TASK-SHIFTING AND HYPERTENSION MANAGEMENT IN GHANA

BY

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DISSERTATION

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ABSTRACT

By the year 2020, it is estimated that hypertension will contribute to 75% of deaths in sub-Saharan Africa. In Ghana, hypertension is the second leading cause of outpatient morbidity and mortality. One of the key barriers to optimal management of hypertension in Ghana is the severe shortage of physicians, exacerbated by the "brain drain," or the movement of physicians out of lower-middle-income-countries to higher income countries. Task-shifting, defined as the rational movement of clinical duties from physician to non-physician health care workers is one potential mechanism of mitigating the consequences of the brain drain.

In Ghana, the TAsk-Shifting Strategy for Hypertension was a cluster-randomized trial in which community health clinics were randomized to a control group, or an intervention group in which community health nurses were trained in the WHO-PEN package to diagnose, treat, and manage hypertension. This dissertation sought to examine 1) how patients involved in TASSH perceived the program and their ability to manage hypertension; 2) the role of social determinants of health in influencing intervention outcomes; and 3) factors influencing the sustainability of the program.

This study provides information that can inform the development of future task-shifting strategies for hypertension by elucidating: positive aspects of the program that fostered behavior change; contextual factors that influence hypertension and can be the focus for tailoring interventions in the future; and factors that can influence the long term sustainability of task-shifting programs from the perspective of stakeholders involved in implementation.

Key words: hypertension; Ghana; task-shifting; WHO-PEN; PEN-3; social determinants

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CHAPTER 1: INTRODUCTION

Ghana, as well as the rest of sub-Saharan Africa (SSA) is undergoing rapid epidemiological transition, in which high rates of communicable diseases are coupled by the growing rates of non-communicable diseases (NCDs) (Hendriks et al., 2015;Hendriks et al., 2012). Hypertension, once a rare public health problem in SSA, has been a growing concern over the past several years (Addo et al., 2012). Poorly managed hypertension further propels the epidemic of cardiovascular disease (CVD) that SSA is facing, and thus contributes increasing morbidity and mortality as a result of chronic disease (Kaddumukasa, Ddumba, Duncan, & Goldstein, 2012). Currently, more than 3.5 million out of 15.8 individuals over 15 are classified as hypertensive in Ghana, making hypertension the second leading cause of outpatient morbidity in adults age 45 and over (Bosu, 2010). Estimates suggest that by 2020, approximately 75% of deaths in SSA will be attributable to hypertension and its complications (Kearney et al., 2005). These statistics raises important questions about how best to mitigate the multiple barriers to optimal hypertension control and reduction of CVD risk.

In a systematic review of eleven surveys conducted in Ghana, the prevalence of hypertension ranged between 19.3% in rural areas to 54.6% in urban areas (Bosu, 2010). Levels of hypertension detection (22%-54%), treatment (7%-31%), and control (0%-13%) were low in six studies where such data were reported, and blood pressure (BP) control rates were between 1.7% and 12.7%. Findings from a population-based study by Cappuccio et al. showed that in the Ashanti Region of Ghana, more than 25% have hypertension (Cappuccio, Kerry, Forbes, & Donald, 2004). Such high prevalence and the low rates of BP detection, treatment, and control are largely responsible for the increasing burden of CVD mortality, particularly stroke, in Ghana (Ogedegbe, Plange-Rhule, et al., 2014). For example, in Accra, CVD rose from being the

seventh and tenth cause of death in 1953 and 1966, to the number one cause of death in 1991 and 2001, respectively (Agyei-Mensah, 2004).

Thus, interventions targeted at BP control are vital to reducing hypertension-related morbidity and mortality (Beaglehole et al., 2008; Mendis et al., 2010). However, there are many barriers to effective detection, treatment, and control, including socioeconomic barriers, lack of insurance coverage, uncoordinated care, and shortage of physicians which limit the detection and control of hypertension at the primary care level across SSA (Barsoum, 2006; Beaglehole et al., 2008; Hagopian, Thompson, Fordyce, Johnson, & Hart, 2004; Mejia, Pizurk, & Royston, 2014; Pang, Lansang, & Haines, 2002; Unwin et al., 2001). Particularly, the severe shortage of health care workers places further demands on an already fragile and under-resourced system. It is estimated that in SSA, there is a ratio of 2 doctors per 10,000 population members (Mayosi, 2013). This extreme shortage forces the system to rely more heavily on community health workers in local area, especially when it comes to intervention implementation. There is a large literature support the importance and utility of community health workers in improving health outcomes, both in terms of economic and social advantages. In SSA the involvement of community health workers has been shown to reduce wait times, streamline patient intake, and reduce the workload of health workers (Mwai et al., 2013). However, many community health workers as well as health care providers are being lost to the "brain drain," or the process of migrating to countries with more stable economies and health care infrastructures (Kalipeni, Semu, & Mbilizi, 2012). As a result, health care worker shortage is further exacerbated. For example, even though 11% of the world's population resides in SSA, and SSA bears 24% of global disease burden, it has only 3% of the global health workforce, and spends less than 1% of the world's financial resources on health (Anangwe & Mtonga, 2007). Given such limited

resources, cost-effective systems-level strategies are urgently needed to address the rising epidemic of hypertension and related CVD in SSA (Beaglehole et al., 2008). To date however, little is known about effective interventions targeted at BP control in SSA, particularly interventions addressing systems level barriers on a wide scale (Opie & Seedat, 2005).

Task shifting strategy, defined as rational movement of primary care duties physician to non-physician health care workers, is a potential method for optimal management of disease, including hypertension in Ghana, particularly in light of the under-resourced health systems (Callaghan, Ford, & Schneider, 2010; Lekoubou et al., 2010). When feasible, task shifting of primary care responsibilities will be distributed from physicians to non-physicians clinicians, nurses, and community health workers. Task shifting, has been proposed as a potential solution addressing the acute shortage of physicians in SSA and viable method to implement primary and secondary prevention at the primary care level (Zachariah, Ford, & Phillips, 2009). The use of task shifting has several documented benefits in the context of HIV/AIDS management (Callaghan et al., 2010); in the context of hypertension, task shifting will help to address the systems level factors related to health care worker shortage (Labhardt, Balo, Ndam, Grimm, & Manga, 2010; Lekoubou et al., 2010). Shifting the tasks of CVD risk assessment and management of uncomplicated CVD risk factors, such as hypertension and diabetes, from physicians to non-physician healthcare providers such as nurses is a viable and potentially cost-effective strategy (Gbenga Ogedegbe, Plange-Rhule, et al., 2014).

In Ghana, a cluster-randomized trial of task-shifting and blood pressure control (TASSH) in community health centers and district hospitals is currently on-going (U01HL114198; PI: Ogedegbe) (Gbenga Ogedegbe, Plange-Rhule, et al., 2014). In partnership with the Ghana Health Services (GHS) through its Community-Based Health Planning and Services (CHPS) program,

this study will evaluate the comparative effectiveness of the implementation of the WHO Package of Essential Noncommunicable diseases (WHO-PEN) program targeted at CVD risk assessment and hypertension control (intervention group), versus provision of health insurance coverage (control group), on blood pressure reduction in the Ashanti region of Ghana.

The World Health Organization (WHO) created the Package of Essential NCD Interventions to strengthen equity and efficiency of primary health care in low-resource settings. The WHO-PEN is a prioritized set of cost-effective interventions that can be delivered to an acceptable quality of care, even in resource-poor settings (WHO, 2010b). Furthermore, WHO-PEN defines a set of standards for "essential NCD interventions for any country that wishes to initiate a process of universal coverage reforms to ensure that health systems contribute to health equity, social justice, community solidarity and human rights" (WHO, 2010b p.10). One of the essential non-communicable diseases targeted by the WHO is cardiovascular disease, which encompasses hypertension. To address cardiovascular disease, the WHO-PEN provides four steps: 1) inquiry about the patient's history (e.g. heart attack, stroke, lifestyle behaviors, diabetes); 2) physical and laboratory experiments (including BP measurements, fasting glucose, cholesterol); 3) estimation of cardiovascular disease risk based on risk charts provided by WHO (categorized as low, medium, or high); 4) initiation of drug therapy, lifestyle counseling, and follow-up visits (Mendis et al., 2010; Ogedegbe, Gyamfi, et al., 2014)

Since 2012, TASSH has trained 64 community health nurses (CHNs) in the WHO-PEN protocol across 32 community health centers (CHCs) and district hospitals randomized to either the intervention (16 CHCs) or control groups (16 CHCs), and randomized 757 patients either to the intervention (368 patients) or control (389 patients). Of the patients enrolled, 651 (86%) have completed 12 months follow up with 24 months follow up currently on-going to assess changes

in behavior related to hypertension management and health outcomes such as blood pressure control. While the findings of TASSH will provide needed information with respect to comprehensive cardiovascular risk reduction and hypertension control in Ghana, it remains unclear how stakeholders (e.g. patients, health care providers) perceive this intervention, how intervention outcomes are influenced more broadly by social determinants of health, and how this intervention could be sustained over time, if successful. Thus, the research questions of the proposed study are: 1) How do patients perceive hypertension and an on-going task-shifting strategy to promote hypertension management? ; 2) How do social determinants of health influence intervention outcomes among patients participating in the TASSH intervention? ; and 3) What is the role of nurses trained in the WHO-PEN package in sustaining the TASSH intervention and ultimately hypertension management?

CHAPTER 2: LITERATURE REVIEW

2.1 HYPERTENSION

Hypertension is defined as a blood pressure of >140 systolic and/or >90 diastolic (Ogedegbe, Plange-Rhule, et al., 2014). More commonly known as high blood pressure, hypertension is a condition in which the force over time of blood against artery walls is high enough to cause potential health complications (Mayo Clinic, 2016). Blood pressure is determined by the amount of blood pumped by the heart, and the resistance to blood flow in the arteries; thus as arteries narrow blood pressure increases due to the greater resistance to flow in the arteries. Hypertension can be present without symptoms while still causing damage to the heart and blood vessels, and in general, develops over the course of several years.

There are two types of hypertension seen in clinical settings. Primary (or essential) hypertension tends to develop gradually over the years, and for which it is difficult to pinpoint an exact cause. Secondary hypertension is causes by an underlying condition and tends to have a more rapid onset that primary hypertension. Conditions associated with secondary hypertension include: Obstructive sleep apnea; Kidney problems; Adrenal gland tumors; Thyroid problems; Medication or substance use, and others. Several risk factors for hypertension have been identified. The risk of hypertension increases with age, particularly over 45 for men and 65 for women. This risk increases due to stiffening of the blood vessels, however this can be prevented or delayed with a healthy diet and regular physical activity (WHO, 2013). Overweight and obesity increase the likelihood of developing hypertension, as the heart is required to pump more blood, thus increasing arterial pressure. Linked with obesity and overweight, physical inactivity puts individuals at higher risk of hypertension. Physically inactive individuals tend to have higher resting heart rates, requiring the heart to pump blood more forcefully with each

contraction. Dietary factors such as excess of sodium, as well as potassium and Vitamin A deficiencies contribute to increased risk of elevated blood pressure. Too much sodium increases bodily fluid retention and thereby blood volume, putting more pressure on arterial walls, and lowering excess sodium intake can reduce blood pressure (Aburto et al., 2013; Mozaffarian et al., 2014). To reduce blood pressure, the World Health Organization recommends a reduction to <2 g/day sodium (5 g/day salt) in adults (WHO, 2015). Potassium assists with maintain the sodium balance within the cells, thus too little potassium, especially in combination with a high sodium diet, exacerbates the risk for hypertension. Finally, tobacco use causes thinning of the arterial walls and narrowing of arteries, which increases blood pressure. Although there is a genetic component to hypertension, with individuals at a higher risk of developing hypertension if biological family members have the condition, the majority of risk factors are related to lifestyle and behavior. Furthermore, many of these behavioral risk factors are highly influenced by people's living and working conditions (WHO, 2013).

2.1.1 Complications of hypertension

One of the dangers of hypertension is that most people have no symptoms at all. Sometimes hypertension can cause dizziness, headaches, chest pains, heart palpitations, and nosebleeds, but these cannot be relied upon to guarantee a diagnosis of hypertension. This is problematic as many people are unaware that they may be at risk for hypertension, or even their current blood pressure. Undetected and untreated, hypertension increases the chance of life-threatening complication such as a cardiovascular event including heart attack or stroke. This is known as cardiovascular risk, which can also be high in people with mild hypertension in combination with other risk factors such as diabetes, high cholesterol, or smoking. Low-socioeconomic status exacerbates these risk factors due to limited access to medical service and

the increased vulnerability in having a hypertension related cardiac event (WHO, 2013). For instance, household income has consistently shown associations with general measures of health (Macintyre, McKay, Der, & Hiscock, 2003). Educational attainment is also a widely used indicator of socioeconomic status, and has been shown to reflect a household's ability to avoid risky behaviors and practice good health (Fotso & Kuate-Defo, 2005). Occupation also reflects health risk and protective factors related to occupational environment and provision of income to assist with healthful behavior practices, including seeking medical attention when needed (Winkleby, Jatulis, Frank, & Fortmann, 1992). Low socio-economic status, usually indicated by low income, low educational attainment, and unemployment or underemployment, compounds the risk of cardiovascular disease development due to limited health education, lack of income and other resources needed to practice good health behavior, and unsafe or stressful working conditions.

2.2 TRENDS IN HYPERTENSION

Globally, elevated blood pressure is estimated to cause 7.5 million deaths per year, approximately 12.8% of all deaths (WHO, 2016). This accounts for 57 million disability adjusted life years (DALYS) or 3.7% of total DALYS. Global prevalence of hypertension is approximately 40% (Mendis et al., 2010). Although the proportion of the world's population with uncontrolled hypertension declined between 1980 and 2008, due to aging and population growth the number of estimated cases of uncontrolled hypertension has increased from 600 million in 1980 to 1 billion in 2008 (WHO, 2016). Across various regions, prevalence of elevated blood pressure is highest in Africa, where it is estimated to be 46% for men and women combined. In sub-Saharan Africa, the leading cause of death and disability in 2010 was stroke, and cardiovascular disease contributed to 3.5% of the total DALYS in the region (Moran et al.,

2013). In all WHO regions, men typically have higher rates of high blood pressure than women (WHO, 2016).

2.2.1 Prevalence of Hypertension in Africa

Estimates suggest that the prevalence of hypertension is rising in sub-Saharan Africa over the last decade (Iwelunmor et al., 2014) with the highest prevalence in Guinea (43.6%) (Balde et al., 2006), Burkina Faso (40.2%) (Niakara et al., 2007), Nigeria (38.2%) (Daniel, Adejumo, Owolabi, & Braimoh, 2013), and Togo (36.7%) (Yayehd et al., 2012). Although rates of hypertension treatment range from 28% in Ghana (Agyemang, 2006; Bosu, 2010) to roughly 80% in Nigeria (Isezou, Abir, Ohwovorilole, & OA, 2010; Omuemu, Okojie, & Omuemu, 2008), actual rates of patients with maintained blood pressure control are as low as 2% in Benin (Houinato et al., 2012). Currently, more than 3.5 million out of 15.8 individuals over 15 are classified as hypertensive in Ghana, making hypertension the second leading cause of outpatient morbidity in adults age 45 and over (Bosu, 2010). In sub-Saharan Africa, the challenge of hypertension management is complicated due to low knowledge and awareness of disease status, prevention, and treatment options. Some studies show that only 6%–34% of hypertensive adults are aware their disease status (Agyemang, 2006; Bosu, 2010; Houinato et al., 2012).

