component, as they are biological or socially assigned (Gochman, 1997). While health policy cannot directly alter these predisposing characteristics, it can however work to define and target certain populations (Gochman, 1997).

Enabling variables such as income or insurance coverage provide the means available to use services and aspects of the community (Aday & Andersen, 1974;

Babitsch, Gohl, & von Lengerke, 2012; Hadley & Cunningham, 2004). It is within these enabling characteristics that health policy work to influence. For example, health policy may expand health insurance coverage and/or increase availability of free or discounted health services to individuals below a certain family income (Babitsch et al., 2012; Hadley & Cunningham, 2004). Lastly, the need component refers to the illness level perceived either by the individual or through a clinical evaluation (Aday & Andersen, 1974). Illness level, while not always, often represents the immediate cause of health services utilization (Andersen & Newman, 1973; Bernstein et al., 2003; Varenne et al., 2006). This study examines measurable variables across all three components (i.e., enabling, need, and predisposing).

Several studies of health services utilization examine its patterns using explanatory frameworks as identifying predictors (Babitsch et al., 2012). Within this study's framework, health delivery system and individual related factors both strongly influence health services utilization (Babitsch et al., 2012). The utilization of health services includes the type, site, purpose, and the time interval involved (Aday & Andersen, 1974). The type of utilization refers to the kind of service (i.e. medical, dental, etc.) received and who provided it (i.e. hospital, practitioner, etc.).

The site is the place where care is received (i.e. community health center). The purpose of a visit refers to preventive (i.e. wellness visit, checkup or immunization), illness-related (i.e. treatment or stabilization of acute illnesses or chronic illness), or custodial care (i.e. care mainly in nursing homes or home care). Time interval is expressed in terms of contact (i.e. entry into the medical system in a given period),

volume (i.e. number of visits/revisits in a given time interval), or continuity measures (i.e. degree of linkage or coordination of medical services; Aday & Andersen, 1974; Gochman, 1997). This study examines a single variable that encompasses all four components (type, site, purpose, and time interval) within this domain.

Patient satisfaction is the level of satisfaction experienced having used a health service (Assefa, Mosse, & Hailemichael, 2011; Berkowitz, 2016). Patients can measure their perceived satisfaction from the performance or quality of care received (Gochman, 1997; Aday & Andersen, 1974). Utilization of health services and patient satisfaction shares a reciprocal relationship. In fact, many studies have shown that patient satisfaction influences whether a person seeks medical advice and maintains a continuing relationship with providers (Assefa et al., 2011; Berkowitz, 2016). One study even found that patience satisfaction was positively correlated with clinical adherence to treatment (Ashish, Orav, Zheng, & Epstein, 2008).

According to the Agency for Healthcare Research and Quality (AHRQ; 2018) patient satisfaction correlates not just to adherence to medical advice and treatment plans; but, also to prevention and disease management. In fact, better health outcomes are often associated with patients who experiences a better quality of care (AHRQ, 2018). Hence, the trend across health care settings now prioritize measuring patient satisfaction; which is an important step towards improving the quality of care (Assefa et al., 2011; Berkowitz, 2016). This study's unit of analysis is at the community level and therefore measures the patients' quality of care through a community clinical quality of care/health outcome measure collected from all CHCs.

Conceptual Model for the Study of CHCs Quality of Care/Health Outcomes

The below conceptual model has been adapted from the Aday and Andersen's (1974) framework for the study of access (see Figure 2.2). This conceptual model explores the linkage or pathways in which the HCP financing influences community quality of care indicators and health outcomes. This conceptual model is used for the purpose of this study. A synthesis and analysis of the relevant literature is detailed within each construct.

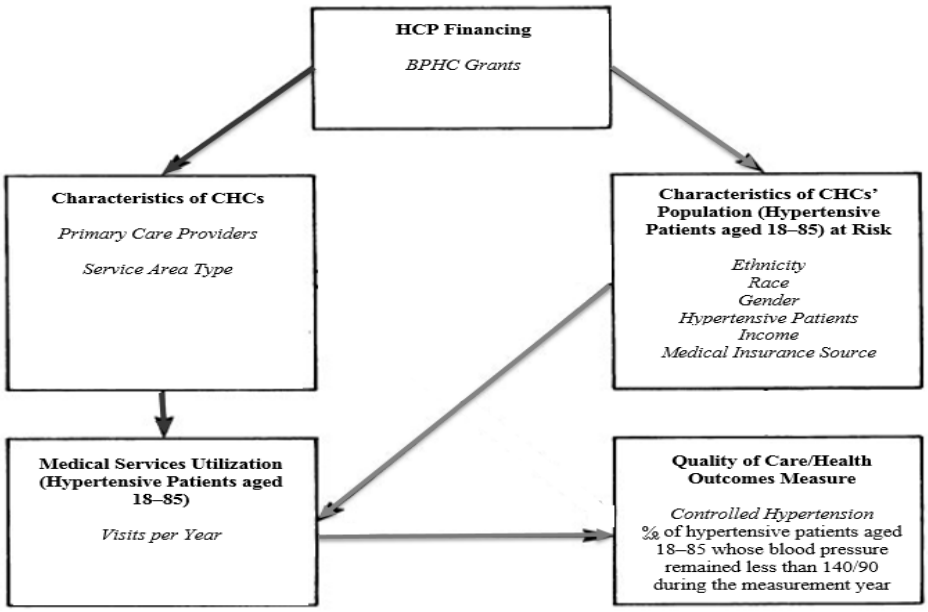

Figure 2.2. Conceptual Model for the Study of CHCs Quality of Care/Health Outcomes. Graphical diagram illustrating the interrelations of the study variables.

Financing of the HCP began in 1965 and although the legislative authority for the HCP has evolved, the program remains fundamentally the same. CHCs are outpatient primary care clinics that receive grant funds administered by BPHC through statute §330 of the Public Health Service Act (PHSA; Taylor, 2004). Since its inception, the HCP's appropriation has increased over time. From FY 2008 through FY 2013, the HCP funding

level increased by nearly $1 billion (Heisler, 2016). For Maryland CHCs, this translated into nearly a $14 million increase of BPHC grant funding during the same timeframe (HRSA, 2016).

Two major federal legislation was passed during the study's period. The American Recovery and Reinvestment Act (ARRA) in FY 2009 provided an additional one-time $2 billion to the HCP (Heisler, 2016). This marked a historic period for the HCP as ARRA delivered the single largest investment in HCP history (CHroniCles, 2018). Of the $2 billion to the HCP, $1.5 billion helped to strengthen health centers' capacity to serve by establishing new access points and enabling health centers to increases services at existing sites. The remaining $500 million went to health centers' capital and facility improvement projects (FederalGrantsWire, 2018; NACHC, 2010).

Under ACA, the HCP continued to expand. This legislation also marked an important period with the passing of historic health reform (FederalGrantsWire, 2018). ACA created the CHCF and appropriated a total of $11 billion between FY 2011 through FY 2015 (Heisler, 2016*).* Of the $11 billion to the HCP, $9.5 billion supported ongoing health center operations, created new health center sites and expanded preventive and primary health care services (HRSA, 2012). The remaining $1.5 billion supported major construction and renovation projects (HRSA, 2012). Under the ACA, CHCs' patient revenues were also increased due to the expansion of Medicaid and private health insurance (Paradise et al., 2017). These two pieces of legislation together afforded Maryland CHCs the opportunity for growth and expansion in terms of service delivery sites, health care services provided, and patient targets.

CHCs play a unique role in the nation's health care delivery system. CHCs are located in areas designated as having a shortage of health services and provide services to all regardless of the ability to pay. The study's conceptual model focuses on Maryland's CHCs resources (see Figure 2.2) in terms of volume of primary care providers and geographical distribution (i.e. urban, rural) of health resources in the community (Aday & Andersen, 1974). Volume of resources is important as it assumes that as the resources increases, medical services utilization increases (Andersen & Newman, 1973; ODPHP, 2018b).

Studies consistently show, even after controlling for sociodemographic measures, that U.S. states with higher ratios of primary care providers to population have better health outcomes, including lower rates of mortality from heart disease (Beck et al., 2015; Mainous, Baker, Love, Gray, & Gill, 2001; Starfield, Shi, & Macinko, 2005). However, due in part, to CHCs' modest salaries for primary care providers, primary care providers' shortage remain a significant issue for CHCs (NACHC, 2016; O'Brien, 2017). In fact, a national survey of CHCs in 2016 revealed that nearly 69% of CHCs had at least one vacancy for a family physician (NACHC, 2016). Therefore, recruitment and retention of primary care providers may present as a challenge for Maryland CHCs.

Another key component of the health delivery system is geographical distribution. Throughout the population, available resources very often are not homogeneously dispersed (Andersen & Newman, 1973; Hartley, 2004; Spoont, Greer, Su, Fitzgerald, & Rutks, 2011). In fact, there is strong evidence to suggest that geographical distribution of resources have a profound effect (i.e. supply/demand) on the utilization of medical

services (Goddard & Smith, 2001; Hale, 2015; Hartley, 2004). A few studies have even found that living in an urban area significantly increases the likelihood of seeking medical care (Anselmi, Lagarde, & Hanson, 2015; Babitsch et al., 2012).

CHCs also face substantial challenges in recruitment of medical staff, particularly in rural areas (Rosenblatt, Andrilla, Curtin, & Hart, 2006; University at Albany, 2011; Hetzler, 2017). One study found that the largest numbers of unfilled positions were for family physicians (Rosenblatt et al., 2006; NACHC, 2017b; NACHC, 2009). Therefore, volume of primary care providers and geographical distribution of health resources in the community may not only challenge the accessibility and utilization of Maryland's CHCs but also have an impact on community health outcomes (NACHC, 2014; MACHC, 2015; Rural Health Information Hub, 2016).

The conceptual model guiding this study examines predisposing (i.e. gender, ethnicity, and race), enabling (i.e. income and medical insurance source) and need (i.e. total patients diagnosed with hypertension) components (see Figure 2.2). Many studies have frequently demonstrated an association between gender and the utilization of health services. These studies report that women are more likely to visit a medical provider than men (Babitsch et al., 2012). These utilization trends also hold true for Maryland CHCs with 61% female and 39% male patients seen in 2016 (HRSA, 2016).

Studies have also reported associations between race and ethnicity and health care utilization. Black non-Hispanics, Hispanics, and Asians are among the racial/ethnicity groups that are significantly less likely than white non-Hispanics to utilize medical services (Ashton et al., 2003; Babitsch et al., 2012). This utilization pattern may in part

influence the prevalence of health outcomes such as controlled hypertension. For example, one study found that while non-Hispanic black adults have higher rates of hypertension, they also have lower rates of controlled hypertension than hypertensive non-Hispanic white adults (Gillespie, Hurvitz, & CDC, 2015). In addition, according to Guzman (2012), in 2008, Hispanic adults only comprised of less than 20% of hypertensive patients 18 years of age and older. This is much less as compared to non-Hispanic Whites (27%) and non-Hispanic Blacks (32%) in 2008 (Guzman, 2012). Of interest in this study will be whether similar patterns is observed among Maryland CHCs' hypertensive patients and its relationship to controlled hypertension.

A key study finding in Shi et al. (2012) was CHCs with greater proportions of uninsured patients had lower odds of achieving high performance for the hypertension control measure. Therefore, of interest in the study was whether a similar pattern would be observed among Maryland CHCs who in 2016 collectively served 18.7% uninsured patients (HRSA, 2016). Several studies also found that having insurance significantly increased the likelihood of medical services utilization (Babitsch et al., 2012). A longitudinal study of Oregon's CHCs found that persons who maintained insurance coverage increased long-term utilization at CHCs as compared to persons with insecure coverage (Hatch et al., 2016).

In addition, many studies have also found an association between utilization and income (Cooper et al., 2012; Larson, & Halfon, 2010; Majo & van Soest, 2011; Vassileva, Boley, Standard, Markwell, & Hazelrigg, 2013). Since the majority of Maryland CHCs' patients have incomes at or below the Federal Poverty Guidelines

(FPG; HRSA, 2016) of interest was how these varying levels of poverty was associated with utilization and ultimately the health outcome of interest, controlled hypertension. Lastly, several studies have found associations between physical status and health services utilization (Babitsch et al., 2012). Poorer physical health was a significant predictor of increased utilization (Babitsch et al., 2012). Another study found that the average number of primary care provider visits increased after they received a hypertension diagnosis (Clement et al., 2014). Therefore, examining the relationship between the total number of hypertensive patients and hypertension control could reveal significant findings.

The study's conceptual model examines medical services utilization as one of the main identifying predictors for improved health outcomes (see Figure 2.2; Aday & Andersen, 1974). The utilization of medical services includes the type, site, purpose, and the time interval involved (Aday & Andersen, 1974). In this study, utilization is the average number of medical visits per year by CHCs' hypertensive patients ages 18 through 85. Medical services utilization is very important as one of the key components in the control and management of hypertension is follow-up care.