2.2.2 Hypertension in Ghana

Ghana, located in Western Africa, is comprised of 25 million residents (Ghana Embassy, 2016). Like many countries in sub-Saharan Africa, Ghana is plagued by the dual burden of communicable diseases and rising rates of non-communicable diseases, such as cardiovascular diseases including hypertension. Over the last 70 years, epidemiological studies investigating cardiovascular disease have been conducted in Ghana. For instance, in 1950, a survey conducted

near Accra found that 5.5% of village inhabitants had some form of cardiovascular disease (Colbourne, Edington, Hughes, & Ward-Brew, 1950). Between 1975 and 1980, nearly 25% of deaths in the Accra region were due to cardiovascular disease (Chukwuemeka et al., 1982). In 1981, the Ghana Health Assessment team determined that 7.7% of years of life were lost due to vascular and hypertension related diseases (Hyder, Rotllant, & Morrow, 1998). Between 1988 and 2007, the incidence of hypertension in Ghana increased from 49,087 new annual cases to 505,180, respectively (Ghana Health Services, 2008). In a systematic review of hypertension in Ghana, Bosu (2010) reported that prevalence of hypertension ranged from 19-48%, with minimal differences between males and females. In general, urban regions showed a higher prevalence than rural populations in studies examining blood pressure measures from health clinics in mixed populations. Individuals were more at risk of hypertension across studies if they were older, consumed excess calories, and drank alcohol excessively. Furthermore, less than one-third of hypertensive patients knew that they had hypertension, and less than 10% of patients maintained blood pressure control (Bosu, 2010). The rising prevalence of hypertension, lack of disease status awareness, lack of knowledge of hypertension in general, and low rates of blood pressure control indicate that hypertension is an emergent health threat in Ghana that merits public health initiatives for hypertension prevention, detection, and management.

2.2.3 Barriers to Effective Hypertension Control in sub-Saharan Africa

Current protocols for hypertension screening in Ghana include measuring blood pressure, providing patient counseling, and documenting patients' conditions and course of action. It is recommended that after two or more readings of elevated blood pressure that patients are referred to a physician for further assessment (Hagopian et al., 2004; Pang et al., 2002). However, inadequate health infrastructure prevents many of these steps from being taken to

detect and manage hypertension. Access to health care is extremely limited in this region, and as a result, many patients with hypertension lack the adequate resources to support hypertension detection, treatment, and control (Iwelunmor et al., 2014). In Nigeria, Yusuf and Balogun (Yusuf & Balogun, 2005) noted that there was no 'institutional system in place to monitor, detect and document adverse drug reactions among patients on anti-hypertensive drug therapy' (p. 235). Furthermore, SSA faces a high burden of chronic diseases, which takes a devastating toll on the health care systems in place, along with severe shortage of health care workers which places further demands on an already fragile and under-resourced system (Connor, Walker, Modi, & Warlow, 2007). The low ratio of doctors to individuals (2 per 10,000 populations members) (Mayosi, 2013) limits the ability for regular blood pressure monitoring and hypertension control (Barsoum, 2006; Beaglehole et al., 2008; Hagopian et al., 2004; Mejia et al., 2014; Pang et al., 2002; Unwin et al., 2001). Given these constraints, cost-effective, systems level strategies are needed to mitigate the burdened of hypertension (Beaglehole et al., 2008; Hagopian et al., 2004).

2.3 SOCIAL DETERMINANTS OF HEALTH

This study is guided by the WHO's seminal work on Equity, Social Determinants and Public Health Programs: the Social Determinants of Health (SDH) framework which delineates different categories of factors influencing health, including socioeconomic/governmental structural, and intermediary determinants. Structural determinants are mechanisms that generate stratification and social class divisions in the society, and factors that define individual socioeconomic position within hierarchies of power, prestige, and access to resources. Intermediary determinants are means through which structural mechanisms or determinants operate, such as material circumstance (e.g. housing and neighborhood quality), psychosocial circumstances (e.g. social support), and behavioral and biological factors (e.g. nutrition, age,

other genetic factors) (WHO, 2008). The development of the SDH theoretical framework was based on previous theories of social production and health, which can fall under three basic approaches: 1) psychosocial approaches; 2) social production of disease/political economy and health; 3) eco-social frameworks (WHO, 2010a). These three approaches aim to elucidate the mechanisms that drive social inequity and inequalities in health. Where these approaches differ is in their emphasis how different social and biological factors integrate to shape health (Krieger, 2001, 2002, 2005). The school of psychosocial factors perpetuates the view that perceptions and experiences of inequality in societies leads to stress and poor health (Raphael, 2006). Theorists of this school describe how the experiences of living in social settings rife with inequality fostering feelings of shame and worthlessness, as people continually compare their status and life circumstances to those around them. Furthermore, those in socially disadvantaged situations typically face chronic stress with undermines health. Steep differentials in income and socioeconomic status can weaken social cohesion and social bonds, which can also negatively impact health (WHO, 2010a). This has led to a large literature supporting the association between social inequality, psychosocial and biological mechanisms, and health status (Lobmayer & Wilkinson, 2002; Lynch et al., 2001; Marmot, 2002; Marmot & Wilkinson, 2001 ; Wilkinson, 2000; Wilkinson & Pickett, 2006).

Researchers from the theoretical perspective of social production of disease and political economy of health explicitly address the economic and political determinants of disease, with a focus on the structural context of inequality, not solely perceptions of inequalities (WHO, 2010a). Economic processes and political decisions influence the resources available to individuals and communities, including education, health services, transportation, availability of food, quality housing, etc. Under this interpretation, the effects of income inequality on health

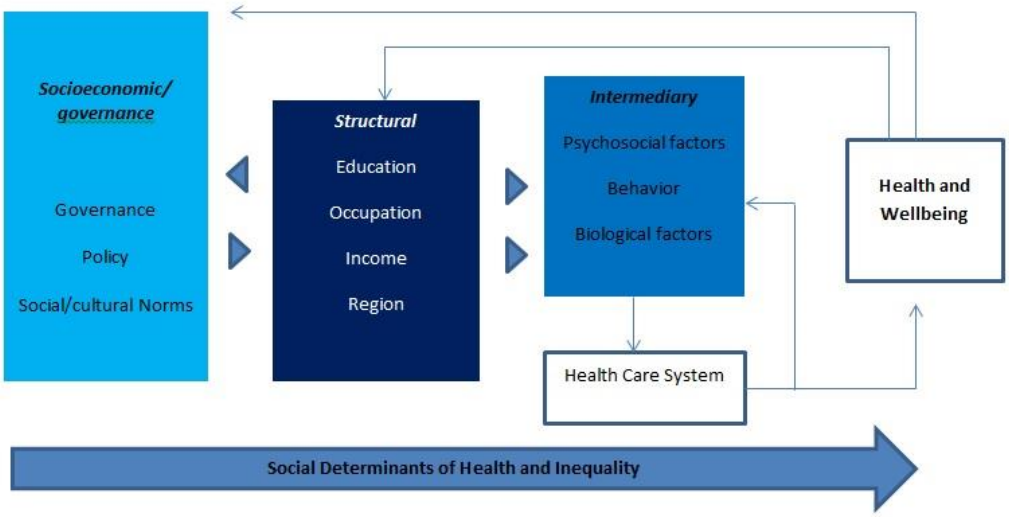
can be surmised as stemming from individual lack of resources (Davey Smith & Egger, 1996; Kaplan, Pamuk, Lynch, Cohen, & Balfour, 1996; Lynch et al., 1998) and "systematic under-investments across a wide range of community infrastructure" (WHO, 2010; p. 16).

Finally, the ecosocial approach is a multilevel framework that has sought to integrate social and biological factors and an ecological perspective to develop insights into population determinants of health (Krieger, 2001, 2002, 2005). Multilevel theories aim to understand how health and disease develop in the context of biological, ecological and social organizations (Krieger, 2001). Krieger describes how "we literally incorporate biological influences from the material and social world" and "no aspect of our biology can be understood divorced from knowledge of history and individual and societal ways of living" (Krieger, 2001, p. 668).

These previous theoretical platforms underscore three main pathways: 1) social selection; 2) social causation; and 3) life course perspectives, which are incorporated into the overarching SDH framework model of "the mechanisms of health inequality," describing how health inequities and health status can result from social position due to the following mechanisms. *Social context* includes how the structure of a society and the relations within that society create social stratification, thereby "assigning" individuals different social position (Diderichsen, 2004). This social stratification in turn contributes to *differential exposure* to situations and environment that can adversely affect health, and *differential vulnerability,* referring to the material resources available to deal with ill health. Likewise, this engenders *differential consequences,* meaning less advantaged groups are disproportionally affected by ill health the social and economic consequences that result (WHO, 2010a).

The SDH Framework (Figure 1) brings together elements from the previously described schools of theoretical perspectives to reflect the impact of social, economic, and political mechanisms that influence individuals' socio-economic position.

Figure 1: Social Determinants of Health framework



Source: World Health Organization. (2008). Social determinants of health. Retrieved from: http://www.who.int/social_determinants/en/

Populations are stratified by a variety of structural determinants including income, occupation, region, gender, race, etc. that subsequently shape intermediary determinants (e.g. material circumstances, social support, health behavior, etc.) related to one's health status, and that are ultimately a reflection of one's place in society (WHO, 2010a). This relationship is bidirectional as genetic, intermediary determinants such as predispositions to illness can in turn influence an individual's social status by potential comprising employment, productivity, and income. Social context broadly "include[s] all social and political mechanisms that generate, configure and maintain social hierarchies, including: the labor market; the educational system, political institutions and other cultural and societal values" (WHO, 2010a; pp. 5). In the SDH framework, structural mechanisms are those that "generate stratification and social class divisions in the

society and that define individual socioeconomic position within hierarchies of power, prestige and access to resources" (WHO, 2010a; pp.5). They are rooted within key institutions of the social and economic context. The most important structural stratifies and proxy measures include: Income, Education, Occupation, Social Class, Gender, Race/ethnicity. Also related to health outcomes are intermediary determinants, through which structural determinants operate. The WHO states: "The vocabulary of "structural determinants" and "intermediary determinants" underscores the causal priority of the structural factors" (WHO, 2010a; pp. 5). Intermediary determinants can be separated into three main categories: material circumstance (e.g. housing and neighborhood quality), psychosocial circumstances (e.g. social support, coping mechanism, stressors), and behavioral and biological factors (e.g. nutrition, physical activity, alcohol consumption, genetic factors).

Having discussed the major theoretical perspectives on social determinants of health and the foundations for the development of the SHD framework, this next section discusses three main pathways that purport to explain health inequities: social selection perspective, social causation perspective, and life course perspective.

2.3.1 Social Selection

Social selection perspective posits that health determines socio-economic position, as opposed socio-economic position determining health. The foundation for this assumption is that health impacts an individual's ability to attain certain social positions. Thus, individuals with poorer health, drift downward in society while healthier people move upward. This pattern is referred to as social mobility, which is that notion that "an individual's social position can change within a lifetime, compared either with his or her parents' social status (intergenerational mobility) or with himself/herself at an earlier point in time (intra-generational mobility)" (WHO,

2010a; p. 16). While there is literature suggesting that health status influences social mobility (Illsley, 1955; West, 1991), the evidence for this is not consistent across different life stages. Furthermore, there is recent evidence suggesting that social mobility does not contribute to widening gaps in health inequalities and inequities (WHO, 2010a). The rationale for this is that people who are downwardly mobile will have a better health status than those in the "destination class." Likewise, people who are upwardly mobile will have a poorer health status that those in the class to which they migrate, thus lowering the "mean health" in their destination class (Manor, Matthews, & Power, 2003; West, 1991). However, this evidence remains inconsistent with some studies suggesting that social mobility and health selection reduce the inequality gaps (Blane, Harding, & Rosato, 1999; Davey Smith & Egger, 1996; Davey Smith et al., 1998; Hart, Davey Smith, & Blane, 1998; Power, Stansfeld, Matthews, Manor, & Hope, 2002), while other studies refute this (Davey Smith & Morris, 1994; Elstad, 2001; Marmot, Ryff, Bumpass, Shipley, & Marks, 1997). Because of this, Blane et al. (1999) and Manor et al., (1991) argue that social mobility cannot be regarded as the primary explanation of health inequality. It is also important to note that social mobility is considered to influence determinants of health (i.e. indirect effect) as opposed to having a direct effect on health (Blane et al., 1994). Furthermore, health determinants on which indirect selection takes place can arise from contextual factors earlier in life. Thus, the influence of social mobility on health could result from an accumulation of social disadvantage over one's lifespan, and it is therefore difficult to determine the exact relationship between social mobility and health (WHO, 2010a).

2.3.2 Social causation

From the perspective of social causation, intermediary factors operate through social position (or structural factors) in order to influence health (WHO, 2010a). Longitudinal research

has demonstrated that individuals in lower socio-economic status groups have higher incidence of disease and a higher risk of developing health problems (Marmot et al., 1991). Socio-economic status contributes to intermediary determinants such as individual's behaviors and life conditions, which place individuals and communities at risk for either a higher or lower prevalence of disease (WHO, 2010a). The primary groups of intermediary determinants that have been identified as important in this causal chain include material, psychosocial, behavioral, and biological factors.

Material factors are often linked with economic hardship as well as physical conditions which could be potentially harmful. These include housing quality and physical work conditions. Researchers from this perspective emphasize that health inequalities often result from different accumulation of exposures that result from these physical conditions (WHO, 2010a) Other material factors related to social advantages interact with physical environment (WHO, 2010a) such that, "people who have more resources in terms of knowledge, money, power, prestige, and social connections are better able to avoid risk … and to adopt the protective strategies that are available at a given time and a given place (Link, Norhtridge, & Phela, 1998)."

Psychosocial factors are those discussed in psychosocial theory above. These include stressors, stressful living circumstances, lack of social support, and negative life events (WHO, 2010a). Researchers coming from this approach posit that inequalities in disease morbidity and mortality across different socio-economic groups cannot be fully explained by material risk factors. Cardiovascular disease is a prime example, as behavioral risk factors such as smoking, and others are only partially explained by socio-economic gradients (Marmot, Shipley, & Rose, 1984; WHO, 2010a). In fact, cardiovascular disease has shown a higher prevalence among those

with depression and psychological stress (Dhar & Barton, 2016; Du et al., 2016) suggesting the importance of psychosocial factors in disease as well as material and structural factors.

Finally, behavioral factors are important determinants of health, including smoking, diet, alcohol use, physical activity, etc. These factors appear to play important roles for determinants of health as many are unevenly distributed in different socioeconomic groups (WHO, 2010a). For instance, there is usually a higher prevalence of alcohol consumption and obesity in lower-income groups (Mackenbach & Bakker, 2001; Olson, Bove, & Miller, 2007) and well as other behaviors that negatively influence health (Watts, Mason, Loth, Larson, & Neumark-Sztainer, 2016).

2.3.3 Life-course

The life course perspective underscores the importance of timing in understanding the effects between exposure and health outcomes, within individual life courses, across generation, and in population disease trends (WHO, 2010a). A life course perspective focuses attention on how social determinants of health operate within the context of development, starting in early childhood, and continuing through adulthood. Life course perspective examines how these determinants influence both short-term and distal health outcomes (WHO, 2010a). Researchers from this school of thought seek to examine how temporal processes across the life course of one cohort are related to previous and subsequent cohorts and are manifested in disease trends observed over time at the population level" (WHO, 2010; p. 17). There are two specific models that stem from the life course perspective. First, the critical period model assumes that exposure to an agent or an event during a specific time period has lasting health effects (Frankel, Elwood, Smith, Sweetnam, & Yarnell, 1996). Second, the accumulation of risk model takes the perspective that factors that influence disease risk accumulate over time, though there may be a

time period in which these factors exert a stronger influence. This idea is based on the notion that as the frequency or intensity of exposure increases, the more damage there is to biological systems, and the greater risk to health (Ben-Shlomo & Kuh, 2002). Proponents of the life course perceptive argue that these exposures are contextualized within social hierarchies, thus accounting for structural mechanisms that influence health over time (Ben-Shlomo & Kuh, 2002; Davey Smith & Morris, 1994).