According to one state's Department of Public Health, when hypertensive patients' blood pressure are controlled, they should follow up with their primary care providers in 2 to 4 month intervals to review readings (Kumar, O'Neal, & Davis, n.d.). Another medical article referenced intervals of 3 to 6 months follow up for controlled hypertensive patients; although, it was also advised that those with other comorbidities many need to visit their primary care provider more often (Appel & Llinas, 2013). Yet,

another study found that hypertensive patients achieved equal hypertension control, treatment compliance, and patient satisfaction at 3 and 6 months follow up visits with primary care providers. Therefore, the conclusion was a recommendation for 6-month follow up intervals (Birtwhistle et al., 2004). Despite the varying recommendations and study findings, most research support the evidence-based guidelines of follow-up intervals of 3 to 6 months for hypertensive patients who blood pressure are being controlled (Javorsky, Robinson, & Kimball, 2014).

Data from multiple survey studies also found that patients who have a medical home or visit their primary care provider do show improvements in hypertension control (CDC, 1994; Dinkler, Sugar, Escarce, Ong, & Mangione, 2016; He et al., 2002; Kirkland et al., 2017). In addition, another study found that less hypertension control was observed in individuals who missed their scheduled medical appointments (Coelho et al., 2005). While adult CHCs' patients report higher rates of hypertension, they were also more than twice (82% vs. 40%) as likely as all hypertensive low-income adults to report that a doctor recommended an intervention (Shin et al., 2013). All of these findings suggest that CHCs play an important role in the follow up care, management, and control of hypertension.

This study uses a conceptual model that examines one of several quality of care/health outcomes indicators as reported by all CHCs. The study's main dependent variable in this study is controlled hypertension (see Figure 2.2). The prevalence of controlled hypertension in the U.S. increased from calendar years 1999 to 2010 and remained unchanged through 2016 (Fryar, Ostchega, Hales, Zhang, & Kruszon-Moran,

2017). Controlled hypertension prevalence is found to increase with age for men and is "higher among non-Hispanic white (50.8%) than non-Hispanic black (44.6%) or non-Hispanic Asian (37.4%) adults" (Fryar, Ostchega, Hales, Zhang, & Kruszon-Moran, 2017). In addition, a study found between 2011 and 2014, non-Hispanic whites also had the greatest prevalence of controlled hypertension, which was significantly different from non-Hispanic Asians, non-Hispanic Black, and overall Hispanic/Latino ethnicity (Yoon, Fryar, & Carroll, 2015). Controlled hypertension is also more prevalent in women than in men (Fryar, Ostchega, Hales, Zhang, & Kruszon-Moran, 2017; Slachta, 2017). Factors associated with higher or improved controlled hypertension include, having private insurance, visiting the same health care facility for care, seeing the same provider for care, and having blood pressure checked during the preceding 6 months (He, J., Muntner, P., Chen, J., Roccella, E., Streiffer, R., & Whelton, P., 2002).

A number of studies have also evaluated CHCs performance on quality-related outcomes (Shi et al., 2012). One study examined the ability of CHCs to manage chronic conditions and found that CHCs provided quality care in the treatment of chronic conditions including hypertension (Heisler, 2016). Another study found that the quality of care delivered in CHCs is comparable to that delivered in other settings including some national benchmark data (Hicks et al., 2006). In addition, studies found that CHCs had higher rates of hypertension control (63%) compared with national rates (50%; Egan, Zhao, & Axon 2010).

CHCs in 2017 continue to serve as leaders in quality health care outcomes including exceeding the national average (HRSA, 2017c). If fact, the percentage of

CHCs' patients with controlled hypertension ranged from 62.39% to 63.76% between 2015 and 2017 calendar years, all of which exceeds the Healthy People 2020 goal (HRSA, 2017c). In Maryland, approximately 62.10% of hypertensive patients in 2016 utilizing medical services at Maryland CHCs had their blood pressure under control (HRSA, 2016). As reported, CHCs are leading the way in the treatment and control of hypertension; however, disparities still exist. One study among of New York State CHCs found that controlled hypertension was associated with gender, race/ethnicity, income, and clinical encounters (Shelley et al., 2011). Even more, the study found that blacks were less likely to have controlled hypertension compared with Hispanics and whites. In addition, male gender and fewer clinical encounters were predictors to uncontrolled hypertension in New York CHCs (Shelley et al., 2011).

Healthy People 2020 has a goal to increase the proportion of hypertensive adults aged 18 years and over whose blood pressure is under control from 43.7% to 61.2% (ODPHP, 2018c). As shown in Figure 2.3, hypertension control among adults aged 18 and older has overall been on an incline over time. However, it is apparent that a more aggressive national intervention is necessary in order to achieve this Healthy People 2020 goal at the national level. According to the Office of Health Equity (OHE; 2017), while it is known that CHCs performance on the clinical quality measures and health outcomes including controlled hypertension has improved over time, what remains undiscovered are the interrelations of variables that will further support BPHC's continued investments in Maryland CHCs.

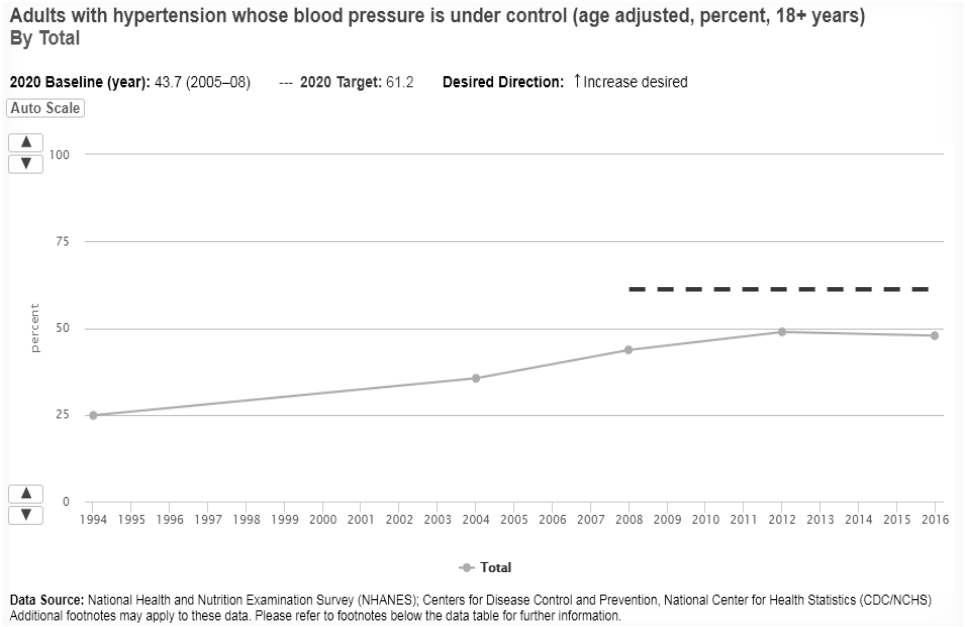

Figure 2.3: Hypertension Control Among Hypertensive Adults Aged 18 and older (ODPHP, 2018c)

Literature Gaps

CHCs are diverse and multifaceted and there is a need to understand the utility and impact of this health care safety net model in diverse populations and communities. Therefore, this study contributes new knowledge in both a better understanding of an integrated theoretical approach through which the CHCs' patients utilize medical services and to the development of an empirical approach, which may have widespread applicability in examining the importance of health policies on health outcomes (Aday & Andersen, 1974; Aday & Andersen, 1981; Andersen & Newman, 1973; Gochman, 1997). While research supports that CHCs are important sources for medical services, especially for low income, racial, and ethnic minority populations, there is no systematic review using the HCP data that examines the association between federal funding, utilization, and clinical outcomes. Policy research has theorized that health policy is the starting

point for understanding access to medical services (Aday & Andersen, 1974; Andersen et al., 2002; Committee on Geographic Adjustment Factors in Medicare Payment et al., 2011). Therefore, this study among Maryland CHCs population will not only add to the literature in public health policy but also demonstrate current utility of a theoretical framework and conceptual model for capturing federal returns on investments to achieve community change.

Research Questions

After a review of the literature, the following research questions for this study arise.

1. Using 2008 and 2013 data, what is the relationship between medical services utilization and controlled hypertension among Maryland CHCs?
2. Is there a significant difference in controlled hypertension rates among Maryland CHCs from 2008 and 2013?
3. What is the association between HCP financing, medical services utilization and controlled hypertension among Maryland CHCs from 2008 and 2013?

Chapter 3: Methodology

Overview of Chapter

From the literature review, several questions emerged and the need to explore the interrelations of variables detailed within the conceptual model. In this chapter, the research methodology details the design to examine each variable and how each variable is measured. The chapter begins with the hypotheses followed by the study design, data source, study population, collection and procedures, and constructs and measurements. The chapter ends with the analytic framework.

Research Hypotheses

Three hypotheses emerged from the literature review and research questions. Research question 1 null hypothesis was as follows: There is no linear relationship between controlled hypertension and medical services utilization. The alternative hypothesis stated that there is a linear relationship between controlled hypertension and medical services utilization. That is, H_0: $\rho = 0$; H_A: $\rho \neq 0$, $\alpha = 0.05$. Research question 2 null hypothesis was as follows: The average controlled hypertension rate among Maryland CHCs is not significantly different in measurement years 2008 and 2013. The alternative hypothesis stated that the average controlled hypertension rate among Maryland CHCs is significantly different in measurement years 2008 and 2013. That is, H_0: u1 = u2; H_A: u1 $\neq$ u2, $\alpha = 0.05$. Lastly, research question 3 null hypothesis stated that all the independent variables are of no value in predicting the variation in the dependent variable (controlled hypertension). The alternative hypothesis stated that the dependent

variable (controlled hypertension) is linear related to the independent variables as a group. That is, H_0: $\beta 1 = \beta 2 = \beta 3 = \beta\ 4 = 0$; H_A: not all $\beta i = 0$, $\alpha = 0.05$.

Study Design and Data Source

This was a cross-sectional study using calendar years 2008 and 2013 Uniform Data System (UDS) data. "The UDS is a core set of information appropriate for reviewing the operation and performance of health centers" (Bureau of Primary Health Care [BPHC], 2014). This data is collected and reviewed annually. CHCs submit data obtained from an Electronic Health Record (EHR) that includes at least 80% of the patients who fit the criteria described in each section or from an audit of charts (70 patients) selected through a process of scientific random sampling (BPHC, 2013; BPHC, 2008). To explore the service areas of Maryland CHCs further, UDS Mapper was also examined. "The UDS Mapper is designed to help inform users about the current geographic extent of U.S. federal (Section 330) Health Center Program (HCP) awardees" (American Academy of Family Physicians, 2018).

Study Sample and Criteria

The study population included all Maryland CHCs who operated service delivery sites in calendar years 2008 and 2013 ($N = 32$). The inclusion criterion included all Maryland CHCs who received HCP funding as authorized by section 330 of the PHS Act (i.e., Community Health Center section 330e, Migrant Health Center section 330g, Health Care for the Homeless section 330h, and Public Housing Primary Care section 330i). Excluded from this study were HCP Look-Alikes, as they do not receive funding. CHCs missing data elements in UDS or from the outcome variable data were excluded from the

study to ensure quality control. Of the 32 Maryland CHCs in the study's population, two CHCs were eliminated due to missing data. Therefore, the sample size included 30 Maryland CHCs from 2008 and 2013 calendar years.

Constructs and Measurements

The outcome/dependable variable was controlled hypertension *(*see Appendix A & B), the percentage of patients 18 through 85 years of age with diagnosed hypertension whose blood pressure was less than 140/90 at the time of the last reading (BPHC, 2013; BPHC, 2008). Patients had to be diagnosed as evidenced by an ICD-9 code of 401.xx–405.xx. prior to June 30th of the measurement year (BPHC, 2013; BPHC, 2008). ICD-9-CM Code 401.xx–405.xx refers a set of codes for hypertension assigned by International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM), "the official system of assigning codes to diagnoses and procedures associated with hospital utilization in the United States" (BPHC, 2013; BPHC, 2008; National Center for Health Statistics, 2015). Additionally, patients had to be seen at least twice during the reporting year (BPHC, 2013; BPHC, 2008). UDS data excluded from CHCs sample data, pregnant patients and end stage renal disease patients for this measurement (BPHC, 2013; BPHC, 2008).

There were two main independent variables in this study, HCP financing and medical services utilization. HCP financing (see Appendix A & B) was the total BPHC grant amount awarded to each Maryland CHC (BPHC, 2013; BPHC, 2008). This total included the following streams of funding: (a) Total Health Center Cluster (i.e. Migrant Health Center, Community Health Center, Health Care for the Homeless, and Public

Housing Primary Care grants), (b) Capital Improvement Program Grants or Capital Development Grants, (d) Integrated Services Development Initiative, (e) Shared Integrated Management Information Systems, and/or (f) Affordable Care Act (ACA) Capital Development Grants, including School Based Health Center Capital Grants (BPHC, 2013; BPHC, 2008). The amount reflected direct funding only. For UDS data, BPHC funds passed through to another BPHC health center were not included (BPHC, 2013; BPHC, 2008).