2.3.4 Applications to Social Determinants of Health Framework

While the SDH framework is, in part, based on all of these perspectives of health inequities, the social causation model demonstrates the strongest parallels. Primarily, the notion that a combination of intermediary and structural determinants, influenced by social position, work together to influence health outcomes at present and over time underscores the SDH framework. Thus, an individual's social position and environment influences behaviors and life conditions, which can either be risk of protective factors for certain diseases (WHO, 2010a). Furthermore, genetic and biological factors can predispose individuals to certain illnesses which can in turn influence social position. While the SDH framework shares similarities with the social causation model, the primary disagreement is that social causation posits that health predicts socio-economic status, and not the other way around. The SDH framework suggests a more bidirectional relationship in which social position influences health, but health can in turn influence social position. Finally, drawing on the life course perspective, exposures to certain conditions (e.g. social conditions, environments, diseases, etc.) tend to differ by social position, and negative conditions concentrate at certain level, typically those with lower social class and social position. Thus, individuals occupying these lower social positions are more likely to experience adverse events and conditions that can negatively impact their health.

2.4 SOCIAL DETERMINANTS OF HEALTH AND HYPERTENSION

Socioeconomic factors and other social determinants of health can adversely impact behavioral risk factors that influence the development of hypertension. For instance, unemployment, or fear that one will be become unemployed, can increase stress levels, placing one at a greater risk of developing elevations in blood pressure. Studies conducted around the global for the last several decades have illustrated this relationship cross-sectionally and longitudinally. In 1989, Iverson et al. analyzed over a period of eight years health outcomes of former workers of Esilnore shipyard in Denmark, which had recently closed down, compared to permanent employees of another shipyard. Resulting data indicated that unemployed workers had a higher prevalence of hypertension (Iverson, 1989) and higher rates of cardio infarctions (Iverson, 1989). In Poland, Zagożdżon et al. (2014) found that unemployment was associated with cardiovascular risk factors including smoking. In the United States, Brackbill and colleagues found that unemployment and underemployment was linked with higher odds of having hypertension when compared employed individuals.

Often related to unemployment, living and working conditions may leave people without access to health care, which can delay timely detection and diagnosis of hypertension as well as prevention of complications. In a population based survey in Indonesia, Helble and Aizawa (2016) found that not only were poor and unemployed participants more likely to have hypertension, but they were also much less likely to have been diagnosed by a health provider and receiving treatment (Helble & Aizawa 2016). The authors also found a disparity in hypertension treatment between urban and rural areas, with those in urban regions enjoying greater detection and treatment of hypertension, as well as a decrease in the detection and treatment gap between wealthy and poor. There is existing evidence however that urban setting

promote unhealthy environments encourage sedentary behaviors, fast food consumption, tobacco use, and excessive alcohol use largely increase the risk for hypertension (WHO, 2013). Because of this, hypertension is more common in urban populations (Seedat, 2007). For instance, migratory studies in Kenya of those moving from rural to urban areas show that those remaining in rural areas had a lower prevalence of hypertension. The urban migrants also had higher body weights, pulse rates, and ratio of urinary sodium to potassium. It has been hypothesized that the African rural diet is relatively healthy, and that when individual migrate to urban areas their consumption of fat and carbohydrates increase (Bourne, Lambert, & Steyn, 2002). Poverty further exacerbates this, as access to a high-fruit, high-vegetable, low-salt diet is challenging (Douglas et al., 2003). While employment status and working conditions are important determinants of hypertension and health in general, one of the most influential determinants of health is education (Robert Wood Johnson Foundation, 2013). In general, better educated individuals live longer, healthier lives (Behrman & Wolfe, 1989; Berger & Leigh, 1989; Gilleskie & Harrison, 1998; Hartog & Oosterbeek, 1998), while low educational attainment is usually associated with high rates of communicable and non-communicable diseases, poorer self-reported health, and shorter life expectancy (Ross & Wu, 1995).

Health behaviors at the individual level are also crucial for controlling hypertension. Most research has indicated that a combination of dietary changes and physical activity are best practices for hypertension management. This has been illustrated by research over the past several decades on the Dietary Approaches to Stop Hypertension (DASH) diet, which emphasizes the importance of incorporating fruits and vegetables into one's diet, include fat free or low-fat options for dairy and protein, limiting foods high in saturated fat, and limited sweets. Appel et al., randomized 810 patients to one of three intervention groups: (1) "established," a

behavioral intervention that implemented established recommendations (n = 268); (2) "established plus DASH," which also implemented the DASH diet (n = 269); and (3) an "advice only" comparison group (n = 273), and evaluated blood pressure of participants after six months (Appel et al., 2003). Both behavioral interventions improved health outcomes including reducing weight, improving fitness, and lowering sodium intake. Additionally, those participating in the DASH diet condition increased fruit and vegetable intake. When compared to the "advice only" comparison group, there were significant differences in blood pressure reduction in the established group, and the established plus DASH group. In comparing prevalence of hypertension across groups from baseline (38%), 26% of patients in the advice group were hypertensive, 17% in the established group, and 12% in the established plus DASH group (Appel et al., 2003). The results indicated that several lifestyle changes can lead to meaningful improvements in blood pressure (Appel et al., 2003). In a meta-analysis of behavioral counseling strategies to promote cardiovascular health, Lin et al. found that long-term observational follow-up in intensive sodium reduction counseling was significantly associated with a decrease in cardiovascular disease, including hypertension (Lin, O'Connor, Whitlock, & Beil, 2010). Dietary counseling resulted in changes in body mass index, systolic and diastolic blood pressure, and total cholesterol (Lin et al., 2010).

Central to hypertension management, however, is medication adherence. In many cases, adults with hypertension, or pre-hypertension, are prescribed medication to reduce blood pressure. There are several mechanisms through which these medications can work, such as such as removing excess salt and fluid from the body, slowing the heartbeat or relaxing and widening the blood vessels (WHO, 2016). Self-monitoring of medication is often the most feasible way to continue administration, however many patients have difficulty adhering to medications over

time. Poor medication adherence is a problem leading to compromised health benefits and economic costs including wasted time, money, and resources (Sabete, 2003).

2.5 SOCIAL DETERMINANTS OF HEALTH IN RELATION TO HYPERTENSION IN SSA

The social determinants framework can be applied to investigating factors influencing blood pressure control maintenance sub-Saharan African countries, including Ghana. Using the social determinants framework allows elements that may influence hypertension at the individual, community, and systems level to be examined.

2.5.1 Intermediary determinants

The following section describes intermediary determinants of health that are of interest in the current study. Factors at the patient level that influence hypertension control include: lifestyle and behaviors (e.g. poor diet and physical inactivity), poor medication adherence, patients' beliefs about hypertension and its treatment, depression and other cognitive dysfunction, low health literacy, comorbidities, patient motivation, coping, and lack of social support are all patient-related barriers to controlled blood pressure (Ogedegbe, 2008).

2.5.1.1 Lifestyle behaviors. There is a large body of research supporting the effects of lifestyle behaviors on hypertension management, including diet (Lin et al., 2010; Salehi-Abargouei, Maghsoudi, Shirani, & Azadbakht, 2013; Sookram, Munodawafa, Malekele Phori, Varenne, & Alisalad, 2015) and physical activity (Ainsworth, Keenan, Strogatz, Garrett, & James, 1991; Carnethon et al., 2010; Paffenbarger, Junga, Leunga, & Hydea, 1991; Rossi, Dikareva, Bacon, & Daskalopoulou, 2012). Specifically, regarding diet there have been many investigations on the benefits of a diet high in fruits and vegetables and low in sodium and fats. Much of this research comes from high income countries, yet the benefits of the DASH diet and physical activity can be applied universally, especially in sub-Saharan Africa (Noubiap, Bigna,

& Nansseu, 2015). In fact, a recent study in sub-Saharan Africa indicates that mean sodium intake is far above the average daily recommendations, and potassium intake is below recommended guidelines (Noubiap, Bigna, & Nansseu, 2015). Another study demonstrated that high salt intake, eating vegetables less than three times per week, and less than ten minutes of physical activity per day were all associated with a greater risk of hypertension (Helelo, Gelaw, & Adane, 2014). Oladimeji and colleagues report similar findings from Nigeria, with physical inactivity and unhealthy diet associated with increased likelihood of hypertension (Oladimeji, Fawole, Nguku, & Nsubuga, 2014). As seen in other parts of the world, smoking and alcohol use are also risk factors for developing hypertension, as smoking things arterial walls, increasing the pressure that results as blood pumps, and excessive alcohol use can cause damage to multiple organs including cardiac tissue (Crampin et al., 2016; Hendriks et al., 2012; Mensah; Oladimeji et al., 2014). The results of these studies as well as many others support the importance of lifestyle behaviors related to diet and physical activity in hypertension management.

2.5.1.2 Medication adherence. Medication adherence is also key for hypertension management, yet remains a challenge among hypertensive patients in sub-Saharan Africa. Available research indicates that poor compliance can decrease the effectiveness of treatment, leading to treatment failure, which subsequently leads to an increase in the use of scarce healthcare resources and overall expenditures (Mendis et al., 2010; Ono, Oyekigho, & Adeleke, 2006). Poor medication adherence exists in approximately 43% to 88% of hypertension cases, depending on the measure of adherence chosen, and it is estimated that as many as 50% of patients within their first year of taking medication may continue hypertensive treatment (Wetzels, Nelemans, Schouten, & Prins, 2004). Ceasing medication use, or low adherence rates are also associated with increased mortality rates among hypertensive patients (Ogedegbe, 2008).

One of the most important determinants of medication adherence is the patients' beliefs about the disease (Grégoire et al., 2002).

2.5.1.3 Patients' beliefs. Previous research has suggested that patients may construct understandings of their illness and treatment that differ with those of physicians and health care providers (Kleinman, Eisenberg, & Good, 1978; Taylor et al., 2012), a discordance that may worsen clinical outcomes (Cohen, Tripp-Reimer, Smith, Sorofman, & Lively, 1994; Heurtin-Roberts & Reisin, 1986; Ogedegbe, Mancuso, & Allegrante, 2004). In the context of hypertension, physicians' beliefs usually stem from the biomedical model, where hypertension is seen as a chronic illness that requires lifelong treatment (Heurtin-Roberts & Reisen, 1992), whereas patients may perceive hypertension as a disease of "nervousness" that causes increased blood pressure (Heurtin-Roberts & Reisen, 1992). In particular, from a patient's perspective, hypertension is a silent disease, and patients may not adhere to their antihypertensive medication as directed because the positive effects of medication are not as obvious as the potential side effects (Ogah & Rayner, 2013). Studies have shown that a considerable number of patients from sub-Saharan Africa have expectations stemming from non-biomedical models (Ogedegbe et al., 2004), which was associated with poorer treatment compliance (Heurtin-Roberts & Reisen, 1992). Furthermore, in the context of interventions, patient acceptability and the way they perceive interventions can influence health behavior change and the effectiveness of intervention uptake. As interventions are developed and evaluated, research is needed to understand how patients may balance concerns regarding safety and efficacy of an intervention, with other issues such as cost, availability, access, and the cultural appropriateness of the care (Joshi, Santo, & Redfern, 2014; Joshi et al. 2014).

2.5.2 Structural determinants.

The following section describes structural determinants of health that are of interest for the current study.

2.5.2.1 Gender. Though often not thought of as a structural determinant of health, the WHO considers gender in this category as gender not only influences health behaviors, but also the availability of and access to health resources (WHO, 2008). A systematic review of 11 studies in Ghana demonstrated that, typically, hypertension prevalence was lower in women than men (Addo et al., 2012a). Other studies throughout sub-Saharan Africa have also supported this. For instance in Nigeria, Kadiri et al. (Kadiri, Walker, Salako, & Akinkugbe, 1999) found the prevalence of hypertension in men and women to be 9.8% and 8.1%, respectively. Another study showed prevalence rates to be 13.9% and 5.3% in men and women, respectively (Olatunbosun, Kaufman, Cooper, & Bella, 2000). In Ghana Agymang et al. found a gender difference for prevalence of hypertension in urban regions (33.4% men; 28.9% women), but not in rural regions (27% men; 27% women) (Agyemang, 2006). More recent reviews have also supported a slight increase in prevalence of hypertension in men (16.8% and 15.7%, respectively) (Twagirumukiza et al., 2011). Another study focused solely in the Ashanti region of Ghana found that the prevalence of hypertension was comparable in men and women (28.7%), but detection was higher in women than men (27.3% versus 13.9%). Treatment rates were higher in women than men (13.6% versus 7.8%), but control was higher in men (4.4% versus 1.4%), though rates of control in both groups were low (Cappuccio, Micah, et al., 2004).

2.5.2.2 Region of residence. Exposure to urbanization also influences the prevalence of hypertension in sub-Saharan Africa (Anderson & Johnson, 1997). In 2011, the proportion of the

population of West Africa classified as "urban" was 44.9% (UNESA, 2011). This is projected to increase to 52% by 2021 (UNESA, 2011). Increasing urbanization is linked with behavioral and lifestyle changes which contribute to the increased burden of chronic diseases (BeLue, Carmack, Myers, Weinreb-Welch, & Lengerich, 2012). For instance Duboz, Macia, Chapuis-Lucciani, Boëtsch, and Gueye, (2012) found that length of time residing in an urban environment was a significant predictor of hypertension. Increases in urbanization typically lead to lifestyle changes that promote chronic diseases (BeLue et al., 2010). Armstead and colleagues also noted that challenges associated with urbanization often require many kinds of acculturative coping, which can lead to movement away from traditional coping strategies among urban dwellers, thereby contributing to hypertension (Armstead, Andersen, Adams-Campbell, Herbert, & Muna, 2010) Sodjinou). Another study reported that longer stays in urban environments increase risk of hypertension because urbanization exacerbates stress exposure as well as social deprivation, and financial constraints, which can contribute to increased incidence of hypertension. (Sodjinou, Agueh, Fayomi, & Delisle, 2007) In a systematic review of hypertension in sub-Saharan Africa, Addo and colleagues reported that hypertension was generally reported at higher rates in urban versus rural regions (Addo, Smeeth, & Leon, 2007). This was later corroborated by systematic review of hypertension specifically in Ghana (Addo et al., 2012a).

2.5.2.3 Socioeconomic status. Economic status also has bearings on blood pressure outcomes. In West Africa, a 2006 report from ECOWAS (Economic Community of West African States) indicated the prevalence of poverty—more than half of its population (60%) lived on less than one dollar a day compared to 46% for all of sub-Saharan Africa and 15% for East Asia (ECOWAS, 2006). While the direct mechanisms through which poverty influences hypertension are unknown (Yusuf & Balogun, 2005), available evidence indicates that social

determinants related to conditions of poverty such as insufficient finances have a direct impact on compliance with antihypertensive treatments (Odedosu, Schoenthaler, Vieira, Agyemang, & Ogedegbe, 2012). Adherence to antihypertensive medications is one of the most challenging aspects of blood pressure control faced by those in poverty, particularly in rural areas without access to health education and primary health care (Cook-Huynh et al., 2012). In a cross-sectional study in Egbeda and Oluyole local government areas of Oyo State in Nigeria, Mendis and colleagues noted that 'the fact that most patients have to pay out of their own pocket for consultation and medications either fully or in part, is likely to have a negative impact on long-term management of hypertension (Mendis, Abegunde, Oladapo, Celletti, & Nordet, 2004, p. 1).' In this particular study, the majority of patients made on average $73 per month, and patients were fully responsible for the cost of the anti-hypertensive medications. Another study in Nigeria by Ilesanmi and colleagues demonstrated the financial burden of hypertension medication in reporting that 52% of their sample was spending a tenth or more of their income on health care related expenses (Ilesanmi, Ige, & Adebiyi, 2013). High costs of drug therapy is also associated with worse adherence in Ghana (Harries, Twumasi-Abosi, Plange-Rhule, & Cappuccio, 2005; Ilesanmi et al., 2013; Osamor & Owumi, 2011). Buabeng et al. (2004) found that 119 out of 128 (93%) patients did not comply with their medication (Buabeng, Matowe, & Plange-Rhule, 2004). The main reason cited was that drug prices were too high and the patients could not afford their medication (Buabeng et al., 2004). Out-of-pocket expenditures were also reported as a barrier to adherence in Kumasi, Ghana, the second largest city in the country (Harries et al., 2005). Another study in Lagos Nigeria supported this, revealing that lack of finances was responsible for 23.8% of non-compliance with antihypertensive drug regimens (Amira & Okubadejo, 2007).

Finally, the relationship between education and hypertension in sub-Saharan Africa is similar to that of education with other health outcomes; there is typically an inverse relationship between education and hypertension, thus the risk of developing hypertension decreases as education increases (Guwatudde et al., 2015; Pires, Sebastião, Langa, & Nery, 2013). Individuals with no formal education are at the greatest risk for developing hypertension (Duda et al., 2007).

2.5.2.4 Health system infrastructure. At the health systems level, inadequate infrastructure severely impedes the county's ability to treat hypertension at the primary care level (Lekoubou, Awah, Fezeu, Sobngwi, & Kengne, 2010; Naicker, Plange-Rhule, Tutt, & Eastwood, 2009). In Ghana and West Africa in general, health care is extremely limited, and as a result, individuals with hypertension often lack health care support needed for detecting, treating, and managing hypertension (Iwelunmor et al., 2014). For example, in southwest Nigeria, Yusuf and Balogun (2005) noted that there was no 'institutional system in place to monitor, detect and document adverse drug reactions among patients on anti-hypertensive drug therapy' (p.30). Furthermore, one of the most cost effective means of identifying and tracking blood pressure control is regular blood pressure monitoring; however, lack of, or inadequate, monitoring due to limited health care personnel and diagnostic tools has been identified as a barrier to hypertension management in SSA (Mendis et al., 2010). For instance, faulty blood pressure monitoring devices have been noted as reasons for lack of routine blood pressure measurements in health care facilities (Mendis et al., 2004).

2.5.2.5 The role of providers. The shortage of health care workers in sub-Saharan Africa has reached a crisis point, which exacerbates the weak health infrastructure and limits available options for hypertension detection, treatment, and control. Within a broader intervention to address severe shortage of healthcare workforce must be efforts to address barriers to

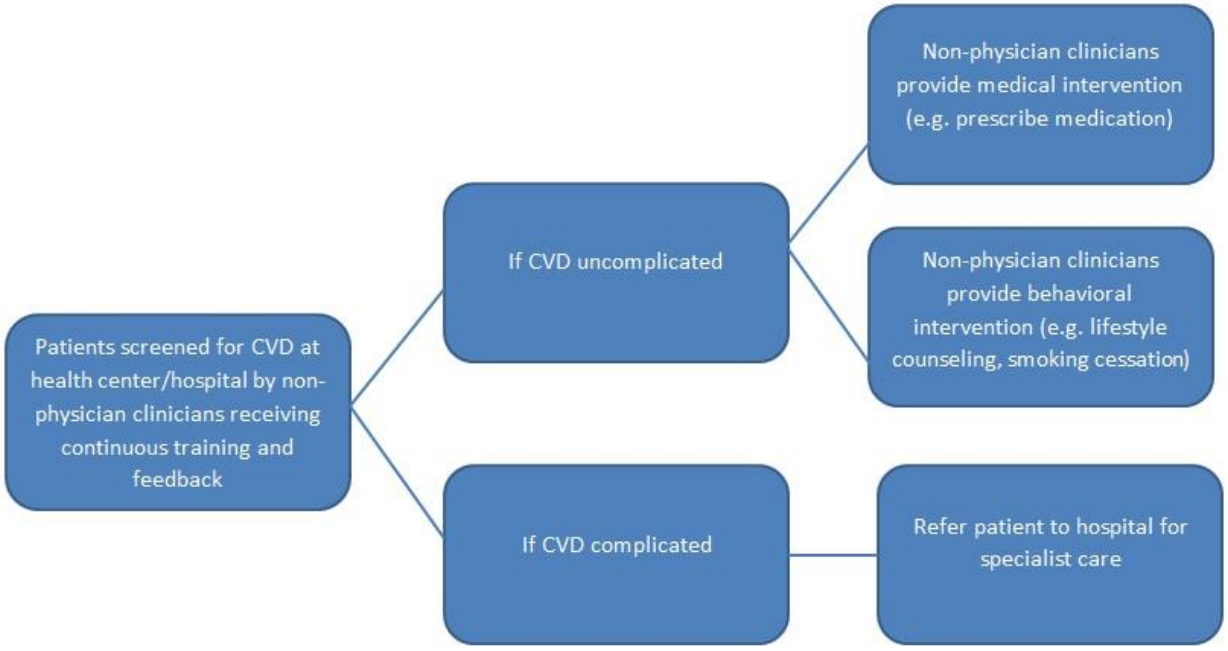
hypertension management at the provider level including lack of intensity of drug therapy (also known as clinical inertia), communication style, and awareness and knowledge of treatment guidelines (Gbenga Ogedegbe, Plange-Rhule, et al., 2014a). Other issues include indifference towards elevated blood pressure among treated patients and insufficient awareness to treatment guidelines (Odedosu et al., 2012; Parker, Nagar, Thomas, Badri, & Ntusi, 2011). Most noteworthy of these barriers is clinical inertia, or failure of health care providers to initiate or intensify drug therapy appropriately in a patient with uncontrolled blood pressure. Despite the importance of clinical inertia, there are few studies investigating it in sub-Saharan Africa; however studies in the United States have been conducted that provide insight as to the urgency of this matter. A national survey of 379 primary physicians revealed that 39% would not initiate drug therapy unless diastolic blood pressure was at least 95 mm Hg, 52% would not begin treatment unless systolic was at least 160 mm Hg. Thus, physicians would not prescribe medications until patients were already over the blood pressure criteria for a clinical diagnosis of hypertension. Results of this study also revealed that 33% physicians would not intensify treatment even if patient's blood pressure was elevating persistently to 158/88 mm Hg (Ogedegbe, 2008). Another study of 270 visits in which blood pressure was increasing persistently, only 37% of the cases underwent treatment intensification (Oliveria et al., 2002). Berlowitz and colleagues examined the care of 800 hypertensive men at Veterans Administration site over two years, finding that patients had average BP level >160/90 mm Hg despite an average of >6 clinic visits per year (Berlowitz et al., 1998). Drug therapy was intensified at only 6.7% of these visits in the time period studied. Treatment was intensified during only 22% of visits with systolic BP levels >165 mm Hg and normal diastolic BP and at 25% of visits with BP values >155/90 mm Hg. On average, physicians did not increase medication in 75% of visits in

which patients were recorded to have hypertension. In southwestern Nigeria, Ono and colleagues (Ono et al., 2006) not only reported a failure of physicians to intensify treatment, they also reported a tendency to keep patients on monotherapy or "no drug treatment" even in cases of repeated visits to the clinic. Some of these cases were reported to be patients with uncontrolled hypertension who were not prescribed moderately aggressive combination therapy by the attending physicians (Ono et al., 2006).

2.6 TASK-SHIFTING FOR HYPERTENSION IN SSA

Task shifting strategy, defined as rational movement of primary care duties from physician to non-physician health care workers, is a potential method for optimal management of disease, including hypertension in Ghana, particularly in light of the under-resourced health systems (Callaghan, Ford, & Schneider, 2010; Lekoubou et al., 2010). As shown in Figure 2, "the process of task shifting should involve ongoing training from higher-level health professionals, delegation and continuous supervision. Also, patients with complicated disease cases should always be referred for specialist care (Ogedegbe et al., 2014 pp.1)."

Figure 2: Referral pathway for cardiovascular disease management using task-shifting



Source: Ogedegebe et al. (2014). Task shifting interventions for cardiovascular risk reduction in low-income and middle-income countries: a systematic review of randomized controlled trials. *BMJ Open*. 4:e005983 doi:10.1136/bmjopen-2014-005983

According to the WHO, and later echoed by the World Medical Association, task shifting is particularly useful in low-resource settings facing a healthcare human resource crisis (World Medical Association, 2009; Lekoubou et al., 2010). The use of task shifting has documented benefits in the context of HIV/AIDS management (Callaghan et al., 2010); in the context of hypertension, task shifting will help to address the systems level factors related to health care worker shortage (Labhardt, Balo, Ndam, Grimm, & Manga, 2010; Lekoubou et al., 2010; Mendis et al., 2010; WHO, 2002). Particularly as current blood pressure protocol in Ghana requires a referral to a physician after two elevated readings (Ghana Health Services, 2016), task-shifting would allow other health workers to manage and treat non-complicated cases of hypertension and only refer high-risk cases to physicians.

In Cameroon, Labhardt et al. tested the effectives of integrating care of hypertension by shifting clinic duties to "non-physician" clinicians in resource constrained regions. (Labhardt et al., 2010). Following an initial needs assessment, the authors equipped the participating clinics with sphygmomanometers, stethoscopes and blood glucose meters, and basic medications for their pharmacies. Non-physician clinicians (NPCs) received an initial three-day training module in which they learned strategies for prevention, diagnosis, and treatment of hypertension and type 2 diabetes. Every six months the NPCs would receive a refresher course on the material learned in the initial training. Outcomes were assessed after two years, at which point NPCs' performance on multiple-choice questions of the knowledge-test was significantly improved. During the study period, treatment for 796 patients with hypertension and/or diabetes was initiated by NPCs, however retention at one year was low (18.1%). Among hypertensive patients with ≥ 2 documented visits (n = 493), systolic BP decreased by 22.8 mmHg and diastolic BP by 12.4 mmHg, both of which were statistically significant (Labhardt et al., 2010).

Another study in South-West Nigeria examined whether the provision of further practice-based support by pharmacists will bring about improved outcomes for blood pressure (BP) control in middle-aged and elderly Nigerian (45+ years) hypertensive patients managed with combination diuretics (Erhun, Agbani, & Bolaji, 2005). Free primary care and medications were provided to participants. Fifty one patients aged 45 or older with uncomplicated hypertension were invited to the pharmacist managed hypertension clinic and followed for the study period. Pharmacists in the intervention were trained: to counsel patients for current medication, provide counseling for behavior modification stressing weight loss and/or increased physical activity, increase patients' awareness by providing relevant education about hypertension and associated/related diseases, adjust patients' medication, utilize treatment schedules that enhanced

patients' adherence to therapy, and monitor treatment outcomes between enrollment and return visits. Results indicated that patients were satisfied with this method of hypertension management, and uncontrolled blood pressure reduced from 92% to 36%, with only 5.9% of cases reporting treatment failure (Erhun et al., 2005).

In South Africa, nurse-led risk reduction programs called the Chronic Disease Outreach Program was implemented in which primary care health nurses were trained in early detection and management of patients with diabetes or hypertension, particularly those who were at high risk for complications related to cardiovascular disease or chronic kidney disease (Katz et al., 2009). Although primary health care nurses were encouraged to initiate treatment and management strategies if hypertension or diabetes was uncontrolled, there was not regimented treatment protocol. Thus, treatment was initiated solely at the discretion of the nurses. Care was free in the primary care clinics and ranged from zero to $8 at the specialist center, depending on a patient's employment status or age. Only 'essential drug list' medication for hypertension was available in the clinics. After a two year study period, the Chronic Disease Outreach Program was found to be successful in supporting primary health care nurses in detecting advanced disease in patients and facilitating timely referral to a specialist. The program improved early detection of hypertension and diabetes and referral of patients at high risk with uncontrolled chronic disease. Finally, the program improved the nurses' knowledge of chronic disease detection, treatment, and referral. Primary weaknesses of the study included poor follow-up (50%) which was thought to be due to the inability of the health system to integrate new programs into existing chronic disease services. Furthermore, the authors stated that the study "revealed an overworked, poorly supported, poorly educated and frustrated primary health care team" (Katz et al., 2009, p. 1).

While interventions to address hypertension in sub-Saharan Africa have used task-shifting strategies (Blank et al., 2013; Erhun et al., 2005; Labhardt et al., 2010), very few have used a randomized control design (Ogedegbe, Gyamfi, et al., 2014). The following section briefly describes recent randomized control trials that have used task-shifting to address hypertension management. One hypertension trial, conducted by Adeyemo et al. (2013) investigated the effectiveness of using nurses to delivery hypertension management care in a primary care setting, compared to the a group receiving this care plus home visits to promote medication adherence (Adeyemo et al., 2013). They examined blood pressure control at six months among 544 patients. The intervention consisted of 1) a nurse-led treatment program with support as needed from on-site physicians; 2) patient clinic visits and health education conducted by the nurses; and 3) use of diuretics and a β-blocker prescribed by the nurses with support from physicians as needed. Blood pressure control was achieved in 66.7% of patients in the clinic only condition, and 65.4% of the clinic plus home visits group. Overall, there was an average of 30mm Hg decline in systolic pressure, and 15 mm Hg decline in diastolic pressure, both of which were statistically significant. Medication adherence among all study participants averaged at 77%.

Another randomized control trial using task-shifting conducted by Mendis and colleagues took place simultaneously in China and Nigeria (Mendis et al., 2010). They used task-shifting strategies to improve blood pressure control among 2,397 hypertensive patients from 40 different primary care facilities, 20 of which were randomized to the intervention group, and 20 to the control group. In the intervention group, non-physician health care workers were trained to provide the WHO cardiovascular disease package, which was designed as an adaptable cost-effective tool for case management of chronic diseases at all health levels in low-middle-income

countries. The program provides clinics decision support, assessment, and management of cardiovascular disease risk through easy-to-follow risk assessments, lifestyle counseling, drug treatment and management protocols, and referral pathways (WHO, 2002). Depending on the patient's risk of cardiovascular disease, the potential treatment decisions include either immediate referral to a specialist if the patient is at high risk, or lifestyle counseling on diet, physical activity, and medication adherence, and follow-up care for lower risk patients. Changes in blood pressure were assessed 12 months later. At both study sites, patients in the intervention condition had more favorable blood pressure outcomes and greater declines; however rates of blood pressure control were low (20%) (WHO, 2002).