Medical services utilization (see Appendix A & B) was the average number of medical visits per year by hypertension diagnosis (evidenced by an ICD-9 code of 401.xx–405.xx) for patients 18 through 85 years of age (BPHC, 2013; BPHC, 2008). In UDS, the number of visits by hypertension (HTN) diagnosis was not categorized by age; therefore, this number was estimated by solving for the denominator. The calculation was as follows: $\frac{\text{\# of all patients with HTN diagnosis}}{\text{\# of visits by all HTN diagnosis}} = \frac{\text{\# of patients with HTN diagnosis (aged 18–85)}}{x}$. Once the total number of HTN medical visits for patients 18 to 85 years of age were solved, this number then served as the numerator to determine the estimated average medical visits per hypertensive patient per year for each Maryland CHC. The total patients with HTN diagnosis ages 18 to 85 represented the denominator. The calculation was as follows: $\frac{\text{\# of vists by HTN diagnosis (aged 18–85)}}{\text{\# of patients with HTN diagnosis (aged 18–85)}} =$ medical services utilization. To meet the medical visit criteria, the interaction had to be documented and a face-to-face contact between a patient and a licensed or otherwise credentialed provider who exercised independent, professional judgment in the provision of services to the patient.

Medical services rendered also had to be documented in the CHC's patient chart (BPHC, 2013; BPHC, 2008; HRSA, n.d.).

Other covariate variables were separated into two categories, one category represented characteristics of Maryland CHCs and the other category represented characteristics of Maryland CHCs' population at risk from the study's conceptual model. The primary care provider and service area type variables (see Appendix A & B) represented characteristics of CHCs. The primary care provider variable included the total annualized full-time equivalent of the following personnel reported by each Maryland CHC: Family Physicians, General Practitioners, Internists, and Nurse Practitioners. These primary care providers all provided direct medical services at each Maryland CHC (BPHC, 2013; BPHC, 2008). Family Physicians, General Practitioners and Internists included M.D.s and D.O.s, except for the excluded psychiatrists, ophthalmologists, pathologists, radiologists, naturopaths and chiropractors in the sample CHCs' UDS data (BPHC, 2013; BPHC, 2008). All Nurse Practitioners were included except for UDS excluded criteria within the sample CHCs' UDS data, which excluded psychiatric nurse practitioners and certified nurse midwives from this measurement (BPHC, 2013; BPHC, 2008). The service area type of each Maryland CHC in the study was determined to be located in either an urban and rural area. Using UDS Mapper, service delivery sites were located for each Maryland CHC. Based on the majority of the service area for each Maryland CHC, either urban or rural was selected as the service area type (American Academy of Family Physicians, 2018; HRSA, 2018c).

Characteristics of CHCs' population at risk (see Appendix A & B) included the following variables: gender, ethnicity, race, income, medical insurance source and hypertensive patients. In UDS, the number of hypertensive patients were not categorized by gender (male or female); therefore, this number was estimated by solving for the numerator. The calculation was as follows: $\frac{\text{\# of all male or female patients}}{\text{\# of all CHC patients}} = \frac{x}{\text{\# of patients with HTN diagnosis (aged 18–85)}}$. Ethnicity (i.e. Hispanic/Latino) and race (i.e. Asian, Native Hawaiian, Other Pacific Islander, Black/African American, American Indian/Alaska Native, White, More Than One Race, or Unreported/Refused to Report Race) were reported for all patients aged 18 through 85 with diagnosed hypertension. The same UDS selection criteria applied to the outcome/dependent variable, controlled hypertension was also applied to this measure in UDS (BPHC, 2013; BPHC, 2008). The ethnicity and race variables reflected the total self-reported categories by Maryland CHCs' patients (BPHC, 2013; BPHC, 2008).

Income (i.e. 100% and below, 101–150%, 151–200%, Over 200%, and Unknown) as a percentage of the Federal Poverty Guidelines (FPG) is defined in ranges relative to the FPG (BPHC, 2013; BPHC, 2008). Health centers use official poverty guidelines defined and revised annually (BPHC, 2013; BPHC, 2008). The official poverty guidelines are published in the Federal Register during the first quarter of each year (BPHC, 2013; BPHC, 2008). In UDS, the number of hypertensive patients were not categorized by income; therefore, this number was estimated by solving for the

numerator. The calculation was as follows: $\frac{\text{\# within each income category for all CHC patients}}{\text{\# of all CHC patients}} = \frac{x}{\text{\# of patients with HTN diagnosis (aged 18–85)}}$.

Medical insurance source (i.e. None/Uninsured, Medicaid included CHIP, Medicare, Other Public Insurance (non-CHIP), and Private Insurance) was the primary health (medical) insurance the patient had at the time of their last visit (BPHC, 2013; BPHC, 2008). In UDS, the number of hypertensive patients were not categorized by medical insurance source; therefore, this number was estimated by solving for the numerator. The calculation was as follows:

$\frac{\text{\# within each medical insurance source category for all CHC patients}}{\text{\# of all CHC patients}} = \frac{x}{\text{\# of patients with HTN diagnosis (aged 18–85)}}$. Hypertensive patients was the total patients 18 to 85 years of age with hypertension, evidenced by an ICD-9 code of 401.xx–405.xx. (BPHC, 2013; BPHC, 2008). The same UDS selection criteria applied to the outcome/dependent variable, controlled hypertension was also applied to this measure in UDS (BPHC, 2013; BPHC, 2008).

Data Collection and Procedures

CHCs must submit annual health center patient data from either their EHR or by a review of a sample of charts. If their EHR was used, it must meet the following criteria: (a) includes every single patient who meets the criteria; (b) all patients are regularly recoded every item in both the inclusion and the exclusion criteria, and (c) the EHR has been in place a minimum of three calendar years of full operation of the EHR (BPHC, 2013; BPHC, 2008). In lieu of the EHR, CHCs may submit a scientifically drawn sample

of 70 patients selected from all patients who fit the criteria and are drawn from the entire patient population identified as the universe (BPHC, 2013; BPHC, 2008). HRSA/BPHC will not accept larger samples (BPHC, 2013; BPHC, 2008). In addition, health centers may not choose to select the same number of charts from each site or the same number for each provider or use other stratification mechanisms (BPHC, 2013; BPHC, 2008).

While National and state data is publicly available via UDS and the UDS Mapper, the privacy of each individual Maryland HC was protected. The study used confidentiality protections designed to ensure that no one Maryland CHC was neither identified in the study's report or would have access to the original database. Institutional Review Board (IRB) approval was obtained on May 3, 2018 from the Morgan State University's Office of Sponsored Programs. Once data was collected from UDS, it was entered into a database via STATA, version 11 and analyzed. There were no missing data elements. Data security was ensured. All electronic or paper documents and spreadsheets was either password protected on the computer and/or stored in a locked cabinet. The database will be stored and maintained for a minimum of five years.

Statistical Analysis

The primary purpose for analysis in this research was to explore the following questions. Research question 1 examined the relationship between medical services utilization and controlled hypertension using 2008 and 2013 data. Research question 2 examined whether the average controlled hypertension measure among Maryland CHCs was significantly different from measurement years 2008 and 2013. Research question 3 examined the association between HCP financing, medical services utilization, and

controlled hypertension using 2008 and 2013 data. To explore these questions, several statistical analyses was performed with controlled hypertension as the outcome variable.

First, descriptive statistics including the study variables totals, percentage of the whole, central tendency (i.e. mean) and dispersion (i.e. range) was conducted to analyze the sample data. Comparison data was also compiled from National Health Center data using 2008 and 2013 calendar years UDS data (See Table 4.3). Pearson's correlation investigated the relationship between the dependent variable (controlled hypertension) to the independent variable (medical services utilization). Pearson's correlation also measured the strength of the relationship and determined if any significant correlation existed. The significance level was $\alpha = 0.05$. If *p*-value was less than α, the correlation was significant. To test whether the medical services utilization variable was statistically significant or a predictor variable for the controlled hypertension variable, the t-test statistic (*t*) was used. If the calculated t value was equal to or greater than the critical t value, then the null hypothesis was rejected.

Next, a paired sample t-test compared the means of the dependent variable (controlled hypertension) for 2008 and 2013 measurement years. This test was most appropriate, as the unit of analysis was Maryland CHCs and measures from the same health center were taken across two time periods, 2008 and 2013. The paired t-test demonstrated whether the mean for controlled hypertension was the same in 2008 and 2013. In addition, the results indicated if the difference of the controlled hypertension measure means in 2008 and 2013 was significant. The significance level was $\alpha = 0.05$. If

the calculated t value was equal to or greater than the critical t value, then the null hypothesis was rejected.

Multivariate analyses was conducted to determine the relationship of the dependent variable (controlled hypertension) and independent variable (HCP financing) from 2008 and 2013 while adjusting for medical services utilization and other covariates (characteristics of CHCs and characteristics of CHCs' population at risk). The multiple linear regression assessed the associations of these continuous community-level covariates. Multiple linear regression analysis also identified the strength of the effect that the independent variables had on the dependent variable (controlled hypertension). The significance level was $\alpha = 0.05$. The unstandardized beta (B) represented the slope of the line between the predictor variable(s) and the dependent variable.

The standardized beta (β; range from 0 to 1 or 0 to -1) compared the variables to see which had the strongest relationship with the dependent variable (controlled hypertension). The t-test statistic (t) calculated for the individual predictor variable(s) and illustrated that a single variable was statistically significant. This t-test statistic was also used to calculate the p value. If p-value was less than α, the individual variable was significant or significantly predicted the dependent variable (controlled hypertension).

Finally, the generalization of the F-test was used to test the hypothesis. The F test demonstrated if a group of variables was jointly significant. If the computed or calculated F was equal to or greater than the F critical value (also called F statistic), then the null hypothesis was rejected. The p-value associated with this F value was also compared to the alpha level ($\alpha = 0.05$). This overall significance test showed whether a

statistically significant relationship existed between the group of independent variables and the dependent variable. Lastly, two regression models were also examined to determine the associations of the independent variables to the dependent variable as well as the effect of the other covariates on the two main independent variables (BPHC grant and medical services utilization). To determine which additional covariates to include as controls in the second model, correlations were conducted between all other covariates and controlled hypertension. Only significant variables were included in the second model.

Chapter 4: Results

Overview of Chapter

This chapter presents the statistical analyses findings that explored the three research questions. The chapter begins with the univariate analysis, which provides descriptive statistics of the study sample. Next, bivariate analyses investigate the relationship between the dependent variable (controlled hypertension) to the independent variable (medical services utilization) as well as compared the means of the dependent variable (controlled hypertension) for 2008 and 2013 measurement years. The results of the multiple linear regressions assessed the association between the dependent variable (controlled hypertension) and independent variable (HCP financing) from 2008 and 2013 measurement years while adjusting for other covariates (medical services utilization, characteristics of CHCs and characteristics of CHCs' population at risk).

Univariate Analysis

Normality was assessed via the skewness and kurtosis indices of the study variables (Kline, 2011). Per Kline (2011), a variable is normally distributed when its skewness index (i.e., skewness statistic/standard error) is less than the absolute value of three and its kurtosis index (i.e., kurtosis statistic/standard error) is less than the absolute values of 20. Several variables were highly skewed (i.e., BPHC grants, ethnicity, and most of the income, medical insurance source, and race variables) as their skewness indices were above three (see Table 4.1). Thus, these variables were transformed using a natural log function. The skewness index of the transformed variables fell below three (i.e., they ranged from -.02 to -2.47); thus, these variables were used in subsequent

statistical testing. This was an essential step for making patterns in the data more interpretable and for helping to meet the assumptions of inferential statistics.

Table 4.1

Skewness and Kurtosis Indices for the Study Variables (n = 30)

Variable	Skewness		Kurtosis	
	Statistic	Index	Statistic	Index
BPHC Gants	1.36	3.18	2.9	3.49
Controlled Hypertension	0.04	0.09	2.21	2.66
Ethnicity				
Hispanic/Latino	2.81	6.59	9.15	10.99
Race				
American Indian/Alaska Native	2.57	6.03	6.21	7.45
Asian	3.28	7.68	12.13	14.56
Black/African American	1.32	3.08	1.41	1.69
Hispanic/Latino	2.81	6.59	9.15	10.99
More than one race	1.8	4.21	2.36	2.83
Native Hawaiian	3.82	8.94	15.73	18.89
Other Pacific Islander	1.83	4.3	2.49	2.99
White	1.62	3.78	1.49	1.79
Gender				
Female	1.16	2.72	0.55	0.66
Male	1.11	2.59	0.73	0.87
Hypertensive Patients	1.14	2.67	0.58	0.7
Income (% of FPL)				
≤ 100%	1.56	3.65	2.78	3.34
101% to 150%	0.75	1.76	-0.86	-1.03
151% to 200%	1.7	3.97	2.94	3.53
> 200%	2.8	6.55	9.04	10.85
Medical Services Utilization	-0.13	-0.30	0.00	0.01
Medical Insurance Source				
Medicaid	1.97	4.6	4.42	5.31
Medicare	1.24	2.91	0.07	0.09
Other public insurance	2.28	5.34	4.3	5.16

Note. SE for skewness statistic = .43. *SE* for kurtosis statistic = .83. (continued)

Table 4.1 (continued)

Skewness and Kurtosis Indices for the Study Variables (n = 30)

Variable	Skewness		Kurtosis	
	Statistic	Index	Statistic	Index
Medical Insurance Source				
Private insurance	1.63	3.82	1.89	2.27
Uninsured	0.59	1.39	-0.23	-0.27
Primary Care Providers	1.03	2.41	0.58	0.7

Note. SE for skewness statistic = .43. *SE* for kurtosis statistic = .83.