2.6.1 Application of the WHO-PEN to hypertension management

One of the most widely known protocols of task-shifting for cardiovascular disease and hypertension management is the WHO Package of Essential Non-communicable diseases. As previously mentioned, this protocol consists of four steps: 1) inquiry about the patient's history (e.g. heart attack, stroke, lifestyle behaviors, diabetes); 2) physical and laboratory experiments (including BP measurements, fasting glucose, cholesterol); 3) estimation of cardiovascular disease risk based on risk charts provided by WHO (categorized as low, medium, or high); 4) initiation of drug therapy, lifestyle counseling, and follow-up visits (Mendis et al., 2010; Ogedegbe, Gyamfi, et al., 2014). This package has been shown to have a positive impact on cardiovascular disease and hypertension management, while being cost-effective. For instance, in Bhutan, Dupka and colleagues conducted a cost-effectiveness analysis of the WHO-PEN package and found that the current screening options for hypertension under the WHO-PEN represent good value when compared to no screening (Dukpa et al., 2015). This was only when 70% of the population was being screened, and thus the cost-effectiveness is projected to

increase as the proportion screened nears 100%. Furthermore, sensitivity analysis revealed that the cost-effectiveness of WHO-PEN remains constant despite variances in prevalence, indicating that application of this model in clinical settings is warranted. Another study in Bhutan investigated a pilot application of the WHO-PEN in two districts by non-physician health workers. The clinics workers conducted risk assessment among patients aged over 40 years who visited the outpatient department of health institutions. Over the course of three months, 39,079 patients visited the clinics where the WHO-PEN was being piloted. Twenty two percent of these patients had hypertension. Out of 896 patients that were registered for the WHO-PEN protocol, 13% had a greater than 20% of chance of developing cardiovascular disease in the next decade. Four hundred forty four patients were seen for three or more follow-up visits, the high risk of cardiovascular disease (>20% risk) declined from 13% to 7.3% of patients. Anti-hypertensive medication use increased and high blood pressure declined from 42.3% to 21.5% of patients (Dukpa et al., 2015)

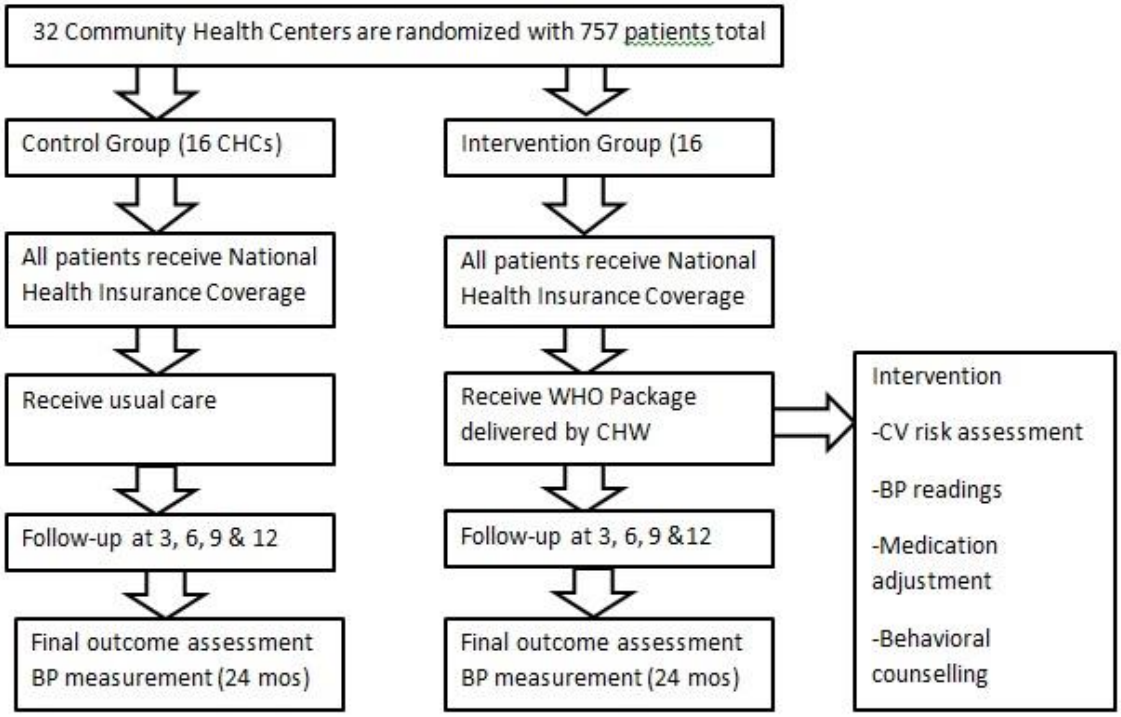
Finally, in China, another study examined the feasibility of this protocol for hypertension management. They found that training 2,000 primary care physicians improved awareness, treatment, and control of hypertension among 300,000 patients living in eight different regions (Zhang et al., 2016). This project demonstrates the magnitude of the WHO-PEN package and its appropriateness in low-middle-income countries.

2.6.2 TASSH

In response to the severe shortage of health care workers, low rates of hypertension detection, treatment, and management, and limited data from randomized control trials to assess task-shifting for hypertension management, a community randomized trial is currently on-going in Ghana (U01HL114198; PI: Ogedegbe) (Ogedegbe, Plange-Rhule, et al., 2014a). The TAsk

Shifting Study for Hypertension control in Ghana (TASSH) is a community randomized trial involving 757 patients receiving care at 32 health care centers in the Ashanti Region of Ghana as shown in Figure 3.

Figure 3: Overview of TASSH study design



Source: Ogedegbe et al. (2014). A cluster-randomized trial of task shifting and blood pressure control in Ghana: study protocol. *Implementation Science*, *9*(73).

The program evaluates the comparative effectiveness of the implementation of the WHO-PEN program (Mendis et al., 2010) on CVD risk assessment and hypertension control (Intervention Group), versus provision of health insurance coverage (Control Group), on blood pressure reduction. Depending on the level of CVD risk determined, the patients is either immediately referred to a specialist in the case of patents with high CVD risk and (BP

≥180/100); or the patient receives lifestyle counselling on diet, physical activity, and tobacco cessation; prescription of an antihypertensive medication; and follow-up with a provider (Ogedegbe, Plange-Rhule, et al., 2014a). A total of 64 nurses (2 from each of the 32 study sites) have been trained in the delivery of the WHO-PEN package, thus shifting the duty of hypertension management from physicians to nurses. Patients in the intervention group receive follow-up care from the nurses every three months. After one year of receiving follow-up care, patients do not receive additional treatment aside from usual care (e.g. medications), and are evaluated at year 2 to determine whether behavior changes and changes in blood pressure were maintained in the 12 months post-follow-up. The proposed study will evaluate patients' attitudes toward the task-shifting intervention, and how health outcomes are influenced by social determinants of health in the context of an ongoing intervention. Though task-shifting has been shown to be effective in disease management (Callaghan et al., 2010; Lekoubou et al., 2010), including hypertension (Blank et al., 2013; Erhun et al., 2005; Labhardt et al., 2010; Mendis et al., 2010), there is a lack of evidence regarding patients' perceptions of these strategies and the effectiveness of them in helping patients maintain blood pressure control in the broader context of social determinants of health over time.

2.7 IMPORTANCE OF SUSTAINABLE HEALTH INTERVENTIONS

For many years, funders and implementers of various interventions have wondered what happens to individuals, communities, and health systems when donor funding for intervention implementation has expired (Bossert, 1990; Scheirer & Dearing, 2011). This is especially relevant for sub-Saharan Africa as the region faces an overwhelming burden of both infectious

and chronic diseases. Thus, sustainability of interventions, defined as continued benefits or implementation of a program after funds are discontinued, or community empowerment to finish program activities, has become a focus in recent years. Though there are many benefits of sustaining interventions, one of the most highly noted reasons was discussed by Shediac-Rizkallah and colleagues (Shediac-Rizkallah & Bone, 1998); these authors suggested that terminating an intervention, particularly due to lack of funds, is counterproductive, especially when the health issue still remains. Furthermore, as interventions incur significant start-up costs, funders want to see whether their investment leaders to long term benefits, or whether expected outcomes fade away after initial implementation. A recent systematic review of sustainability in health interventions implemented throughout sub-Saharan Africa demonstrated that not only are many interventions not sustained once funding ends, but many do not begin intervention planning and implementation with a clear plan for sustainability in mind (Iwelunmor et al., 2016). Therefore, as this project seeks to explore outcomes of the TASSH program to manage hypertension, it is also appropriate to examine stakeholder perceptions (e.g. community health nurses) of whether the program is sustainable in years to come, and which factors will be most influential in determining this.

2.8 RESEARCH QUESTIONS

This study addresses three specific research questions. 1) How do patients perceive hypertension and an on-going task-shifting strategy to promote hypertension management? Based on the literature suggesting that one of the primary reasons for poor medication adherence is patients' beliefs about the disease (Grégoire et al., 2002; Ogedegbe, 2008), and the frequent

discordance between patient and provider understandings of hypertension(Ogedegbe et al., 2004), this research question is pertinent to better understanding intervention aspects that can be improved to increase intervention utility for patients. 2) How do social determinants of health influence intervention outcomes among patients participating in the TASSH intervention? While TASSH will provide important information regarding blood pressure outcomes among patients who receive a task-shifting intervention versus those who do not, understanding how social determinants of health influence task-shifting outcomes among those in the intervention group is essential for identifying factors that are most influential for blood pressure control and management. Furthermore, while there have been trials to improve hypertension outcomes in sub-Saharan Africa, few, if any of these studies have investigated under for whom, and under which conditions health outcomes improve specifically within the intervention group. 3) What is the role of nurses trained in the WHO-PEN package in sustaining the TASSH intervention and ultimately hypertension management? The current body of literature indicates the important role of healthcare providers in hypertension management, including barriers such as poor communication between providers, disparities in knowledge, and therapeutic inertia (Ogedegbe, 2008). Thus, in order to fully understand the process of hypertension management among patients in a task-shifting intervention it is necessary to explore the role of community health nurses administering the TASSH intervention to hypertensive patients in Ghana.

CHAPTER 3: METHODS

Three different methodological approaches are discussed in this section to address the three aims of this project. A description of the study site and recruitment process that was used throughout is provided first.

3.1 STUDY SETTING

3.1.1 Study site

This study was conducted in the Ashanti region of Ghana, located in the south of the country. The Ashanti region is home to 3,612,950 residents, making it the most populous region in Ghana (Government of Ghana, 2016). Approximately 170 community health centers are located in the Ashanti region. In collaboration with Kwame Nkrumah University of Science and Technology (KNUST) School of Medicine located in Kumasi, Ghana, capital of Ashanti Region, 32 health clinics were recruited and randomized to the intervention or control group by the TASSH research team. Potentially eligible participants were identified at individual community health clinics. Komfo Anokye Teaching Hospital (KATH) served as the main recruitment and training facility for community health nurse. This hospital was the primary site of TASSH (U01HL114198; PI: Ogedegbe) (Gbenga Ogedegbe, Plange-Rhule, et al., 2014a).

3.1.2 Community health center recruitment

One of the key aspects of the Ghana Health System is the Community-based Health Planning and Services program, a strategy that utilizes community health nurses across the country to deliver primary health care services at community health centers (CHCs) (Nyonator, Awoonor-Williams, & Phillips, 2005). CHPS is a national strategy involving health planning and service delivery within communities, with the primary focus of providing for deprived sub-

districts and bringing health care resources into the community. CHPS operates on the following principles which guide their service development and delivery: 1) community participation, empowerment, ownership, gender considerations, and volunteerism, 2) focus on the community health needs to determine the CHPS services required, 3) Using task-shifting to achieve universal health care, 4) Using communities as social and human capital for health system development and delivery of health services, 5) Delivering health services using a systems approach, and 6) Having community health organizers (CHOs) as leaders and community mobilizers (Ghana Health Services, 2016)

The program moves health services into communities to develop sustainable volunteer based approaches to providing access to health care for all. CHPS is regarded as the "primary strategy for reaching the unreached," (Nyonator et al., 2005, p. 26) and has become an integral part of the Ghana Health Services. A key part of CHPS is local leadership and commitment, as well as the mobilization of a traditional community team to delivery appropriate services. Health staff who are part of this include CHOs, who provide mobile door-to-door services for individuals in the community. CHOs can reach up to as many 3,000 individuals, and provide a wide range of services including immunizations, family planning, antenatal/postnatal care, treating minor illnesses and injuries, and health education. These individuals are supported by community volunteers who assist with community mobilization and other essential activities to maintain the program. The CHOs are also supervised and assisted by local community health clinics staff, including community health nurses (Nyonator, Awoonor-Williams, Phillips, Jones, & Miller, 2005).

The CHPS program provided an opportunity to implement the TAsk-Shifting Strategy for Hypertension, and can potentially serve as a model of implementation for other Low-Middle income countries (LMICs). Participating CHCs were selected from geographically distant regions in the Ashanti region of Ghana, with equal representation of urban and rural clinics. Eligible CHCs had at least one community health nurse employed by the CHPS program, be a certified provider of the Ghana National Health Insurance Scheme (NHIS), and have the capability to provide blood testing (Mendis et al., 2010). From each facility, two nurses were selected to attend the TASSH training; if a facility was staffed with at least two nurses from the CHPS program, two of these nurses were selected by each site to attend. If a facility was only staffed with one nurse from the CHPS program, he or she was selected to attend the TASSH training along with an additional staff nurse selected by the facility. All selected nurses attended TASSH training at KATH. CHCs were identified with the assistance of the Kumasi Metropolitan Director of Health for the Ghana Health Services. Clinics were randomized into one of four cohorts, for a total of 8 clinics in each cohort. The randomization sequence was generated by the study statistician and kept in sealed envelopes. The distribution of clinics is presented in Table 1.

Table 1: Clinic characteristics

Characteristics	**Total (n=32)**	**Intervention Group (n=16)**	**Control Group (n=16)**
District Hospitals (%)	16 (50%)	8 (50%)	8 (50%)
Health Centers (%)	16 (50%)	8 (50%)	8 (50%)
Rural (%)	16 (50%)	9 (56%)	7 (44%)
Urban (%)	16 (50%)	7 (44%)	9 (56%)

Clinics were informed of their group assignment by telephone. Due to the nature of the study, it was impossible to keep the group assignment from the clinic directors and the study

nurses. To mitigate the risk of group assignment biasing blood pressure measurements, automated blood pressure measurements were taken (Ogedegbe, Plange-Rhule, et al., 2014a).

3.1.3 Nurse recruitment

Nurses selected for the study were active workers at the clinic. Nurses received training in the WHO Package of Essential Non-communicable disease, which includes algorithms for assessing cardiovascular disease risks, taking anthropomorphic measures, BP measurements, administering questionnaires, blood draws, and urine collection. All processes were standardized across clinics. Study nurses received additional training in behavioral counseling to assist patients with making lifestyle changes. Nurses underwent training prior to the start of the program, and again every six months. Project coordinators and nurses received proper training in obtaining informed consent from participants. Study nurses were responsible for screening, data collection, and referring complicated cases of hypertension (e.g. those with severe comorbidities) to physicians for follow-up care.

3.1.4 Patient recruitment

Potentially eligible participants were identified at community health clinics and were referred to community health nurses by physicians. Eligibility criteria included: registered to receive care at the community health clinics, at least age 40 with BP 140-179/90-99 mm Hg, were not receiving treatment for hypertension, and were able to provide either written or verbal informed consent. Exclusion criteria were any of the following: diagnosis of diabetes, coronary artery disease, transient ischemic attack, stroke, heart failure, angina; BP equal to or greater than 180/100 mm Hg, positive urine dipstick for protein, pregnancy, unable to comply with follow-up

requirements or provide informed consent. In total, 757 were recruited to participate in the TASSH program (intervention group: n = 368; control group: n = 389).

3.1.5 Randomization

Randomization occurred at the level of the health centers. Thirty two CHCs were randomized, with eight CHCs in each cohort. CHCs were randomized to control or intervention group using a 1:1 ratio. A statistician associated with the TASSH study conducted the randomization. Once randomization was complete, members of the TASSH research team informed the clinics of their assignment. Because of the nature of this intervention, it was not possible to blind patients, community health nurses, and study coordinators to intervention condition. To mitigate the risk that the study coordinators could misreport blood pressure readings, thereby biasing results, automated blood pressure devices were used to prevent external influence on the readings.

3.2 AIM 1

Explore how patients perceive hypertension and an on-going task-shifting strategy to promote hypertension management

To enrich the current literature base in this area, qualitative interviews with patients participating in the TASSH intervention were conducted to explore patients' perceptions of the TASSH intervention, and their perceived ability to manage their hypertension, thus allowing for a rich exploration of patients' experiences in an on-going task-shifting intervention. To recruit study participants of TASSH to participate in qualitative interviews, purposive sampling was used, in which patients were selected based on the study purpose with the expectation that each participant would provide rich and unique information for the study. Patients in the intervention

condition at clinics delivering the WHO-PEN package were contacted in the fourth year of the study either by phone or by a TASSH nurse during follow-up visits, and were given information on the purpose of the study, what was expected, and potential incentives for participating. Patients were provided transportation to the interview site, as well as 20 Ghana dollars for their participation.