As shown in Table 4.2, the final sample size for the population used for this study was $n = 30$. BPHC grants for Maryland CHCs totaled over 62 million or 1.34% of the total BPHC grant awards for all CHCs nation-wide during this study period (See Table 4.3). On average, Maryland CHCs received an estimated 2 million each to carry out HRSA/BPHC's mission. This was comparable to the National Health Center data, which during this same study period, CHCs received on average $2 million each as well (See Table 4.3). The average controlled hypertension measure for Maryland CHCs during this study period was 62% (see Table 4.2). This measure was similar to the National Health Center data of 63% during the same study period (See Table 4.3). However, Maryland CHCs' controlled hypertension measure was much higher when compared to other national studies (same age criteria) during similar periods. Among a nationally representative population, controlled hypertension rates during similar periods ranged between 44% and 48% (CDC, 2013; CDC, 2011).

Maryland CHCs' Hispanic/Latino hypertensive patients comprised of 5% of the total hypertensive patients. This was low for this ethnicity when compared to the

National Health Center data, which estimated 24% of the total hypertensive patients were of Hispanic/Latino descent (See Table 4.3). In reference to gender, Table 4.2 shows an estimated 60% of Maryland CHCs' hypertensive patients were female. This was consistent with the National Health Center data of 59% female during this same study period (See Table 4.3). The majority of Maryland CHCs hypertensive patients' income (60%) fell at or below 100% of the FPG. This reported measure was lower than the National Health Center data of which 71% of hypertensive patients during the same study period fell at or below 100% of the FPG (See Table 4.3).

Table 4.2 also reflects that Maryland CHCs' hypertensive patients on average had 2.25 medical visits per year (utilization). This data was comparable to the National Health Center data, of 2.45 medical visits per year during the same study period (See Table 4.3). An estimated 40% of Maryland CHCs' hypertensive patients had Medicaid as their primary source of insurance followed by private insurance (23%) and uninsured (27%). While the percentage of Medicaid insured patients similarly compared to the National Health Center data (39%), the data for the National Health Center's hypertensive patients had a lower percentage for privately insured (15%) patients and a higher percentage of uninsured patients (36%) during the same period (See Table 4.3).

As shown in Table 4.2, Maryland CHCs had on average 10 primary care providers to serve an estimated 2,500 hypertensive patients. This equated to a caseload of 250 hypertensive patients to 1 primary care provider. This estimated caseload was comparable to the National Health Center data that reflected a caseload of 230 hypertensive patients to 1 primary care provider on average (see Table 4.3). The majority

of Maryland CHCs hypertensive patients were black (55%) and white (43%). This demographic variable appeared differently in the National Health Center data with 31% black and 61% white hypertensive patients during the same study period (See Table 4.3). Lastly, slightly more than half of Maryland CHCs were located in an urban area (53.3%), the rest were in rural areas (46.7%). This measure was slightly higher when compared to the National Health Center data with reported estimates of 49% CHCs located in rural areas in similar periods (The National Advisory Committee on Rural Health and Human Services, 2008; NACHC, 2013). Full descriptive statistics for the study variables are shown in Table 4.2 and Table 4.3.

Table 4.2

Maryland CHCs Descriptive Statistics for Hypertensive Patients Ages 18–85 (n = 30)

Variable	Total (%)	$\bar{x}$	Range
BPHC Grants	$62,430,363	$2,081,012	$291,600 to $6,574,572
Controlled Hypertension	-	61.49%	34.09% to 89.57%
Ethnicity			
Hispanic/Latino	3,618 (4.93)	120.6	0 to 919
Race*			
American Indian/Alaska Native	272 (0.40)	9.07	0 to 62
Asian	1,053 (1.56)	35.1	0 to 289
Black/African American	36,789 (54.48)	1,226.3	3 to 4,593
More Than One Race	173 (0.26)	5.77	0 to 33
Native Hawaiian	17 (0.03)	0.57	0 to 8
Other Pacific Islander	94 (0.14)	3.13	0 to 17
White	29,127 (43.14)	970.9	6 to 4,270
Gender			
Female	44,805 (61.05)	1,493.43	56 to 4,780
Male	28,580 (38.95)	952.73	32 to 2,932
Hypertensive Patients	73385	2,446.17	88 to 7,712

*Total percentage is from all hypertensive patients, excluding subcategories with unreported/refused to report race i.e. 5,860, 7.99%. (continued)

Table 4.2 (continued)

Maryland CHCs Descriptive Statistics for Hypertensive Patients Ages 18–85 (n = 30)

Variable	Total (%)	$\bar{x}$	Range
Income (% of FPG)**			
≤ 100% below	25,695 (60.07)	856.49	21 to 3,100
101% to 150% above	8,524 (19.93)	284.13	7 to 828
151% to 200% above	3,599 (8.41)	119.97	3 to 554
> 200% above	4,960 (11.59)	165.27	0 to 1,344
Medical Care Services Utilization	67.42	2.25	1.32 to 3.19
Medical Insurance Source			
Medicaid	29,548 (40.26)	987.97	9 to 4,573
Medicare	6,886 (9.38)	229.53	4 to 746
Other Public Insurance	928 (1.27)	30.93	0 to 225
Private	16,614 (22.64)	553.71	2 to 2,461
Uninsured	19,409 (26.25)	6,46.97	19 to 1,865
Primary Care Providers	292.93	9.76	1.25 to 27.91
Service Area Type			
Rural	14 (46.67)	-	-
Urban	16 (53.33)	-	-

** Total percentage is from all hypertensive patients, excluding subcategories with unknown income i.e. 30,607, 41.7%.

Table 4.3

2008 and 2013 National Health Center Comparison Data (N = 2,282)

Variable	Total (%)	$\bar{x}$
BPHC Grants	$4,670,866,394	$2,046,830
Controlled Hypertension	-	62.90%
Ethnicity		
Hispanic/Latino	1,159,203 (24.17)	507.98
Race*		
American Indian/Alaska Native	39,437 (0.94)	17.28
Asian	144,693 (3.45)	63.41
Black/African American	1,303,522 (31.05)	571.22

*Total percentage is from all hypertensive patients, excluding subcategories with unreported/refused to report race i.e. 514,716, 10.73%. (continued)

Table 4.3 (continued)

2008 and 2013 National Health Center Comparison Data (N = 2,282)

Variable	Total (%)	$\bar{x}$
Race*		
More Than One Race	141,817 (3.38)	62.15
Native Hawaiian	9,501 (0.23)	4.16
Other Pacific Islander	23,236 (0.55)	10.18
White	2,536,304 (60.41)	1,111.44
Gender		
Female	2,820,286 (58.80)	1,235.88
Male	1,976,232 (41.20)	866.01
Hypertensive Patients	4,796,518	2,101.89
Income (% of FPG)**		
≤ 100% below	2,569,794 (71.15)	1,126.12
101% to 150% above	530,064 (14.68)	232.28
151% to 200% above	236,218 (6.54)	103.51
> 200% above	275,668 (7.63)	120.80
Medical Services Utilization	4.81	2.45
Medical Insurance Source		
Medicaid	1,860,698 (38.79)	815.38
Medicare	385,941 (8.05)	169.12
Other Public Insurance	112,449 (2.34)	49.28
Private	703,290 (14.66)	308.19
Uninsured	1,734,140 (36.15)	759.92
Primary Care Providers	20,924.67	9.17

*Total percentage is from all hypertensive patients, excluding subcategories with unreported/refused to report race i.e. 514,716, 10.73%.
** Total percentage is from all hypertensive patients, excluding subcategories with unknown income i.e. 1,184,774, 24.70%.

Bivariate Analysis

Pearson's correlations analysis was used to determine the relationship between the dependent variable (i.e. controlled hypertension) to the independent variable (i.e. medical services utilization). The significance level was $\alpha = 0.05$. Prior to conducting the Pearson's correlations, assumptions of normality, homoscedasticity, and linearity (see Table 4.1; see Figures 4.2 and 4.3) were assessed and determined met. The correlation

between controlled hypertension and medical services utilization was $r = 0.38$ which is a weak or low positive relationship. A p-value less than α demonstrated that the correlation was significant. This correlation was statistically significant ($p = 0.04$). As such, it is concluded that there was a statistically significant relationship between controlled hypertension and medical services utilization.

To further test the hypothesis that a linear relationship existed, the calculated t value had to be equal to or greater than the critical t value. The critical t value was 2.05. The calculated t value was 2.17. Since the calculated t value of 2.17 was greater than the critical t value of 2.05, the null hypothesis was rejected, and it was concluded that there is a linear relationship between controlled hypertension and medical services utilization.

Next, the coefficient of determination calculated as the square of the correlation coefficient (r^2) in this study was computed as $r^2 = 0.14$. Therefore, 14% of the variance among the controlled hypertension variable can be "explained" by the medical services utilization variable. In other words, the linear model explained 14% of the variability of the data around its mean. To further understand the sample observations in this study (n = 30), a scatter plot chart visually inspected the data for linearity (see Figure 4.1).

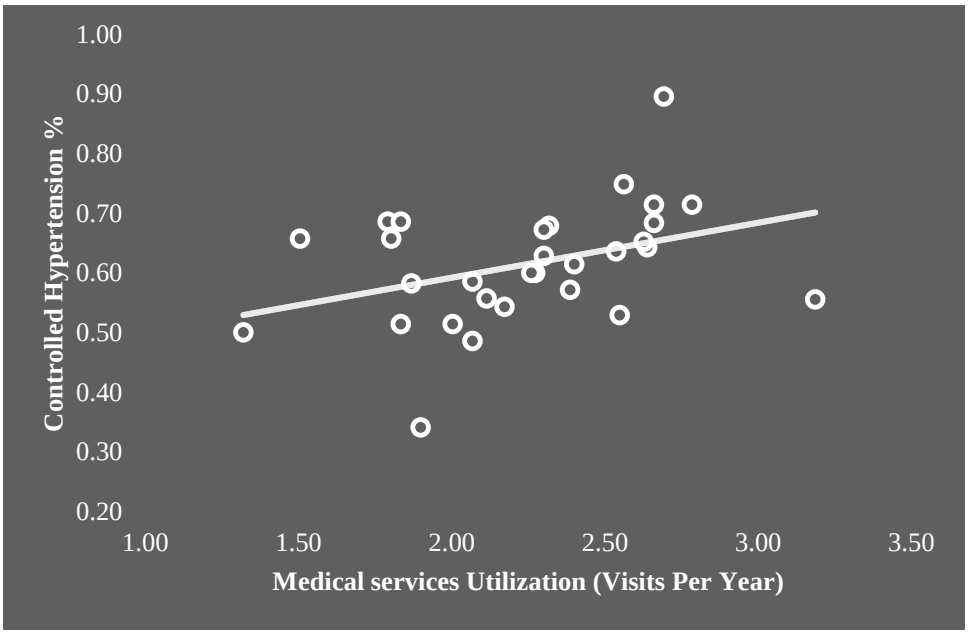

Figure 4.1. Scatter Plot Showing Weak to Low Positive Linear Correlation. The scatter plot illustrated that the majority of the data was close to the fitted regression line, thus it shows linear relationship.

Additional bivariate analysis included a paired *t*-test procedure to compare the means of the dependent variable (controlled hypertension) for 2008 and 2013 measurement years (see Table 4.4). The significance level was $\alpha = 0.05$. However, prior to conducting the t-test procedure, common assumptions were assessed and conditions were determined to be met. Controlled hypertension was a continuous variable. The observations (n=15) were independent of one another. Normality of the dependent variable (controlled hypertension) was assessed via the skewness and kurtosis indices (see Table 4.1). The dependent variable did not contain any outliers. Lastly, the population variance was unknown.

As shown in Table 4.4, the mean 2008 controlled hypertension measure was 0.57 (*SD* = 0.09). The mean 2013 controlled hypertension measure was 0.65 (*SD* = 0.09). A *p*-

value less than α demonstrated the difference of means was significant. Table 4.4 supports that the mean difference of -0.08 (95% CI = -0.16, -0.01) was significant (p = .028). In addition, the hypothesis that the mean controlled hypertension rate among Maryland CHCs would be significantly different between measurement years 2008 and 2013 was tested. The calculated t value had to be equal to or greater than the critical t value. The calculated t value of -2.45 was greater than the critical t value $t(14) = -2.1448$. As such, the null hypothesis was rejected, and it was concluded that Maryland CHCs had statistically significant higher controlled hypertension rates on average in 2013 as compared to Maryland CHCs controlled hypertension rates in 2008.