3.2.1 Theoretical framework

The PEN-3 Cultural Model was used to explore patients' perceptions of hypertension and TASSH. Developed in 1989, and further updated in 1994, the PEN-3 cultural model which takes into consideration the cultural and social factors influencing health, has grown in popularity in the design and implementation of culturally relevant public health interventions targeting minority populations. The acronym PEN-3 represents the three domains of the model; 1) Cultural Identity; 2) Relationships and Expectations and 3) Cultural Empowerment (Airhihenbuwa et al., 2009). The Cultural Identity domain is comprised of three constructs- person, referring to the focus on the one person who has the most influence on health decisions, extended family, or how kinship plays a role in health decisions, and neighborhood, meaning the community context that shapes values and health decisions. Relationships and Expectation consists of perceptions, or beliefs and values held by people about a condition, enablers, or resources that promote or hinder behavior change, and nurturers, referring to the role of family and friends or other forms of social support, and their ability to make a positive or negative impact. Finally, Cultural Empowerment focuses on positive factors, underscoring the importance of identifying positive attributes instead of solely negative ones, existential factors, or qualities that make a culture unique by should not be blamed for program or health failure, and negative factors, or values and behaviors that contribute to a health problem (Airhihenbuwa et al., 2009).

Since its inception, the model has been used to guide the interpretation and analysis of data ranging from HIV and AIDS to cancer, diabetes, malaria, smoking, health care seeking practices, nutritional influences on birth outcomes, and reproductive desires. Literatures reviews highlight how the model has been used to explore not only the cultural contexts that shape health beliefs and practices, but also the role of family in enabling and nurturing health behaviors and the significance of exploring positive health behaviors, unique practices that have a neutral impact on health and the negative factors that are likely to have adverse influence on health (Airhihenbuwa et al., 2009; Airhihenbuwa, 1995). This study focuses specifically on the Relationships and Expectations domain to examine patients' perceptions, or beliefs regarding hypertension and hypertension management, perceived enablers, or factors that hinder or foster hypertension management, and nurturers, or the role of social support in hypertension management in the context of TASSH. Using the PEN-3 as a guide allows for a rich and comprehensive data analysis that accounts for individual, social, and cultural factors influencing how TASSH influences hypertension management in patients.

3.2.2 Data Collection

Prior to data collection, six research coordinators fluent in Twi, the local Ashanti dialect, received a brief one-hour training session in qualitative interviewing methodology from the research team. This included providing informed consent, conducting an interview, recording participant responses, and providing appropriate probes when further information was needed. All participants read an informed consent document, or were read the informed consent document by the research coordinators; they either provided a signature or a thumb print in lieu of a signature as record of their agreement to participant. At the beginning of each interview, research coordinators collected basic demographic information for all participants including sex,

age, and education. An interview guide created based on the PEN-3 cultural model guided the qualitative interviews (See Appendix A). The interview guide contained 11 questions based on the Relationships and Expectations domain of the PEN-3 Cultural Model, addressing patients' perceptions of TASSH, the beneficial and negative aspects of the program, barriers to self-management of hypertension, how TASSH has helped them to manage hypertension, and their confidence in their ability to continue to maintain adequate blood pressure control at the end of TASSH. Additionally, patients were asked how they felt TASSH addressed their hypertension needs. Although the Relationships and Expectations domain usually encompases of the role of family and friends, other forms of social support can be included as well. For the current study, the role of the TASSH nurses in providing support for hypertension management was examined. A total of 60 patients were contacted and 42 agreed to be interviewed; all interviews were conducted individually and lasted up to 45 minutes. Research coordinators transcribed the interviews in real time, and then translated them into English prior to data analysis.

3.2.3 Promoting trustworthiness of the data

Approaches to qualitative research have become extremely diverse, and because of that there is increased attention to the criteria used to judge the trustworthiness of data. Trustworthiness of data involves establishing credibility, dependability, transferability, and confirmability. Credibility, which is analogous to internal validity in quantitative research, is a term used to describe the process of establishing whether the results are believable. The issue depends on three distinct elements: data collection techniques, research credibility, and the value of the qualitative inquiry (Patton, 1999). In order for credibility, or believability to be established, rigorous techniques for gather high quality data are needed, which can be facilitated by use of a firm theoretical basis for the qualitative inquiry and data collection materials, as well

as triangulation, or data collected from different sources. These different sources can complement one another in an analysis, or yield different conclusions which can impact the credibility of data (Patton, 1999). Furthermore, the credibility of the researcher is important, which is dependent on training, experience, track record, and presentation of oneself. It is also necessary for researchers to be aware of their personal biases, and how those may affect their presentation of themselves during data collection and during the analysis. Though difficult, it is important for researchers to remain as objective as possible during the research process in order to facilitate credibility of themselves and of the data (Patton, 1999). Finally, the value of the qualitative inquiry is important for credibility, for example taking into account different methods of inquiry (e.g. naturalistic inquiry), inductive analysis without the presupposition of an existing theoretical framework, and holistic thinking when undergoing data analysis. This leads to another important issue of credibility, which is integrity in analysis. When a researcher begins to describe patterns and linkages in the data, especially for inductive analysis, it is important to also look for themes and conditions that refute these ideas. This can be done inductively, referring to looking for another way of organizing the data that may lead to different findings, or logically, meaning thinking about other logical possibilities and whether these can be supported by the existing data (Patton, 1999.). Consideration of rival themes is not an attempt to disprove the findings of the analysis, but rather the absence of alternative explanations in the data further strengthens the credibility of the initial explanation (Patton, 1999). Closely related to this is the idea of testing for negative cases, or cases that do not fit the typical pattern of the data. These can sometimes be used to broaden themes to include information about a specific sub-set of a sample (Patton, 1999).

Dependability is another important feature to insure the quality of qualitative data. Dependability takes into account factors of instability and factors of design that induce change in a qualitative study, and is similar to that of reliability in a quantitative study, meaning that observations are consistent with the same measurement. Essentially, the qualitative view of dependability is based on the assumption of replicability or repeatability, or whether a researcher would obtain the same results if the same thing was observed more than once. The idea of dependability underscores the need for qualitative researchers to account for the changing environments in which research occurs. Researchers are responsible for describing changes as well as discussing how changes can affect the way a study is conducted (Lincoln & Guba, 1985). Lincoln and Guba (1985) also highlight the similarities between dependability and credibility, suggesting that demonstration of the former goes, to some extent, to demonstrate the latter. Triangulation or overlapping methods can be one way to achieve credibility and dependability in research. To more directly address dependability, study processes should be reported in detail, which would enable future researchers to conduct the same study (Shenton, 2004). Important features of this include: reporting the research design and implementation, describing what was planned and executed; the operational details of data gathering, reporting what was done in the field; and reflective appraisal of the study, which evaluates the effectiveness of the type and process of inquiry taken, noting strengths and limitations (Shenton, 2004). As many qualitative findings are specific to the situation in which they were obtained, reporting this information in detail is necessary in the event of future replication, or to demonstrate why the situation was too unique for replication. There are a number of steps that can be taken to facilitate dependability in addition to a detailed reporting of inquiry methods. First, a step-wise replication approach can improve dependability. This involves two researchers dealing individually with the data and the

results are contrasted, allowing for different perspectives and potential alternate explanations to be brought to light. Communication with team mates is crucial for this at preset points in the analysis, typically prior to beginning the analysis, halfway through, and at the end to review the final product. Another method to increase dependability is to complete a code-recode procedure, meaning that after initial coding, a researcher should wait for a period of time and the return and recode the data. This allows the researcher to see if he or she reaches consistent conclusions. Finally, using fellow research team members and methodological experts is another way to facilitate dependability of data, either having them participate in the coding process, or reviewing the steps taken in the coding process and development of results to see if they reached those same conclusions (Lincoln & Guba, 1985)

Transferability refers to the need for the findings to be applicable in other contexts, similar to external validity in quantitative research. Since qualitative projects typically consist of small samples it is impossible to demonstrate clearly that the findings are applicable to other contexts and populations. However, Lincoln and Guba (1985) describe that it is the responsibility of the investigators to provide sufficient information about field sites and the context of the research so that the reader can determine situations to where the work may be transferable. They also uphold that researchers know only the "sending context" and cannot make transferability inferences. After examining a researcher's report, readers must take it upon themselves to determine how confident they can be in transferring the results and conclusions to other situations (Shenton, 2004). Important information for the reader to receive before transferability inferences are made include: the number of organizations that partook in the study and their location; restrictions on the type of people who participated; number of participants involved; data collection methods; number and length of data collection sessions; time period of data

collection (Shenton, 2004). While this is crucial information for researchers to provide for readers, often an accumulation of different studies in a variety of settings allows for a more inclusive representation of a phenomenon to be obtained. Gross (1998) supports this, saying that her phenomenon of interest takes place in a variety of environments, and how her study of one particular environment can provide a baseline understanding in that specific context, but is not indicative of the overall picture (Gross, 1998). Borgman (1986) also argued that an understanding of a phenomenon is gained gradually through examining several studies, and even if results of studies do not always agree, it is not grounds for implying that certain studies are untrustworthy, but that different contexts can lead to different conclusions (Borgman, 1986). For instance, the data obtained from the TASSH study are very specific to the many aspects of the study context: Ghana, the Kumasi region, and task-shifting to nurses. While the specific results of this study cannot be used to make inferences about other contexts and other interventions, they can provide a baseline understanding, which in combination with other evidence can inform readers about task-shifting programs for hypertension management.

Confirmability is the final aspect used to establish trustworthiness of data, which refers to the extent to which the findings are shaped by respondents and not researched bias or motivation. This is analogous to objectivity in quantitative research, thus removing the emphasis of the investigator and places the emphasis on participants and the data (Lincoln & Guba, 1985). The role of triangulation is an important feature promoting confirmability, and can help reduce investigator bias. Indeed, different sources of data reflecting the same ideas and conclusions present stronger evidence of confirmability as opposed to just one data source. Another factor that is considered a key criterion for confirmability is the extent to which the researchers admit their own bias (Shenton, 2004). This can be reflected in the research report, acknowledging

limitations in the techniques used. Detailed methodological descriptions are also paramount for confirmability. The use of an audit-trail can be done to boost confirmability as well as dependability. In this instance an external person can take a data-oriented approach or a theoretical approach to conducting an audit. A data-drive approach consists of showing how the data lead to the conclusions and recommendations that result from a study, while a theoretical approach involves tracking concepts inherent to the research question throughout the duration of the project (Shenton, 2004).

The researchers took several steps in order to promote these many aspects of trustworthiness. First, multiple researchers independently coded the data, compared their results and reviewed the data holistically to resolve any discrepancies. Second, a detailed code book was maintained, accounting for the inclusion and exclusion criteria for each code. Finally, notes were kept throughout the coding process to document the researchers' analytic processes. This process is described in further detail in the following section.

3.2.4 Data analysis

Open and axial coding techniques were used for data analysis (Corbin & Strauss, 2008). Open coding entailed holistically reviewing all data, analyzing responses by individual participant, comparing responses by individual question, cross-checking the responses of all participants to the same questions, labeling concepts, and breaking the data down into categories that best addressed the purpose of the investigation (Corbin & Strauss, 2008). During the axial stage of coding, connections were made among concepts, and thematic categories that best described the purpose of the investigation (Corbin & Strauss, 2008). Data were then deductively analyzed, which entailed a detailed analysis of the data in relation to the chosen theoretical framework, the PEN-3 Cultural Model. Specifically, data were analyzed in relation to the

Relationships and Expectations domain to understand perceptions, enablers, and nurturers to hypertension management among patients within TASSH. Two researchers independently coded the data and conduct thematic analysis. A consensus was reached between the researchers, leading to the established themes for the study.

In order to promote trustworthiness of the data, the researchers followed a five-step process (Smith & Firth, 2011; Srivastava & Thomson, 2009) that involved: (i) familiarization (a process during which the researcher becomes immersed in the details of each transcript to gain a sense of the whole interview, prior to dividing them into sections and identifying recurrent themes), (ii) guidance of a theoretical framework (a process by which the researcher identifies recurrent and important themes in the transcripts in relation to a presupposing theoretical framework), (iii) indexing (during which the researcher becomes further immersed in the data in order to refine identified themes and sub-themes), (iv) summarizing data in an analytical framework (during which the researcher reduces materials into understandable, but brief summaries of what was said by participants), and (v) data synthesis, and interpretation (which allows for comparison of themes and sub-themes against original transcripts, field notes, and audio recordings to ensure appropriate context. Following the framework approach, as described above, transcripts of the interviews were coded and classified according to a coding index that was created, and specific comments and quotes by respondents were identified. This technique allowed the researchers to cross-check and compare findings to ensure that consistent results were reached. The researchers each independently read the data (familiarization), using the PEN-3 cultural model to guide the structure of recurrent themes and ideas (guidance of a theoretical framework). The researchers independently created codes, and decided on a final list of applicable codes to the data. (See Table 2 for the coding index and Table 3 for inclusion and

exclusion criteria.) This involved discussing the reasoning behind the code selection and coding process, and the definition of codes, and merging the coding schemes to create a final list by expanding or reducing the inclusion criteria of certain codes and modifying definitions. Then, the researchers used the final list of codes to refine and identify themes and sub-themes (indexing), and together summarized the themes into the presupposing analytical framework, deciding on the final themes using the same process as was done for codes (summarizing data in an analytical framework). As part of the data synthesis and interpretation, the researchers compared themes and sub-themes to those identified in the previous literature, as well as revisited the original data transcripts to ensure that they are placed appropriately in context (data synthesis and interpretation).

Table 2: Qualitative coding index for aim 1

Themes	**Initial Categories**
Attitudes and beliefs	Knowledge
	Beliefs
	Perceived health state
Role of nurses as supports	Advice
	Relationships
	Counselling
	Communication
	Accessibility
	Attentiveness
	Home visits
Treatment as lifestyle change	Improved health outcomes
	Behavior changes
	Quality of life
	Medication adherence
Challenges moving forward	Medication access
	TASSH leaving
	Community awareness
	Barriers
	Enablers

Table 3: Codebook with inclusion and exclusion criteria for Aim 1

Themes	Initial Categories	Definition	Inclusion/Exclusion
Attitudes and beliefs	Knowledge	Knowledge of hypertension that resulted from TASSH intervention	I: explicit or implied mention of knowledge gained from TASSH E: beliefs about HNT or behavior changes resulting from TASSH
	Beliefs	Perceptions, beliefs, or attitudes about hypertension	I: personal belief, perception, or attitude (e.g. "I think; I believe, I feel) E: knowledge, awareness or behavior change
	Perceived health state	Patients' perceptions of their health state and progressions or regressions	I: mention of feeling a certain way (e.g. healthier, fitter, more in control, etc.) E: behavior changes or perceptions of HTN itself
Role of nurses as supports	Advice	Information and guidance provided by nurses	I: direct or implied mention of advice provided by nurses in TASSH to help with HTN management E: behavior change; beliefs; knowledge gained; advice given outside the TASSH program
	Relationships	The relationship between nurses and their patients that fostered HTN management	I:mention of a relationship with nurses or how that relationship helped in behavior change and HNT management E: other relationships mentioned (i.e. physicians, study coordinator)
	Counselling	Behavioral counselling received through TASSH	I: discussion behavioral counseling and motivational interviewing conducted by the nurses in TASSH E: behavioral counseling outside of the TASSH program
	Communication	Patient provider communication, specifically nurse-patient communication	I: direct or implicit mention of communication with nurses regarding HNT management and behavioral changes E: communication with other health staff or providers outside the TASSH program
	Accessibility	Accessibility of nurses and willingness to answer patient questions	I: examples of whether nurses were accessible and/or willing to answer questions E: accessibility of other health services (e.g. medication)

Table 3 (cont.)

	Explanations	The quality of the explanations provided by nurses during TASSH visits	I: examples of whether nurses provided adequate explanations during educational sessions (e.g. lifestyle modifications; medication guidelines) E: other aspects of clinical care provided by nurses or other providers
	Home visits	Follow-up visits to patients' home provided by nurses and study coordinators to follow-up on their health	I: discussion of the quality of home visits and patients' perceptions of home visits E: clinic visits
Treatment as lifestyle change	Improved health outcomes	Changes in clinical outcomes related to blood pressure control	I: direct mention of whether blood pressure outcomes have improved or other measurable health outcomes E: perceptions of health status
	Behavior changes	Lifestyle and behavioral changes that resulted from the TASSH intervention	I: examples of how patients applied behavioral counseling in TASSH to making/not making behavioral changes to improve hypertension E: perceptions or beliefs about HNT; knowledge/awareness resulting from the program
	Quality of life	Changes in quality of life (positive or negative) that resulted from behavior and health changes stemming from the TASSH intervention	I: description of positive or negative changes related to quality of life (e.g. improved functioning, ability to carry out daily tasks) E: behavior changes; knowledge or awareness gained from TASSH; perceptions of HNT
	Medication adherence	Factors influencing whether a patient adhered to prescribed anti-hypertensive medication regime	I: factors impacting medication adherence when a patient had access to medications (e.g. lack of understanding the importance of medication; medication side effects) E:challenges to medication access
Challenges moving forward	Medication access	Factoring influencing access to anti-hypertensive medication for patients in TASSH	I: description of factors affecting patients' ability to access and obtain medication E: knowledge/awareness of medication benefits, side effects, personal attitudes toward medication

Table 3 (cont.)

	TASSH leaving	Patients' concerns about the TASSH program ending (shortly after interviews were conducted)	I: concerns or apprehensions patients had about TASSH leaving including concerns about their abilities to maintain behavior changes and health outcomes E: issues related to medication adherence and access
	Community awareness	Patients' description of the role of the community in promoting TASSH	I: discussion of the current role of the community or future roles the community can play E: role of patients and health care providers
	Barriers	Patient identified barriers to HNT management after the TASSH program ends	I: logistical or personal reasons that patients feel are barriers to HNT management after TASSH (e.g. cost of medication, healthy foods; time limitations for physical activity; transportation difficulties) E: enablers to continuing HNT management after TASSH
	Enablers	Patient identified enablers to HNT management after the TASSH program ends	I: factors that will help patients continue to maintain behavior changes and HNT management after TASSH E: barriers to HNT management

3.2.5 Limitations

This approach was subject to noteworthy limitations. First, there was a risk that responses were biased due to social desirability. It was possible that participants wanted to please the researchers, and thus gave responses based on what they believed the researchers were hoping to hear. Furthermore, it was possible that only participants who had favorable things to say about the program agreed to participate, thus making the data subject to response bias. One method taken to mitigate the bias that may have been caused was having multiple researchers independently review the data so that the presentation of the results reflected what was stated by the participants instead of an individual researcher's bias. Having multiple people review, code, and summarize the data into thematic categories can promote findings negative cases that may be

relevant for the data, as well as compare rival themes that may emerge during the analysis (Shenton, 2004; Lincoln & Guba, 1985).

3.3 AIM 2

Examine how social determinants of health influence intervention outcomes among patients participating in the TASSH intervention

Aim 2 was a secondary analysis of data collected during the primary TASSH trial. This aim focused solely on the intervention group to explore how social determinants of health influence intervention outcomes. Specifically, this aim addressed the question, for whom and under what conditions is the TASSH intervention most effective? Though there are many social determinants of health, as described earlier, this study specifically focused on the following structural determinants: region of residence (urban/rural), education, and gender, and the following intermediary determinants: physical activity, medication adherence, current smoking, and alcohol use, while controlling for age and body mass index.

3.3.1 Theoretical framework

The World Health Organization Commission on Social Determinants of Health's framework was developed to achieve the following: identify the social determinants of health and inequities in health; demonstrate how these determinants are related; clarify the mechanisms through which inequities result from these determinants; provide a framework for evaluating important social determinants of health, and maps specific intervention and policy entry points (WHO, 2010a). The key components of this framework include: 1) the socio-political context; 2) structural determinants and socio-economic position; and 3) intermediary determinants (WHO, 2010a). The socioeconomic-political context is deliberately broad to encompass a

spectrum of factors that are not directly reflected at the individual level. This "context" includes structural, cultural, and functional aspects of social systems, which impact individuals' health opportunities, as well as generate and maintain social hierarchies (e.g. labor market, educational system). Structural determinants are mechanisms that create and/or reinforce social stratification in societies, which contribute to defining individuals' economic position, and ultimately configuring health opportunities. The most important structural stratifiers in societies include: income, education, occupation, social class, gender, race/ethnicity, and region. Social mechanisms that shape hierarchies based on these mechanisms are the root cause of health inequities. The final categories of determinants, intermediary factors, are mechanisms through which structural determinants operate to influence health. The main categories of intermediary determinants described in this framework are: material circumstance, psychological circumstances, behavioral and biological factors, and the health system itself.

Placing the current study within the context of the SDH framework, determinants of interest include education, gender, and region of residence at the structural level, and physical activity, medication adherence, and smoking and drinking behaviors at the intermediary level. Given that intermediary factors are often influenced by structural determinants (Graham, 2004), the prediction was that within the intervention group, intermediary determinants of health (physical activity and medication adherence) mediated the relationship between the aforementioned structural determinants of health to be examined and blood pressure outcomes. However, because the question of "for whom and under what conditions is the intervention most successful?" is paramount, moderation was also be explored to examine whether individuals with certain characteristics, or social determinants of health, had better blood pressure outcomes in the TASSH intervention.

3.3.2 Data collection

This aim involves a secondary analysis of previously collected data from the TASH intervention. Following the randomization and patient eligibility confirmation procedure, all patients regardless of assignment to the intervention or control group received six study visits: baseline, and follow-up visits at 3, 6, 9, 12 and 24 months. The structure of each study visit and the respective measures were the same for each group. Data collection for this portion of the study was completed by the TASSH research team in Ghana beginning in 2012.

3.3.2.1 Baseline visit. All patients regardless of randomization group received informed consent and confirmation of eligibility to participate in the study. Patients were consented by study coordinators and required to read and sign a consent form. If the patient was unable to read, the study coordinator read the form to them, and after all the patients' questions were answered, a thumbprint was used to represent a signature. The study coordinators conducted baseline assessments. History of comorbidities was determined from patient medical records prior to initiating the study. Height, weight, waist circumference, blood pressure (BP) measurements, laboratory tests for fasting blood glucose, and cholesterol levels were assessed in the clinic through anthropomorphic measurements and laboratory tests. Patients were then given a schedule of study visits with instructions about each visit. Furthermore, each patient received a telephone call the day before the appointment to remind them attendance. Following this initial session, patients received their appropriate interventions based on group assignment. Patients in the control received cards for the health insurance coverage through the National Health Insurance Scheme (NHIS), and were informed of the benefits covered under said health insurance. Patients were also given standard educational materials related to hypertension and treatment both orally by the nurses along with educational pamphlets. Finally, the patients were

asked to follow-up with their current health care providing regarding management of their hypertension. Patients in the intervention group also received health insurance cards and an explanation of benefits, but additionally received the WHO-PEN package from community health nurses at the study site. This included a medical assessment to determine risk for cardiovascular disease, and based on the assessed risks, nurses followed the appropriate treatment protocol for the WHO-PEN package. Patients also received motivational interviewing and lifestyle counseling on medication adherence, self-management skills related to diet and physical activity, and initiation of drug treatment therapy based on their stage of hypertension. Nurses then scheduled a follow-up visit with the patients and thanked them for their time.

3.3.2.2 Follow-up visits. During follow-up visits, patients had their blood pressure taken as per the protocol describe below. Patients in the intervention group met with community health nurses who assessed the patients' weight, weight circumference, and blood pressure control status (<140/90) to determine how to proceed with the medication titration schedule as per the WHO guidelines. Patients also received lifestyle counseling on increasing dietary intake of fruits and vegetables, weight loss, physical activity, and medication adherence. The study coordinators conducted assessments of physical activity and medication adherence. At the conclusion of baseline visit and follow-up visits (1-5), patients received $5 (~10 Ghana Cedis) for travel reimbursement.

3.3.3 Measures

The following section describes the measures used to collect data for the TASSH study. Measures of interest are classified as structural or intermediary determinants of health, and the outcomes of interest.

3.3.3.1 Structural determinants. Patients reported the highest level of education attained, which was recoded as one of the following: none, primary (1-6 years of school), secondary (7-12 years of school), or tertiary (beyond secondary school); this was treated as an ordinal variable. Gender was self-reported by patients as male or female. Both gender and education were self-reported by patients. Patients' region of residence was a binary variable (urban/rural), which was determined from the clinic attended, recorded on their charts.

3.3.3.2 Intermediary determinants. Age was reported by participants in years and cross-checked with patient charts, and was treated as a continuous variable. Height and weight were measured at clinic visits without shoes, using a tape measure and digital scale and patients' body mass index (BMI) was computed, which was treated as continuous. Patients were asked at each visit whether they were current smokers, and they also reported the average number of alcoholic beverages consumed each week. Current smoking was treated as a binary variable (yes/no), and number of alcoholic beverages was treated as a continuous variable.

Adherence to prescribed hypertensive drugs was assessed using a modified version of the Self-Reported Medication-taking Scale (SRMS), developed and validated by Morisky, Green, and Levine (1986). This scale consists of five questions with yes/no responses. Scores were computed with a range of 0-5, with higher scores indicative of better medication adherence. Because of the importance of medication adherence for hypertension management, the influence of structural determinants of health on medication adherence at 6 and 12 months were examined as well.

Physical activity was assessed with the Global Physical Activity Questionnaire (GPAQ) developed by the WHO to assess physical activity in low-middle income countries (WHO, 2008). Data on physical activity were only collected at 6 and 12 months. The GPAQ consisted of

16 questions measuring moderate physical activity, vigorous physical activity, and sedentary behavior. Respondents indicated whether they participated in moderate and vigorous physical activity, respectively, at work and during recreational activities. If yes, respondents indicated the number of days per week and the average minutes of physical activity per day. Participants also indicated the average number of minutes per day they engaged in physical activity as a means of transportation (e.g. walking or bicycling), which was considered moderate activity by the WHO (WHO, 2008). Total minutes of all physical activity per week were computed based on daily estimates. Also because of the importance of physical activity for hypertension management, the influence of structural determinants of health on physical activity at 6 and 12 months was also examined.

Blood pressure readings were taken following the American Heart Association guidelines (Pickering et al., 2005). Three BP readings were taken with the patient sitting comfortably, using an automated BP machine. The average of the three readings was used as the BP measure for each visit. This same procedure occurred at all study visits; however, information on physical activity was only collected at six months and twelve months, thus only data from baseline, six months, and twelve months are analyzed for the current study. The two outcome variables will be systolic blood pressure change, assessed from baseline to six months and baseline to twelve months. The second outcome variable is blood pressure control at six months and twelve months. Blood pressure control is defined as systolic blood pressure < 140 mm Hg *and* diastolic blood pressure < 90 mm Hg.

3.3.4 Selection of statistical tests

Multiple linear regression was chosen to assess change in blood pressure from baseline to six months and baseline to twelve months. Mean change in blood pressure from baseline to 6

months and baseline to 12 months represented a continuous variable, as the change in both systolic and diastolic blood pressure can represent a variety of different values, as opposed to a distinct set of discrete values. Because several factors contributed to a patient's blood pressure change throughout the course of an intervention that have to be examined and controlled for in statistical analyses, multiple linear regression was an appropriate method of investigation allowing for an examination of multiple predictors on a continuous dependent variable. Many studies investigating change in blood pressure typically only report change in systolic blood pressure, as it is a better indicator of the pressure being placed on the arterial walls (Kengne & Mayosi, 2014; Lekoubou et al., 2010; Ogedegbe, Plange-Rhule, et al., 2014a). With one continuous variable (change in systolic blood pressure) and a variety of predictor variables, multiple linear regression offered an opportunity to explore this relationship.

Using multiple linear regression allowed for determination of overall fit, or the variance explained by the model, and the relative contribution of each predictor previously described in the total variance explained. Many of the necessary assumptions of multiple linear regression were met by the data: a dependent variable measured on a continuous scale; and at least two independent variables which can be either continuous or categorical; and the relationship between the independent variables and predictors in the overall model was linear, with relatively constant variance between the data points. Another assumption of multiple linear regression that was upheld was that the dependent variable showed a normal distribution, which can be seen in Figure 4 and Figure 5 for six and twelve months, respectively.

Figure 4: Histogram of blood pressure change from baseline to six months

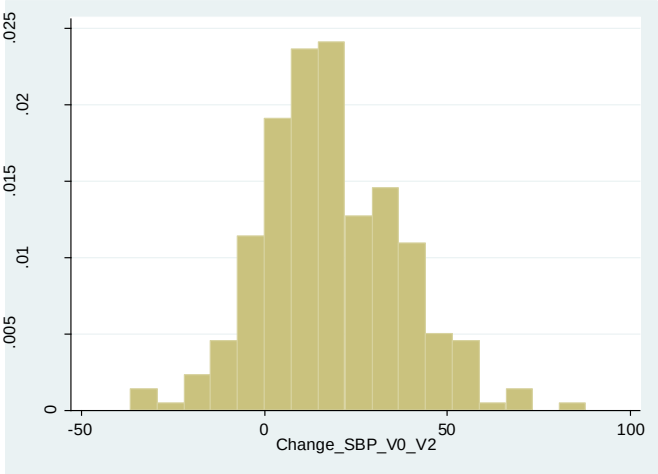
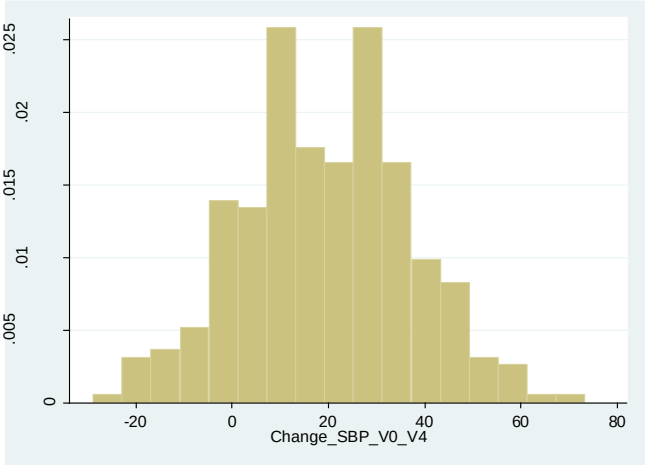


Figure 5: Histogram of blood pressure change from baseline to twelve months



The variance inflation factors for change in blood pressure from baseline to 6 months (2.25) and baseline to 12 months (1.20) were well under the suggested value of 10 for multiple linear regression (Hair, 1995), thus satisfying another assumption of linear regression that there is no multicollinearity between the predictors. Finally, the data uphold the assumption of homoscedacity, or that the variance around the regression line is similar for predictor variables: Model 1 (change from baseline to six months)- Chi-Squared = .5; *p* =.48; Model 2 (change from

baseline to 12 months)- Chi-squared = 1.27; p = .26, with the null hypothesis of equal variance upheld. One assumption that is not upheld by the current data is the assumption of independence, which was expected as it was probable that patients attending the same clinics had more similar outcomes than patients attending other clinics. To correct for this, multilevel modeling was used, which can adjust for bias in different clusters within a sample, including different clinics. If clustering of the data is ignored, traditional linear and binary models tend to underestimate the standard error of a parameter. Because observations within the same cluster tend to be more similar, researchers can to a certain extent predict outcomes within that same cluster, but not across clusters. This implies that while not every data point within a cluster is independent from one another, the aggregated information from a cluster can provide information showing how different groupings within a hierarchical structure can impact outcomes (Guo, 2000). As individual patients attended one of 16 clinics, using multilevel modeling to account for this clustering provided an important correction for standard errors and confidence intervals that could have otherwise be biased if the clinic attended was not taken into account. This helped account for differences that may have arisen to due various policies and practices that differed between clinics, as well as patient characteristics that may have differed by clinic as well.

Multiple linear regression is also advantageous over ANOVA measurements as it allows for an exploratory analysis of moderation and mediation (described below). Additionally, as two of the measures of interest, physical activity and medication adherence, did not have available data from the baseline visit, a longitudinal growth model was not possible. Therefore, multiple linear regression was a suitable method for addressing the research question of interest.