Table 4.4

Means, Standard Deviations, and Paired t-test Results from Controlled Hypertension Across Time (n = 15)

Controlled Hypertension	*n*	$\bar{x}$	*s*	*df*	*t*	*p*
Year	15	0.57	0.09	14	-2.45	0.028*
2008						
2013	15	0.65	0.09			

* p < .05. ** p < .01. *** p < .001.

Multivariate Analysis

Multivariate analyses was conducted to determine the relationship of the dependent variable (controlled hypertension) and independent variables (HCP financing and medical services utilization) between 2008 and 2013 while adjusting for characteristics of CHCs and characteristics of CHCs' population at risk. The significance level was α = 0.05. Prior to conducting the multiple linear regression analysis, assumptions of multivariate normality, homoscedasticity, linearity, and multi-collinearity

were assessed. Per Norusis (1991), multivariate normality is fulfilled when the points in a normal probability plot cluster towards the diagonal. As shown in Figure 4.2, this assumption was fulfilled as the points clustered towards the diagonal.

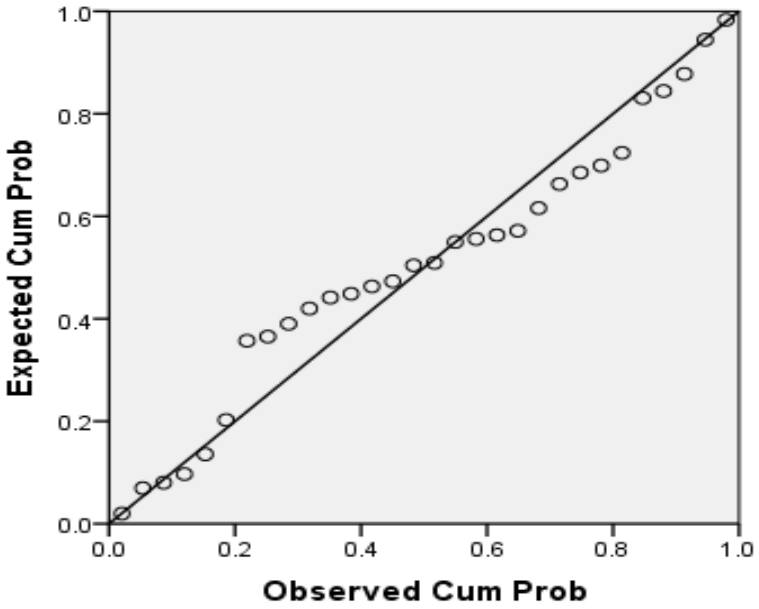

Figure 4.2. Normal Probability Plot for the Controlled Hypertension Model. Assumption fulfilled as the points clustered towards the diagonal.

Per Norusis, homoscedasticity and linearity are fulfilled when the scatterplot of the studentized deleted residuals by the standardized predicted values result in a random scatter. As shown in Figure 4.3, this assumption was fulfilled; there was no discernible pattern to the scatterplot points. Per Norusis, multi-collinearity is not problematic when the tolerance values of the predictors are above .20. Tolerance values ranged from .44 to .75; as such, multi-collinearity was not a problem.

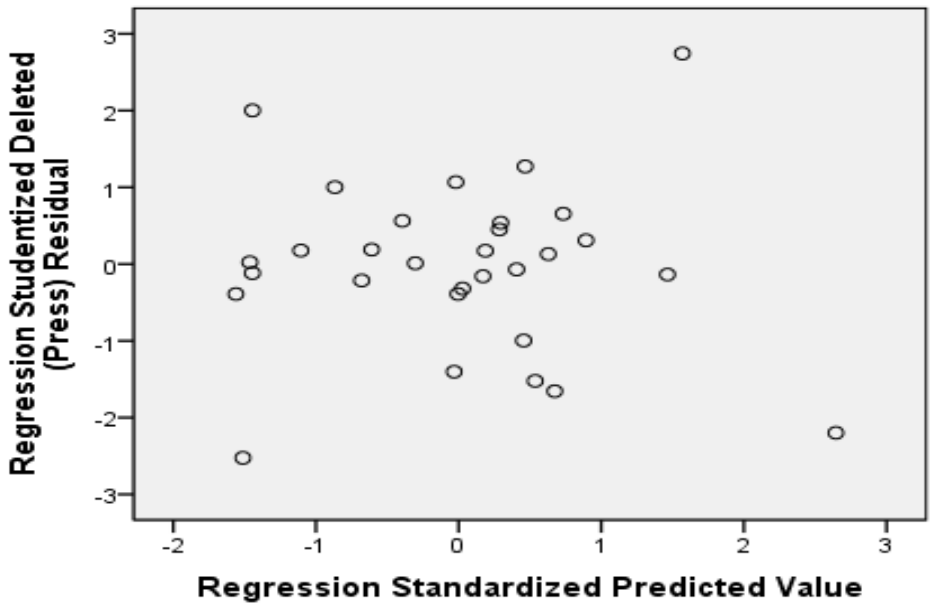

Figure 4.3. Scatterplot of the Studentized Deleted Residuals by the Standardized Predicted Values for the Controlled Hypertension Model.

To examine the relationship between HCP financing (i.e. BPHC grants), medical services utilization, and controlled hypertension, an examination between BPHC grants and controlled hypertension was first analyzed. A simple linear regression analysis between BPHC grants and controlled hypertension revealed the following linear equation, $\hat{y}$ = 0.8208 - 0.0144 (BPHC Grants), where, $\hat{y}$ is the predicted of expected controlled hypertension. The regression coefficient associated with BPHC Grants suggested that each one-unit increase in BPHC grant funding was associated with a 0.01 unit decrease in controlled hypertension. However, the correlations between BPHC grant funding and controlled hypertension were not statistically significant (r = 0.10, p = 0.60).

Next, medical services utilization (r = 0.38, p = 0.04) was assessed as a confounder and accounted for using a multiple linear regression analysis (see Table 4.5). The multiple regression model was $\hat{y}$ = 0.7978 - 0.0288 (BPHC Grant) + 0.1025

(Medical Services Utilization). The negative relationship between BPHC grants and controlled hypertension was now slightly larger (-0.03 versus -0.01) after adjustment for medical services utilization. A one unit increase in BPHC grant funding was now associated with a -0.03 unit decrease in controlled hypertension, holding medical services utilization constant. Each additional medical visit per year was associated with a 0.10 unit increase in controlled hypertension, while holding BPHC grant funding constant. While, BPHC grant funding remained not statistically significantly associated with controlled hypertension ($p = 0.28$), the magnitude of the negative association was higher after adjustment. Thus, part of the association between BPHC grant funding and controlled hypertension was explained by medical services utilization. In this multiple linear regression model, the individual predictor variable of medical services utilization was significant, $p = 0.03$.

Table 4.5

Regression Results for Controlled Hypertension Model 1 (n = 30)

Variable	B	SE B	β	*t*	*p*
BPHC Grants	-0.03	0.03	-0.2	-1.10	0.28
Medical Care Services Utilization	0.10	0.04	0.42	2.31	*0.03

Note. Overall model $F(2, 27) = 2.82$, Prob > $F = .08$, $R^2 = .17$.
* $p < .05$. ** $p < .01$. *** $p < .001$.

To test the hypotheses of a linear relationship among the three variables, the test statistic *F* was examined. As shown in Table 4.5, the computed value of VR is 2.82. The null was rejected if the computed value of VR was equal to or greater than test statistic distributed a $F_{(2, 27 \text{ d.f.})} = 3.35$. Since 2.82 was less than 3.35, we failed to reject the null

and concluded that there is not a linear relationship among HCP financing (i.e. BPHC grants), medical services utilization, and controlled hypertension.

To determine which characteristics of Maryland CHCs and characteristics of Maryland CHCs population at risk variables to include also as controls, correlations were conducted between all covariate variables and controlled hypertension. A *p*-value less than α demonstrated that the correlation was significant. As shown in Table 4.6, hypertensive patients with incomes 151% to 200% above the FPG, $r = .42$, $p = .02$ and white hypertensive patients, $r = .40$, $p = .03$ were significantly correlated with controlled hypertension. Both covariate variables were considered to have a moderately positive relationship with controlled hypertension and included in an additional multiple linear regression analysis.

Table 4.6

Correlations Between Other Covariates and Controlled Hypertension (n = 30)

Variable	*r*	*p* value
BPHC Grants	-0.10	0.60
Ethnicity		
Hispanic/Latino	0.23	0.21
Race		
American Indian/Alaska Native	0.17	0.38
Asian	0.33	0.08
Black/African American	0.03	0.88
Native Hawaiian	0.08	0.68
More Than One Race	0.07	0.72
Other Pacific Islander	0.07	0.70
White	0.40	*0.03
Gender		
Female	0.16	0.40
Male	0.17	0.36
Hypertensive Patients	0.17	0.38

* $p < .05$. ** $p < .01$. *** $p < .001$.

(continued)

Table 4.6 (continued).

Correlations between Other Covariates and Controlled Hypertension (n = 30)

Variable	*r*	*p* value
Income (% of FPG)		
≤ 100% below	0.32	0.08
101% to 150% above	0.26	0.16
151% to 200% above	0.42	*0.02
> 200% above	0.26	0.16
Medical Insurance Source		
Medicaid	0.25	0.18
Medicare	0.21	0.27
Other Public Insurance	0.07	0.71
Private	0.27	0.14
Uninsured	0.12	0.51
Primary Care Providers	0.11	0.56
Rural Service Area Type		
Rural	0.10	0.62
Urban	0.10	0.62

* $p < .05$. ** $p < .01$. *** $p < .001$.

Finally, the relationship between HCP financing (BPHC grants) and controlled hypertension was examined and the following independent variables, medical services utilization, income 151% to 200% above the FPG and white hypertensive patients were examined as confounders using a multiple linear regression analysis. The multiple regression model was $\hat{y}$ = .8441 - 0.0400 (BPHC Grants) + 0.0069 (151%–200% above FPG) + 0.0161 (White) + 0.04435 (Medical Services Utilization). Assessing only the *p*-values suggested that none of these four independent variables were independently statistically significant in this regression model.

To test the hypotheses of a linear relationship among these five variables, the test statistic *F* was examined. Shown in Table 4.7, the computed value of *F* was 3.03. The null was rejected if the computed value of F was equal to or greater than test statistic

distributed a $F_{(4, 25 \text{ d.f.})} = 2.76$. Since 3.03 was greater than 2.76, we rejected the null and concluded that there was a linear relationship among the five variables. This linear relationship was also significant evident by the probability of *F* (0.04) which was less than alpha ($a = 0.05$). Therefore, it was concluded as a group of variables the relationship was statistically significant to the dependent variable, hypertension control.

Table 4.7

Regression Results for Controlled Hypertension Model 2 (n = 30)

Variable	B	SE B	β	*t*	*p*
BPHC Grants	-0.04	0.03	-0.28	-1.59	0.12
Income (% of FPG)					
151% to 200% above	0.01	0.02	0.10	0.41	0.69
Race					
White	0.02	0.02	0.33	1.35	0.19
Medical Services Utilization	0.08	0.04	0.34	1.87	0.07

Note. Overall model $F(4, 25) = 3.03$, Prob > $F = .04$, $R^2 = .33$.
* $p < .05$. ** $p < .01$. *** $p < .001$.

To understand the magnitude of association between HCP financing (BPHC grants) and controlled hypertension as well as the effect of additional covariates, Table 4.8 illustrates each estimated regression equation over three models. The second model (see Table 4.8) added two additional variables, note when these two variables were added, medical services utilization as an independent variable became insignificant. In other words, by controlling white race and income 151% to 200% above the FPG, medical services utilization had no effect on controlled hypertension. If white race and income 151% to 200% above the FPG failed to be accounted for then medical services, utilization would have picked up the effect of these two variables.

Table 4.8

Estimated Regression Model

Regression Model	Estimated Regression Equation	B (BPHC Grants)
Simple linear	$\hat{y}$ = 0.8158 - 0.0140 (BPHC Grants)	-0.01
Multiple Linear 1	$\hat{y}$ = 0.7978 - 0.0288 (BPHC Grants) + 0.1025 (Medical Services Utilization)	-0.03
Multiple Linear 2	$\hat{y}$ = 0.8441 - 0.0400 (BPHC Grants) + 0.0069 (151%–200% above FPG) + 0.0218 (White) + 0.0829 (Medical Services Utilization)	-0.04

Chapter 5: Discussion

Overview of Chapter

The purpose of this study was to examine the relationship between HCP financing, medical services utilization, and controlled hypertension among Maryland CHCs from 2008 and 2013. With controlled hypertension as the dependent variable, this study examined its relationship with medical services utilization as well as the association with HCP financing, while controlling for other covariates (i.e. medical services utilization, characteristics of CHCs, and characteristics of CHCs' population at risk). The controlled hypertension measure was also examined over two points of time. This chapter presents a summary and discussion of the results associated with these research questions and hypotheses. Findings are compared and contrasted with the reviewed literature. The chapter also discusses implications for public health practice and policy. This chapter concludes with the study's strengths and limitations as well as discussions of future research.

Health Center Program Financing in Maryland Community Health Centers

BPHC grants was one of the two main independent variables examined from the conceptual model. The literature discussed that health policy including financing is the starting point for understanding medical services utilization and thereby improved health outcomes. However, in the study, a simple correlation (r = -0.10, p = 0.60) as well as multiple linear regressions (see Table 4.8) showed that BPHC grant funding in Maryland CHCs shared a negative relationship with controlled hypertension. In other words, as

BPHC grants increased, controlled hypertension decreased. This was indeed an unexpected finding of this study.

While the Aday and Anderson's (1974) framework and the adapted conceptual model, detailed the indirect link or pathway in which health policy/financing interacts with health outcomes, the literature also provided many key public health policies that have resulted in improved community health outcomes. In addition, two major federal pieces of legislation passed during the study's period afforded Maryland CHCs an increase in terms of staff, sites, services, and patient targets. While the literature supported that these increases in community resources yielded improved community health outcomes, the literature also provided two pathways in which health policy/financing influences health outcomes (Aday & Anderson, 1974). Therefore, a closer examination of this study's variable along with an additional literature scan was necessary to offer a possible explanation for this negative relationship between BPHC grants and controlled hypertension among Maryland CHCs. Discussed next are the three themes that emerged.

First, although the average Maryland BPHC grant amount of $2 million (see Table 4.2) is comparable to the average National Health Centers' BPHC grant amount of $2 million (see Table 4.3), a disparity in funding exist. According to the Kaiser Family Foundation's, *Distribution of Revenue by Source for Community Health Centers* (2016b), Maryland CHCs' BPHC grants represented only 14% of their total revenue. This placed Maryland CHCs in the lowest quartile in receiving BPHC grant funding across the U.S. states and territories. Therefore, if health policy including financing is indeed the starting

point for understanding improved community health outcomes, then addressing this inequality of BPHC grant funding amount for Maryland CHCs could yield a more positive relationship with the health outcome of interest, controlled hypertension.

Another possible explanation of the negative relationship between BPHC grants and controlled hypertension among Maryland CHCs may rest within the type of BPHC grant funding received in the study's sample. For example, in a closer examination of the BPHC grant study variable, it was discovered that two data points in this study represented a CHC that received solely Health Care for the Homeless funding and six data points in the study represented three CHCs that received Migrant Health Center funding. Due to the study's small sample size, the types of BPHC grant funding were not determined to be an exclusion criterion.

Controlling chronic health conditions, such as hypertension, in CHCs that specifically target a homeless population can be difficult due to the added barriers of those experiencing homelessness have (Baggett, O'Connell, Singer, & Rigotti, 2010; Bann, 2016; National Health Care for the Homeless Council [NHCHC], 2011a). Additionally, populations experiencing chronic homelessness are also more likely to experience comorbidities of conditions and diseases (Chassin, 1996; IOM, 1988; NHCHC, 2012; NHCHC, 2011b). Even more, due to the migratory culture of migratory and seasonal agricultural workers and their families, many challenges (i.e. lack of transportation, inadequate, or unsafe housing, etc.) and barriers to care, (i.e. fears of undocumented workers, social isolation, and exclusion, etc.) have an impact on health outcomes including chronic diseases such as hypertension (Arcury & Quandt, 2011;

Gwyther, & Jenkins, 1998; Rural Health Information Hub, 2018). Therefore, despite funding amounts for these types of BPHC grants among Maryland CHCs that specifically target special populations, positive health outcomes are more likely difficult to obtain.

Lastly, despite policy makers best efforts and intentions, not all public health policies and financially supported campaigns/interventions yield positive community outcomes. For example, the anti-drug Public Service Announcements (PSAs) that flooded U.S. television programming in the 70's and 80's. In support of this antidrug early movement, millions of school-aged children completed the Drug Abuse Resistance Education (D.A.R.E.) program, which began in 1983 to teach students good decision-making skills regarding substance abuse and other behaviors (D.A.R.E., 2018; Inglis-Arkell, 2014; Nordrum, 2014). Unfortunately, many studies showed that the D.A.R.E. program was not effective (Pan & Bai, 2009; Perry et al., 2003; West & O'Neal, 2004).

Another example of public health policies with unintended outcomes included the federal investment into abstinence-only education programs/interventions to combat the teen pregnancy epidemic (Inglis-Arkell, 2014). The United States spent approximately $2 billion on promoting abstinence-only programs/interventions over the past two decades (Donavan, 2017). However, many studies even after controlling for many confounders proved this approach not to be an effective strategy (Kirby, 2001; Kirby, 2007; Stanger-Hall & Hall, 2011; Trenholm et al., 2007). Consequently, while not expected, the negative association between BPHC grants and controlled hypertension among Maryland CHCs simply highlights the complexity of the interrelations of variables within the

study's conceptual model, all of which work together to impact community health outcomes.

Characteristics of Maryland Community Health Centers

Primary care providers were one of two variables that represented the characteristics of Maryland's CHCs as other covariates from the conceptual model. From the study's findings, Maryland CHCs primary care providers had an estimated caseload of 250 hypertensive patients to 1 primary care provider. This estimated caseload was comparable to the National Health Center data that reflected an estimated caseload of 230 hypertensive patients to 1 primary care provider on average. From the literature, higher ratios of primary care providers to patient were associated with better patient health outcomes (Beck et al., 2015; Mainous, Baker, Love, Gray, & Gill, 2001; Starfield, Shi, & Macinko, 2005). However, in this study of Maryland CHCs, while the primary care providers did share a very weak positive relationship ($r = 0.11$) with controlled hypertension, it was not significant ($p = 0.56$). Thus, not a predictor for controlled hypertension.

The second variable, service area type, also represented other covariates of the characteristics of Maryland's CHCs from the conceptual model. Within this study's sample, 14 (47%) of Maryland CHCs were located in rural areas and 16 (53%) were located in urban areas (see Table 4.2). This finding was similar to the National Health Center data that reported an estimated 49% of CHCs were located in rural areas during similar periods (The National Advisory Committee on Rural Health and Human Services, 2008; NACHC, 2013). From the literature, rural areas often experience fewer resources,

which ultimately affect health outcomes. However, in this study of Maryland CHCs, the rural service area type shared a very weak positive relationship ($r = 0.10$) with controlled hypertension, while not significant ($p = 0.62$). Thus, not a predictor for controlled hypertension.

This finding seemed to contradict the literature in that a negative relationship was expected between rural Maryland CHCs and controlled hypertension. One possible explanation of the positive association could in part be due to Maryland's substantial investment in supporting rural residents' health (NORC Walsh Center for Rural Health Analysis & University of Maryland School of Public Health, 2017). In fact, "the state's commitment to rural health is reflected in the creation of key government and non-profit organizations that provide leadership, investments, and guidance to promote health and well-being for rural communities and their residents" (NORC Walsh Center for Rural Health Analysis & University of Maryland School of Public Health, 2017). Therefore, Maryland CHCs' rural patients may not experience as many barriers to care and thereby have improved health outcomes.

Characteristics of Maryland Community Health Centers' Population At Risk

Ethnicity was one of six variables that represented the characteristics of Maryland CHCs' population at risk as other covariates within the conceptual model. Within the study's sample, only an estimated 5% of Maryland CHCs' hypertensive patients identified as Hispanic/Latino (see Table 4.2). This was quite low for this ethnicity when compared to the National Health Center data (see Table 4.3), which estimated 24% of the total hypertensive patients were of Hispanic/Latino descent. However, Maryland CHCs'

overall patient demographics during similar periods reported that Hispanic/Latino only comprised of 12% of the total Maryland CHCs' population (MACHC, 2013; MACHC, 2009). In addition, the United States Census Bureau, (2010a) reported that Maryland's state population comprised of only 10% Hispanic/Latino. Therefore, the 5% Hispanic/Latino hypertensive patients within Maryland CHCs' during the study period do not appear to be an alarming finding. Lastly, this study's finding seemed to support the literature in that the prevalence of hypertension appeared to be lower among the Hispanic/Latino patient population (Fryar, Ostchega, Hales, Zhang, & Kruszon-Moran, 2017). Also, the Hispanic/Latino ethnicity shared a weak positive relationship ($r = 0.23$) with controlled hypertension, although it was not significant ($p = 0.21$) in the study. Thus, not a predictor for controlled hypertension.

Race was one of six variables that represented the characteristics of Maryland CHCs' population at risk as other covariates within the conceptual model. Within the study's sample, the majority (55%) of Maryland CHCs hypertensive patient population identified as Black/African American (see Table 4.2). When compared to the literature, this finding supported the fact that Black/African American have the highest prevalence of hypertension (Benjamin et al., 2017; Keenan, & Rosendorf, 2011; Nwankwo, Yoon, Burt, & Gu, 2013). This finding was however much higher when compared to the National Health Center data (see Table 4.3), which estimated only 31% of the total hypertensive patients were of Black/African American decent. This may be due in part to the higher concentration of Black/African American population in Maryland, which comprised of 30.8% of the total population in 2010 (United States Census Bureau,

2010a). The U.S. Black/African American population only comprised of 12.6% of the total population in 2010 (United States Census Bureau, 2010b).

From the literature, Blacks/African Americans were also less likely to have controlled hypertension when compared to Whites (Fryar, Ostchega, Hales, Zhang, & Kruszon-Moran, 2017; Shelley et al., 2011). This study among Maryland CHCs also found similar findings. Maryland CHCs' Black/African American hypertensive patients shared a very weak positive, non-significant relationship with controlled hypertension ($r = 0.03$, $p = 0.88$). Therefore, the Black/African American race was not a predictor to controlled hypertension.

To the contrary, Maryland CHCs' White hypertensive patients, not only had a moderate positive association with controlled hypertension but this relationship was also significant. ($r = 0.40$, $p = 0.03$). Therefore, the White race was indeed a predictor for controlled hypertension. This implies that a higher controlled hypertension measure would be expected for Maryland CHCs that have greater numbers of White hypertensive patients. This finding is also supported in the literature in that controlled hypertension prevalence was higher among the White race when compared to other races (Fryar, Ostchega, Hales, Zhang, & Kruszon-Moran, 2017).

However, this finding also highlights the fact that racial disparities exist even within Maryland CHCs. While the majority of Maryland CHCs' hypertensive patients were Black/African American, only the White race was a predictor for controlled hypertension. While the literature supported that Black/African Americans are among the racial groups that are significantly less likely than White to utilize medical services

(Ashton et al., 2003; Babitsch et al., 2012); the literature also supports the importance of addressing the social determinants of health that greatly impact the Black/African American population (CDC, 2018b; ODPHP, 2018d; WHO, 2018b). Therefore, by addressing these social determinants of health (i.e. unstable housing, unsafe neighborhoods, transportation options, substandard education, etc.) will not only influence medical services utilization at Maryland CHCs but also work to improve health outcomes for the Maryland CHCs' Black/African American hypertensive patients.

Gender was one of six variables that represented the characteristics of Maryland CHCs' population at risk as other covariates within the conceptual model. Within the study's sample, the majority (61%) of Maryland CHCs' hypertensive patient population identified as female (see Table 4.2). This finding was comparable to the National Health Center data (see Table 4.3), which estimated 59% of the total hypertensive patients were of female gender. This finding was also supported in the literature; most studies found that females were more likely to visit a medical provider than men (Babitsch et al., 2012).

There were no notable differences in Maryland CHCs' female ($r = 0.16$, $p = 0.40$) and male ($r = 0.17$, $p = 0.36$) hypertensive patients' relationship with controlled hypertension. Both were very weak positive and yielded non-significant results. Therefore, neither male nor female gender were predictors for controlled hypertension. This finding slightly varied in the literature where one study actually found the male gender was a predictor for uncontrolled hypertension in New York CHCs (Shelley et al., 2011).

Hypertensive patients were one of six variables that represented the characteristics of Maryland CHCs' population at risk as other covariates within the conceptual model. Within the study's sample, the average number of hypertensive patients served at Maryland CHCs were an estimated 2,500 (see Table 4.2). This finding was slightly higher than the National Health Center data which estimated an average of 2,100 hypertensive patients served at all Health Centers (see Table 4.3). In the literature, a relationship exist between illness level and medical services utilization, all of which influence health outcomes (Andersen & Newman, 1973; Babitsch et al., 2012; Bernstein et al., 2003; Varenne et al., 2006). However, in this study of Maryland CHCs', hypertensive patients shared a very weak positive relationship ($r = 0.17$) with controlled hypertension, while not significant ($p = 0.36$). Thus, the hypertension diagnosis was not a predictor for controlled hypertension.

Income was one of six variables that represented the characteristics of Maryland CHCs' population at risk as other covariates within the conceptual model. Within the study's sample, the majority (60%) of Maryland CHCs hypertensive patients' income was equal to or less than 100% below the FPG (see Table 4.2). This measure is an important indication of poverty and according to BPHC's Health Center Program Compliance Manual, individuals and families with annual incomes at or below this income category must receive a full discount or nominal charge for health care services (BPHC, 2018). When compared to the National Health Center data, an estimated 71% of hypertensive patients' income was equal to or less than 100% below the FPG (see Table 4.3). The differences in income does not appear to be alarming as Maryland's median

household and median family income is much higher when compared to the U.S. population (Department of Numbers, 2016). In addition, between 2011 and 2018, either Maryland was ranked second or third in terms of the lowest overall poverty rate among all U.S. states and territories (Center for American Progress, 2018).

In the literature, enabling variables such as income provides the means to use services (Aday & Andersen, 1974; Babitsch et al., 2012; Hadley & Cunningham, 2004). In addition, many studies found association between income and medical services utilization which thereby influence health outcomes (Cooper et al., 2012; Larson, & Halfon, 2010; Majo & van Soest, 2011; Vassileva et al., 2013). In this study of Maryland CHCs', all income categories appeared to support the literature, in that, they shared a weak to moderate positive relationship with controlled hypertension. However, the third income category in the study, 151% to 200% above the FPG, shared a moderate positive relationship ($r = 0.42$) with controlled hypertension that was significant ($p = 0.02$). Thus, Maryland CHCs' hypertensive patients with incomes at 151% to 200% above the FPG was a predictor for controlled hypertension. Consequently, Maryland CHCs who have a greater hypertensive patient population with incomes at 151% to 200% above the FPG would expect to have a higher controlled hypertension measure.

To determine whether this particular income category had any unique characteristics in the study's population, a closer examination of the study's variable along with an additional literature scan was necessary. Within the study's sample, the 151% to 200% above FPG income category represented the least income category in both Maryland CHCs' hypertensive patients (8%) as well as the National Health Center data

(7%). According to BPHC's Health Center Program Compliance Manual, only partial discounts are provided for individuals and families with incomes within this income category (BPHC, 2018). In addition, no discounts are provided to individuals and families with annual incomes above this income category (BPHC, 2018). Therefore, there may be additional compensatory factors present within this income category, which ultimately influences health outcomes. In other words, this category could represent the "working poor" and additional targeted resources may be available to them.

It has been extensively studied and proven that a positive correlation exist between socioeconomic status and health outcomes. As income increases, health status/outcome increases. However, this study's income categories do not appear to follow any particular pattern. As it was expected that the highest category, greater than 200% above the FPG, would have been correlated with controlled hypertension as well. Yet, another explanation for this finding may also rest within how income is reported by Maryland CHCs hypertensive patients.

According to BPHC's Uniformed Data System Manual (2013; 2008), self-declaration of patients income are acceptable. In addition, BPHCs' Health Center Program Compliance Manual (2018) states that CHCs determines how to document income and determine whether discounts are offered to individuals who refuse to provide income information. Therefore, these policies may in fact impact income data collected by CHCs' patients. For example, over 40% of Maryland hypertensive patients' income was unknown (see Table 4.2) while the National Health Center data estimated 25% of unknown hypertensive patients' income (see Table 4.3). The differences in this unknown

income category is not alarming as eight data points (25%) of this sample represented four HCs that target patients experiencing homelessness and migratory agricultural workers and their families. As discussed early, the types of BPHC grant funding were not determined to be an exclusion criterion. Therefore, after a thorough assessment of the data and literature, it is concluded that this finding within the income category, 151% to 200% above the FPG, may simply represent an anomaly and warrant future studies.

Medical insurance source was one of six variables that represented the characteristics of Maryland CHCs' population at risk as other covariates within the conceptual model. Within the study's sample, the majority (40%) of Maryland CHCs' hypertensive patient population had Medicaid (see Table 4.2). This finding was comparable to the National Health Center data (see Table 4.3), which estimated 39% of the total hypertensive patients were on Medicaid. This was an expected finding as the majority of U.S states including Maryland adopted Medicaid expansion as a result of ACA (Henry J. Kaiser Family Foundation, 2018).

There were notable differences between Maryland CHCs' hypertensive patients' private insurance (23%) and the uninsured (26%) when compared to the National Health Center data which estimated hypertensive patients' private insurance at 15% and the uninsured at 36%. As discussed earlier, Maryland's median household and median family income is much higher when compared to the U.S. population (Department of Numbers, 2016). In addition, during this study's period, Maryland also had lower unemployment rates compared to the U.S. (Statista, 2018). Therefore, Maryland's higher incomes and lower employment rates coupled with ACA's impact on the private

insurance market and mandates for individuals to be insured, may in part explain the difference in these medical insurance source findings.

In the literature, enabling variables such as insurance also provides the means to use services (Aday & Andersen, 1974; Babitsch et al., 2012; Hadley & Cunningham, 2004). One study in the literature found that CHCs with greater uninsured patients were less likely to achieve higher controlled hypertension (Shi et al., 2012). In this study of Maryland CHCs' hypertensive patients, the data seemed to support the literature. The correlation for the uninsured category ($r = 0.12$, $p = 0.51$) compared to the private insurance category ($r = 0.27$, $p = 0.14$) had a weaker relationship with controlled hypertension, although neither results were significant. In addition, none of the medical insurance sources categories was predictors for controlled hypertension.

Medical Services Utilization at Maryland Community Health Centers

Medical services utilization was one of the two main independent variables explored from the conceptual model. From the study sample, this measure was on average 2.25 medical visits per year and it was comparable with the 2.4 medical visits per year as compared to the National Health Centers' data during the same period. Guidelines from the literature supported that once hypertension control was achieved, follow up visits to primary care providers should take place at intervals of 3 to 6 months; which, on average is 2 to 4 times a year (Javorsky, Robinson, & Kimball, 2014). Thus, the results from this study suggest that Maryland CHCs' hypertensive patients' follow up care were in line with recommended guidelines.

The first research question examined the relationship between medical services utilization and controlled hypertension. Pearson's correlations (r = 0.38, p = .04) as well as the t-test indicated that in the study's sample of Maryland CHCs', medical services utilization shared a positive, significant linear relationship with controlled hypertension. In other words, medical services utilization was a predictor for controlled hypertension. Therefore, it is assumed as medical services utilization increases at Maryland CHCs, the measure for controlled hypertension increases as well. This finding was supported in the literature in that medical services utilization was one of the main identifying predictors for improved health outcomes (Aday & Anderson, 1974; Babitsch et al., 2012). Additionally, the finding highlights additional key points from the literature, which is the importance of follow up care and maintaining a medical home, as vital components in the control and management of hypertension (CDC, 1994; He et al., 2002; Kirkland et al., 2017).

Quality of Care Measures/Health Outcomes in Maryland CHCs

Controlled hypertension was the main outcome/dependent variable from the conceptual model. In the study's sample of Maryland CHCs' hypertensive patients, the average controlled hypertension measure was 61.49% (see Table 4.2). This was comparable to the National Health Center data of 62.90% during the same study period (see Table 4.3). However when compared to other nationally represented studies during similar periods (44% and 48%), Maryland CHCs had a much higher controlled hypertension measure (CDC, 2013; CDC, 2011).

Due to these differences in findings, there was a need to explore further, how Maryland CHCs, who serves a predominantly Black/African population who are at greater risk for hypertension and experience greater health disparities, have greater hypertension control than the national population? The answer to this question in part, rest within the literature within two areas: (1) Maryland's sociodemographic and socioeconomic changes, and (2) patient satisfaction with the quality of care received. From the literature, it was discovered that Maryland's sociodemographic factors and socioeconomic status of the population has changed over the last decade. While Maryland CHCs are located in underserved and disadvantaged, rural and urban communities, more whites residents with higher incomes have populated Maryland's urban and inner cities (MACHC, 2011).

Consequently, within the study's population of Maryland CHCs hypertensive patients 18 through 85 years of age, an estimated 43% identified as white. This is much higher than nationally represented studies during a similar time period that reported the prevalence of hypertension among whites to be an estimated 28% (Keenan & Rosendorf, 2011; Nwankwo, Yoon, Burt, & Gu, 2013). As discussed earlier in this chapter, both White race ($r = 0.49$, $p = .03$) and income 151% to 200% above the FPG ($r = 0.42$, $p = .02$) were significant predictors for controlled hypertension. Therefore, one possible explanation for Maryland's CHCs higher controlled hypertension rates than the national population could simply be that being white and having a higher income are protector factors for controlled hypertension in Maryland CHCs.

Another possible explanation rest within the literature on patience satisfaction with the quality of care received at Maryland CHCs. Maryland CHCs are known to deliver culturally competent and high quality health care (HRSA, 2018d). These qualities of Maryland CHCs may in part, influence the access to, or utilization of, medical services due to cultural/ethnic factors, language needs, or overall satisfaction with care. In addition, Maryland CHCs are geographically located in underserved communities and offer medical services to all, regardless of the ability to pay (HRSA, 2018d). These additional attributes of Maryland CHCs, may in part, influence the access to, or utilization of, medical services by lessening barriers of care due to locality and income. In addition, the literature discussed that patient satisfaction influences whether a person seeks medical advice, maintains a continuing relationship with providers, adherence to medical advice and clinical treatment plans, as well as overall disease management (AHRQ, 2018; Ashish, Orav, Zheng, & Epstein, 2008; Assefa et al., 2011; Berkowitz, 2016). Therefore, all of the above combined characteristics of Maryland CHCs coupled with Maryland's CHCs higher controlled hypertension rate could simply be a reflection of patients' perceived experiences with a better quality of care (AHRQ, 2018).

The second research question examined whether a significant difference existed between Maryland CHCs' mean controlled hypertension rate from calendar years 2008 and 2013. This was an important question to explore, as from the literature, two major federal legislation, ARRA in FY 2009 and ACA in FY 2010 were passed during the study's period (CRS, 2018; Heisler, 2016). Both federal legislation afforded Maryland CHCs the opportunity for growth and expansion. The paired sample t-test found that the

mean difference of -0.08 (95% CI = -0.16, -0.01) was significant (p = .028). Thus, the conclusion was that Maryland CHCs in 2013 had a significantly higher controlled hypertension measure than calendar year 2008. This finding seemed to be supported in literature in that health policy/financing influences community resources, all of which aim at improving community health outcomes. This finding also highlights the importance of health policy and financing as the starting point in improving community health outcomes.

The third research question examined the association between HCP financing (i.e. BPHC grants), medical services utilization, and controlled hypertension. Two multiple linear regression models were explored (see Table 4.8). The first model examined the association between BPHC grants and controlled hypertension while adjusting for medical services utilization. The results found that when medical services were controlled for, the three variables as a group were not linearly related. However, medical services utilization as a single variable, was still significant as a predictor for controlled hypertension (t = 2.31, p = 0.03). In addition, BPHC grants had a negative relationship with controlled hypertension. The interpretation for the BPHC grant variable findings was that for every one-unit increase in BPHC Grants, the controlled hypertension measure would decreases by .03 units. As discussed earlier in the chapter, this negative association was indeed an unexpected finding of this study.

From the literature, it was anticipated that a linear relationship between BPHC grants, medical services utilization, and controlled hypertension would exist. That is as BPHC grants increase, medical services utilization would increase, and ultimately greater

controlled hypertension would be expected. However, the Aday and Anderson's (1974) framework as well as the conceptual model clearly details the complexity of the interrelations of variables as well the indirect link or pathway in which policy/financing influences health outcomes. Therefore, to assess thoroughly the association between BPHC grants and controlled hypertension, additional covariates from the conceptual model was examined.

The second model examined the association between BPHC grants and controlled hypertension while adjusting for several other covariates. To determine other confounders to control for in the second model, regressions were ran for all variables and controlled hypertension within the study. As discussed earlier in this chapter, income at 151%–200% above the FPG and White race were significantly correlated with controlled hypertension. Thus, these two variables were then entered into the multiple linear regression model.

The results found that when White race, income 151%–200% above the FPG, and medical services were all controlled for, the five variables as a group were indeed linearly related and that linear relationship was significant ($p = 0.04$). However, medical services as a single variable, was no longer a predictor for controlled hypertension ($t = 1.87$, $p = 0.07$). In addition, BPHC grants now had an even greater negative relationship with controlled hypertension. The interpretation now for the BPHC grant variable findings was that for every one-unit increase in BPHC Grants, the controlled hypertension measure would decreases by .04 units.

The significant linear relationship between BPHC grants, White race, income 151%–200% above the FPG, medical services utilization, and controlled hypertension was supported in the literature. Evident by the Aday and Anderson's (1974) framework and conceptual model, one pathway in which health policy/financing affects health outcomes is by its influence on the characteristics of the population at risk (Aday & Anderson, 1974; Babitsch et al., 2012; Gochman, 1997). For example, Maryland CHCs aims to increase medical services utilization by targeting racial/ethnic populations as well as low-income populations who are often underserved and experience greater health disparities. In addition, by offering discounted medical services, Maryland CHCs work to lessen barriers for care among these populations. While this study supported one pathway by which health policy/financing affects health outcomes, it did not support the alternative pathway in that Maryland CHCs resources did have any significant relationships with controlled hypertension.

Another point of discussion centers on the magnitude of BPHC grants' negative relationship with controlled hypertension as additional covariates were added to the model. If BPHC grant funding aims to targets ethnic/minority populations and those with lower incomes, then it is of no surprise that being White and having a higher income has a greater negative effect on BPHC grants in the model. One conclusion that can be drawn from these results is that in order for BPHC grants to positively affect community health outcomes, more interventions must be concentrated on its targeted population (i.e. low income, ethnic/minority, special populations, etc.) and their social determinants of health that greatly impact the utilization of medical care as well as the disease process itself.

For example, it was not a surprised finding that although Maryland CHCs serve more Black/African American hypertensive patients, White hypertensive patients still experienced greater controlled hypertension. If fact, White hypertensive patients in a Maryland CHCs were a predictor for controlled hypertension. While BPHC grants greatly help Maryland CHCs in terms of creating access to care for racial/ethnic populations, as evident from the study's findings, racial disparities in terms of clinical adherence to treatment still exist.

Another interesting finding was the effect on medical services utilization when race and income was added to the second model. In the first multiple linear regression model, medical services utilization as an independent variable was a significant predictor for controlled hypertension while the model itself was non-significant. However, when race and a higher income were added to the second model, medical services utilization became non-significant as a single variable, while the overall model itself was significant. The conclusion drawn from this finding was White race and income 151%–200% above the FPG may be correlated with medical services utilization, as the estimated effect of medical services utilization decreased and became non-significant. This could only be due to the fact that medical services utilization did not uniquely explain controlled hypertension.

From the literature, it was discussed that White race and higher incomes were associated with increased utilization. Therefore, when White race and a higher income were added to the model, medical services utilization was no longer a significant predictor for controlled hypertension as a single variable. This finding further highlights

the potential racial disparities even in medical services utilization, which is likely, linked again to the social determinants of health. Using a previous example, while Maryland CHCs hypertensive patients were predominantly Black/African American, White hypertensive patients were associated with greater controlled hypertension. In fact, White hypertensive patients were a predictor for controlled hypertension. This finding highlights the fact that more work is still necessary for CHCs to truly combat the hypertension crisis. There must be a shift from solely focusing on creating access to care for ethnic/minority and low-income populations to understanding and addressing the strong correlations between race/ethnicity and low income and poorer health status.

Implications for Public Health Practice and Policy

While it is known that CHCs aim to provide community accountable and culturally competent care, this study discovered that there are still embedded racial inequities within CHCs that pose significant barriers for racial/ethnic populations to achieve improved health outcomes. One public health implication of this study is the need to explore further these racial inequities even in CHC settings. In order for CHCs to improve health outcomes for racial/ethnic population, public health initiatives must continue to not only build capacity to support racial/ethnic populations in a multi-cultural context but simultaneously address the social determinants of health that greatly influences their health status and outcomes.

Another public health implication of this study highlights the complexity of health policy and the need for a more coordinated community strategy to combat chronic diseases such as hypertension. The literature implies that CHCs create an improved

service delivery environment for racial/ethnic and low-income populations, which in turn increases services utilization and the desired health outcome. However, the literature fails to provide evidence on how health policy/financing of the HCP addresses both the social and environmental influences of its targeted population. This study supports the fact that a more coordinated strategy involving several non-clinical partnerships may be required to move the needle. Any clinical interventions for racial/ethnic populations that fails to address the social determinants of health may in fact find that disparities in medical services utilization, adherence to treatment and health outcomes will continue to exist.

Lastly, an additional public health implication of this study is the advocacy of the CHC model in order to achieve HP 2020 goal for controlled hypertension nation-wide. Both the literature and this study supports that CHCs are exceeding HP 2020 goals for controlled hypertension while the national population lags behind. This study therefore highlights not only the importance of CHCs as the nation's largest safety net but also a model that has managed to improve community health outcomes, such as controlled hypertension despite serving many of the population most at risk for hypertension. Therefore, there is still much to learn and explore in terms of the effectiveness of CHCs and how their mission of delivering culturally aware, high quality health care without the ability to pay can be extrapolated to other primary care settings.

One of the main independent variables examined in this study was HCP financing measured by the total BPHC grant funding to each Maryland CHC. This study found that a negative relationship between BPHC grants and controlled hypertension exists. One health policy implication of this finding is that in order to achieve community health

change, federal government should target funding at specific programs or interventions. In addition, in federal government, this economic concept of return on investment is being applied to justify public health program spending. However, is essential for federal government to explicitly define what success looks like. Is it improved community health outcomes, increased patient access, reduction in health disparities, elimination of racial disparities, etc.?

Therefore, another health policy implication of this study is the need for health policies to develop smart goals and objectives in order to evaluate the impact of federal health policies and funding. For example, this study concluded that Maryland CHCs were exceeding both the national average and HP 2020 goals for controlled hypertension. However, when examined from a different lens, it was discovered that racial disparities exist either within medical services utilization or in terms of adherence to treatments. Lastly, an examination of community-level data can help guide decisions and provide recommendations to health policy officials; however, the depth of examinations are only as good as the data available. Therefore, in order to fully examine federal public health programs such as CHCs, data must contain additional community-level indicators that will offer additional objectives measures of outcomes and reduce the need for making estimations.

Study Strengths

A major strength of this study is that UDS data remains the most comprehensive, description of the HCP. According to HRSA, this is the only standardized reporting system that provides consistent information about CHCs on an annual basis (HRSA, 2018c). In addition, because CHCs are allowed to submit data obtained either from an

EHR or from an audit of 70 patient charts, the UDS reporting manual contains specific instructions on how to select a random sample and HRSA/BPHC expects CHCs to follow this methodology (BPHC 2013; BPHC 2008). These detailed reporting instructions in UDS also help ensure uniformity and accuracy in reporting. In addition, because UDS is a required part of the annual HRSA/BPHC grant process, there is a 100% response rate. Lastly, this examination makes use of community-level data which could be used to provide recommendations to further guide local, state, and federal efforts in the monitoring, treatment, and management of chronic diseases such as hypertension, which disproportionately affect racial/ethnic populations.

Study Limitations

In light of this study's finding, there are a number of limitations to address. First, the list of covariates is limited to variables that can be determined through UDS. When exploring CHCs' clinical measures, like controlled hypertension, only a few community-level indicators were categorized in UDS. All other community-level indicators had to be estimated using Maryland CHC's general population. In addition, aggregate data limits the statistical test and modeling techniques. One key limitation of aggregate data is ecological fallacy. Therefore, control for individual patient characteristics were not possible due to the design of this study. While data collected by the CHCs helped examine associations, attempts to establish causation or generalization of individual patients had to be avoided. Lastly, there may be variation in data reporting across the CHCs. Some CHCs may report information on all patients using EHRs, while others may report on a sample of patients using manual record abstraction. Consequently, sample

selection during chart reviews may not be consistent or generalizable to the health center population at large.

Future Research

Despite the limitations of this study, there are many opportunities to expand and explore CHCs further. First, this adapted conceptual model can be applied to any of BPHCs CHCs' clinical measures. Recent BPHC supplemental grant funding opportunities has specifically targeted substance use disorders, mental health, behavioral health, and the opioid crisis. Therefore, examining the relationship between these supplemental grant funds and the intended patients or services outcomes could reveal significant findings. As evident by the Aday and Anderson's (1974) framework and the study's adapted conceptual model, there are several interactions and interrelations of variables that can further be examined. The study findings also suggest that sociodemographic and socioeconomic disparities of hypertension control within CHCs exists. Therefore, another study can focus specifically on the relationship between these sociodemographic and socioeconomic variables and medical services utilization or adherence to treatment. These findings could help inform BPHC leadership on other non-clinical interventions to improve community health outcomes in CHCs.

Lastly, to understand better the controlled hypertension measure across other CHCs, comparison data could be drawn from CHCs that have engaged in a more specific intervention or targeted program such as the Million Hearts. In 2014, Million Hearts established a two-year cooperative agreement with NACHC to pilot strategies and tools to improve diagnosis and control of high blood pressure in 11 CHCs (NACHC, 2018).

The controlled hypertension measure among these 11 CHCs could then be examined with 11 comparable CHCs who did not engage in the intervention. These findings could also inform BPHC leadership on the impact of targeting funding to specific interventions with CHCs and its relationship to community health outcomes.

Conclusion

In closing, this study examined the relationship between HCP financing, medical services utilization, and controlled hypertension among Maryland CHCs from 2008 and 2013 appears to be the first of its kind. The results suggests the following key points. First, health policy including financing may be the starting point for examining community health outcomes but by far is not the final solution. There are also several interactions and interrelations of variables in which health policy/financing acts upon that influences health outcomes. Not fulling addressing these other factors (i.e. social determinants of health) may indeed have unintended impacts on community health outcomes.

Second, medical services utilization, as an independent variable is a significant predictor for controlled hypertension. However, medical services utilization does not uniquely explain controlled hypertension among Maryland CHCs. In other words, there are additional factors such as race and income that influences medical services utilization in Maryland CHCs. Lastly, the best-fit model in predicting controlled hypertension in Maryland CHCs included the BPHC grants, White race, income 151–200% above the FPG, and medical services utilization variables. This model also demonstrated that White race and income 151–200% above the FPG interacted with both BPHC grants and

medical services utilization. This implies that while health policy/financing is important, unless it specifically address those social determinants of health, medical services utilization as well as controlled hypertension will likely demonstrate that racial disparities within CHCs still exist.

While Maryland CHCs in this study population exceeded both the national average and HP 2020 goals for controlled hypertension, further work is warranted to address the sociodemographic and socioeconomic disparities within Maryland CHCs. Indeed, CHCs are important in the continuous monitoring, treatment, and control of hypertension especially among the most vulnerable and at-risk populations. Furthermore, utilizing medical services at CHCs can be an essential first step response and possible effective long-term treatment strategy for monitoring and controlling hypertension among patients of racial and ethnic minority groups that are disproportionately affected (Bovet et al., 2008). However, as public health advocates and officials, we must continue to dispel the notion, if you build it, they will come, as this no longer applies in targeting racial/ethnic and low-income populations. Instead, more focus and interventions should be placed on the potential disparities in medical services utilization and in the adherence to treatment, which is influenced by the social determinants of health.

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Appendix A

Framework, Conceptual Model, and Study Variables Crosswalk

Framework	Conceptual Model	Variable
Health Policy - Financing	HCP Financing	BPHC Grant

Characteristics of Health Delivery System
- Resources
  o Volume
  o Distribution
	Characteristics of CHCs	Primary Care Provider Providers
		Service Area Type

Characteristics of Population at Risk - Predisposing - Enabling - Need	Characteristics of CHCs Population at Risk	Ethnicity Race Gender Income Medical Insurance Source Hypertensive Patients
Utilization of Health Services - Type - Site - Purpose - Time Interval	Medical Care Services Utilization	Medical Care Services Utilization
Patient Satisfaction - Quality	Quality of Care/Health Outcomes	Controlled Hypertension

Appendix B

Variable Summary Table

Variable/(Type)	Definition
Controlled hypertension (continuous)	Percentage of patients 18 through 85 years of age with diagnosed hypertension whose blood pressure was less than 140/90 at the time of the last reading.
Medical services utilization (continuous)	Average number of medical visits per year by hypertension diagnosis for patients 18 through 85 years of age.
CHC health policy financing (continuous)	Total BPHC section 330 grant award.
Primary care provider (continuous)	Total annualized full-time equivalent of Family Physicians, General Practitioners, Internists, and Nurse Practitioners.
Service area type (dichotomous)	Type (urban or rural) that describes the majority of the service area.
Gender (continuous)	Total number of hypertensive male and female patients 18 through 85 years of age.
Ethnicity (continuous)	Total number of self-reported Hispanic/Latino of hypertensive patients 18 through 85 years of age
Race (continuous)	Total number of the self-reported race of hypertensive patients 18 through 85 years of age: Asian, Native Hawaiian, Other Pacific Islander, Black/African American, American Indian/Alaska Native, White, More Than One Race, or Unreported/Refused to Report Race
Income (continuous)	Total number of family income of hypertensive patients 18 through 85 years of age defined in ranges relative to the Federal poverty guidelines: 100% and below, 101–150%, 151–200%, Over 200%, or Unknown

Note. Each definition includes data as reported by each CHC. (continued)

Variable Summary Table (continued)

Variable/(Type)	Definition
Medical insurance source (continuous)	Total number of primary health (medical) insurance the hypertensive patients 18 through 85 years of age had at the time of their last visit: Uninsured, Medicaid, Medicare, Other Public Insurance (S-CHIP or Non-S-CHIP) or Private.
Hypertensive Patients (continuous)	Total patients 18–85 years of age with ICD-9-CM Code 401.xx–405.xx diagnosis.