Binary logistic regression was used to examine the impacts of social determinants of health on blood pressure control. This was a suitable method as blood pressure control is a

dichotomous outcome (achieved control =1; not controlled=0). Furthermore, a variety of different predictors can be used in binary logistic regression including both continuous and categorical predictors. Preliminary analyses revealed that binary logistic regression model fitted upheld the Goodness of Fit Test, failing to reject the null hypothesis that the regression model is a good fit (6 months: p = .349; 12 months: p = .326). Additionally the linktest, which indicates whether model was specified correctly, was conducted with a high p value for the hatsq. This indicated that the null hypothesis that the model was specified correctly was upheld, and there was not a significant amount of specification error, or correlation between the independent variables and the error terms (Institute for Digital Research & Education, 2015). As with the multiple linear regression examining blood pressure change, multilevel modeling was used to account for clinic clustering and correct potentially biased standard errors and confidence intervals.

3.3.5 Statistical analysis

Change in systolic blood pressure from baseline to six months and baseline to twelve months was assessed using multiple linear regression, with gender, urban/rural, education, medication adherence, physical activity, smoking, and alcohol consumption as predictor variables of interest. Systolic blood pressure was the primary outcome of the TASSH trial and is most indicative of health status which was the rational for focusing specifically on this measurement instead of diastolic blood pressure (Ogedegbe, Plange-Rhule, et al., 2014). Two separate multilevel regressions, one with blood pressure change from baseline to six months and one assessing blood pressure change from baseline to twelve months were conducted. Subsequently, multilevel binary logistic regressions with blood pressure control at six and twelve months were conducted.

After running the initial models, the researcher conducted an exploratory analysis examining different ways in which social determinants of health influence blood pressure outcomes. One pertinent question to address was for whom, and under what conditions is the intervention most effective? To examine this several interaction terms were tested in a moderation analysis. Moderation analysis provides information regarding variance in effects under different variables conditions, and thus was used to address the aforementioned question There were several potential interaction terms that could have been created to examine whether intervention effects varied by categories of intermediary and structural determinants. These included: education and physical activity (educationXPA), gender and physical activity (genderXPA), region and physical activity (regionXPA), education and medication adherence (educationXMA), region and medication adherence (regionXMA), gender and medication adherence (genderXMA), gender and alcohol consumption (genderXalcohol), region and alcohol consumption (regionXalcohol), education and alcohol consumption (educationXalcohol), gender and smoking (genderXsmoking), region and smoking (regionXsmoking), education and smoking (educationXsmoking), gender and region (genderXregion), gender and education (genderXeducation), and education and region (educationXregion). Due to the large number of possible interactions, and to reduce the risk of over-saturating the model, interaction terms were only created and included in the analysis if the variables were significant predictors of blood pressure outcomes, and if the interaction term contributed significantly to the new model. Moderators were be chosen based on effect sizes and statistical significance to help frame the description and interpretation of the results based on the guidelines in Jose (2013), that moderators are typically less significant or have effect sizes of less magnitude than independent variables (Jose, 2013).

The following steps were used to guide the moderation analysis. For each dependent variable, the researcher conducted a block 1 regression model predicting the outcome variable Y from both the predictor variables and the moderator variables. The effects of the independent variables must have been significant value prior to adding the interaction terms. Assuming the criteria for the block 1 regression were met, the researcher ran a block 2 regression model with the added interaction effects. If the change in the R2 value between the models is significant and the interaction term was also significant, this suggested moderation occurred. If the predictor and moderator were not significant with the interaction term added, then complete moderation had occurred, however, if the predictor and moderator were significant with the interaction term added, then moderation with significant main effects had occurred (Aiken & West, 1991). All analyses were conducted using STATA 14.

Furthermore, based on the SDH framework, positing that intermediary determinants mediate the relationship between structural determinants and health (Graham, 2004), the researcher took steps to determine whether mediation occurred in the models in the current study. Independent variables of interest included structural determinants (region, gender, education), and potential mediators included physical activity, medication adherence, smoking, and alcohol consumption. Using the approach designed by Baron and Kenney (Baron & Kenney, 1986), mediation was established if four criteria are met: 1) the independent variable(s) must directly affect the dependent variable(s); thus region of residence, gender, and education must significantly impact blood pressure change control. 2) The mediators must affect the dependent variable. In this case, physical activity and medication adherence must significantly affect blood pressure change and control in adjusted models. To reduce the risk of a Type 1 error, all potential mediators were included in the regression model and the magnitude of effect on blood pressure

control was examined for each potential mediator to determine whether this criterion was met. 3) The independent variables must affect the mediators; therefore, region of residence, education, and gender must have a significant relationship with medication adherence and diet. 4) Finally, after controlling for the mediators, the relationship between the independent variables and dependent variables is removed (complete mediation) or is reduced (partial mediation).

3.3.6 Limitations

One of the notable limitations of this aim was s the large amount of missing data due to the longitudinal nature of the TASSH study. This can bias the data, as there may be inherent differences between participants who did continue to follow up versus those who did not. One method used to correct some of the bias that would result from this is maximum likelihood estimation. The maximum likelihood (ML) parameter is the value that is most likely to have results from the observations. In the case of missing data, likelihood functions can be factored and computed separately for those cases with complete data on some variables and then on data with all variables complete. The likelihoods are maximized together to provide a final estimate and standard error (Allison, 2000). There are several advantages to using maximum likelihood over other strategies for addressing missing data such as multiple imputation (MI). First, for any given dataset, ML produces the same results whereas MI, another approach for handling missing data, gives different results every time. Because MI involves a large random component, every time it is applied to a dataset there will be different parameter estimates, standard errors, and test statistics. This raises the issue that different investigators looking at the same data could come to different conclusions. In contrast, ML will produce the same results for the same dataset. Second, MI requires many different decisions, all which have a level of uncertainty and subjectivity, whereas ML requires far fewer decisions. Finally, with MI there is always the potential of a

conflict between the imputation model and the analysis model, where in ML this concern is eliminated because everything is run under one model (Allison, 2000). Given the advantages of the ML estimations over multiple imputation and the preference for it in the scientific community, ML was determined to be an appropriate method of handling missing data for this current study (Allison, 2000).

3.4 AIM 3

Understand the role of nurses trained in the WHO-PEN package in sustaining TASSH and ultimately hypertension management

This aim examined how nurses experienced the implementation of a task-shifting protocol for hypertension management, and their perceptions of barriers and enablers to sustaining the program and its goal of hypertension management beyond the initial implementation phase. Nurses who were currently participating in the TASSH program and had attended trainings for delivering the WHO-PEN package to patients were the focus for this aim, as the goal was to understand their experience implementing this protocol for hypertension management in patients.

Conceptual mapping methods with current TASSH nurses were used to explore current barriers and facilitators to TASSH implementation and future sustainment. Concept mapping is a participatory research approach that results in an interpretable conceptual framework that expressed entirely in the language of participants, and yields a graphic representation which shows all major ideas and their interrelationships (Trochim, 1989). Concept mapping is applied in situations where there is an identifiable group responsible for planning or evaluation efforts. There are six steps involved in concept mapping:

1. **Preparation.** Participants are familiarized with the general process of concept mapping, and general demographic information will be collected. The focal question for the research is identified (e.g. What are factors that will influence the sustainability, or continuation of TASSH?)
2. **Generation.** In this phase, recruited participants address the focal questions by generating a large number of statements relevant to the focal question.
3. **Structuring.** Participants sort the generated statements into groups based on similarities, and then rank the statements in order of importance to the focal point discussed. Based on this, participants choose clusters that best represent what they feel to be enablers/barriers to sustaining TASSH and hypertension management.
4. **Representation.** The data generated are analyzed using The Concept Systems software. Results include visual representations of the statement clusters generated by participants as well as statistical outputs. The visual representations, called concept maps, are created using two quantitative methods: multidimensional scaling (MDS) and hierarchical cluster analysis (HCA). MDS examines the similar ideas generated by participants, while HCA creates the boundaries visually represented between items with strong degrees of similarity.
5. **Interpretation.** Participants review the concept maps and assess the clusters formed, examine each item as it forms a cluster, and discuss the content of the cluster domains.
6. **Utilization.** The findings are discussed to determine how participants can collectively inform the original focal question. One of the most common uses is to perform pattern-matching to explore consensus among participants on the factors that influence hypertension management among TASSH patients.

Because of the exploratory nature of concept mapping methods, data collection is typically done without the presupposition of an existing theoretical framework. During the representation phase of concept mapping, multidimensional scaling and hierarchical cluster analysis create statement clusters representing important constructs discussed, and essentially create a framework visually depicting central issues related to the focus prompt.

3.4.1 Participants

The researcher used purposive sampling to recruit community health nurses that were trained in delivering the WHO-PEN package to hypertensive patients. Every six months, nurses from all clinics attended follow-up trainings for the TASSH program. At one of these follow-up trainings, the researchers recruited nurses to complete the concept mapping process following the training. This ensured that nurses from all clinics are equally represented and reduce potential bias of nurses from certain clinics or areas being unable to attend to travel or other logistical reasons. It also helped ensure that perceptions of nurses from all clinics are voiced and included in the data analysis.

All nurses provided informed consent prior to participation and were made aware that their decision not to participate or terminate participation at any point would not influence their employment and training through the TASSH program. The consent process and study purpose were explained to participating nurses in Twi, the local dialect of the Ashanti region by a study coordinator fluent in both English and Twi. Participants were required to be at least 18 years of age to participate.

3.4.2 Data collection

As previously mentioned, concept mapping is a six-step participatory research approach. During phase 1, Brainstorming, community health nurses responded to a focus prompt, *"Based on your experience, what factors will help to promote the long-term continuation (or sustainability) of the TASSH program in Ghana?"* In response to this question, nurses provided concise statements related to challenges to TASSH sustainability. Nurses completed brainstorming exercises one-on-one with a study coordinator in Twi. After duplicate statements were removed, the nurses sorted the statements related to the focus prompt into groups based on similarity. Nurses recorded these categories and corresponding statements on worksheets provided to them. In this stage, nurses also ranked the importance of each item for TASSH sustainability and its feasibility on a 5-point Likert scale. Importance and feasibility ranged from: for importance-1, relatively unimportant to 5, extremely important, and for feasibility-1- not at all feasible to 5-extremely feasible compared to all other statements. For instance, for each statement nurses were asked "how important is this to continuation of TASSH?" and "how feasible is this to address?"

3.4.3 Data analysis

There are three steps involved in concept mapping analysis. Using Concept Systems software, first a point map was created, which identified each statement as an individual, separate point on a map. Statements that were closer together on the map were more likely to have been sorted together, and thus were more similar from participants' perspectives; statements with further distances were less likely to be sorted together. Second, the statements were partitioned into clusters (cluster map), which represented conceptual groups from the

original sets of statements. Finally, a point-rating map was created which overlays the average rating point-by-point. To accomplish the first step in creating a point map, non-metric multidimensional scaling was used, which is a multivariate analysis that "takes a table of similarities or distances and iteratively places points on a map so that the original table is as fairly represented as possible." (Trochim, 1989, p. 7). In concept mapping, multidimensional scaling creates a point map which represents the brainstormed statements based on their similarity. A two-dimensional solution that sets points into a bivariate distribution suitable for plotting on an X and Y graph axis is specified for ease of interpretability.

The second part of the analysis involves hierarchical cluster analysis, which was used to group statements on the map into clusters of statements that are similar. Based on the similarity results of multidimensional scaling, this analysis partitioned the point map into different clusters. At each stage in the analysis, the Concept Systems algorithm combines two clusters until all the statements are in one cluster; thus the analyst must choose how many clusters the statements should be sorted into for the final representation. In some instances this is done by asking participants which cluster map most accurately reflects their ideas, or by a team of researchers who, together, reach a consensus regarding the appropriate number of clusters depending on the research question. The third step in the analysis involved overlaying averages from participant rating for each statement (importance and feasibility), which produced a map of average point ratings. The point map was divided into "go-zones;" Lines in the Go Zone matrix, which correspond to the mean rating for each axis, divide the graph into four quadrants (low/low, low/high, high/low, and high/high). Items in the top right quadrant are those that were rated as highly important to continuation of TASSH, and feasible to address. Items in the bottom left quadrant are those that were rated as not important for sustaining TASSH, and not feasible to

address. Following the assumption that high ratings are ideal, the high/high quadrant is considered the Go Zone as it contains those ideas rated most highly on both criteria (Parker, Nagar, Thomas, Badri, & Ntusi, 2011) (i.e. importance and feasibility for continuing TASSH long-term).

3.4.4 Limitations

In using concept mapping methods there is a chance for social desirability bias, in which the participants give responses they believe the researchers would like to hear. Additionally, concept mapping is a labor intensive process which can deter individuals from participating. Despite these limitations, one of the strengths of the approach is the expression of results at each stage of the research process entirely in the language of participants. This helps ensure that the data are representing the participants' perceptions and not just those of the researchers.

Together, the three aims of this study will depict patients' perceptions and experiences with an on-going task-shifting intervention, patient outcomes after initial intervention implementation, and providers' experiences with the intervention and their understanding of barriers and facilitators to sustaining optimal blood pressure management. Utilizing a mixed methods approach allows for a rich understanding of patients' and providers' perceptions, while contextualizing their experiences within the broader context of social determinants of health to examine whether there is concordance between perceptions of intervention stakeholders and factors that are shown to influence blood pressure management over time.

CHAPTER 4: PAPER 1

"I believe high blood pressure can kill me:" Using the PEN-3 Cultural Model to understand patients' perceptions of an intervention to control hypertension in Ghana

4.1 ABSTRACT

Objectives: In Ghana, hypertension represents the second leading cause of out-patient morbidity and mortality. Regular screening for, and early detection of hypertension are necessary for controlling the burden of the disease, yet are made difficult by the severe shortage of health care workers. Task-shifting strategy is one such approach to address hypertension in light of under resourced health systems. Currently in Ghana, there is an on-going task-shifting strategy in which nurses are trained in hypertension management. While this study will provide useful information on the viability of this approach, it is not clear how patients in the intervention perceive hypertension, the task-shifting strategy, and its effects on blood pressure management. The objective of this paper is to examine patients' perceptions of hypertension and hypertension management in the context of an on-going task-shifting intervention to manage blood pressure control in Ghana.

Design: Forty-two patients participating in the Task Shifting Strategy for Hypertension program (23 males, 19 females, and mean age 61. 7 years) completed in-depth, qualitative interviews. Interviews were transcribed, and key words and phrases were extracted and coded using the PEN-3 cultural model as a guide through open and axial coding techniques, thus allowing rich exploration of the data.

Results: Emergent themes included patients' perceptions of hypertension, which encompassed misperceptions of hypertension and blood pressure control. Additional

themes included enablers and barriers to hypertension management, and how the intervention nurtured lifestyle change associated with blood pressure control. Conclusions: This study offers a unique perspective of blood pressure control by examining how patients view an on-going task-shifting initiative for hypertension management. The results of this study shed light on factors that can help and hinder individuals in low-resource settings with long-term blood pressure management.

Key Words: hypertension; task-shifting; Ghana; PEN-3 cultural model

4.2 INTRODUCTION

Currently, more than 3.5 million out of 15.8 individuals over 15 are classified as hypertensive in Ghana, making hypertension the second leading cause of outpatient morbidity in adults age 45 and over (Bosu, 2010). Poorly managed hypertension exacerbates the burden of chronic diseases, thus increasing morbidity and mortality in African countries (Kaddumukasa et al., 2012). In Ghana, as with most of SSA, there is a severe shortage of health care workers. It is estimated that in SSA, there is a ratio of 2 doctors per 10,000 population members (Mayosi, 2013), which limits the ability for regular blood pressure monitoring and hypertension control (Barsoum, 2006; Beaglehole et al., 2008; Hagopian et al., 2004; Mejia et al., 2014; Pang et al., 2002; Unwin et al., 2001). Task shifting strategy, defined as rational movement of primary care duties physician to non-physician health care workers, is a potential method for optimal management of disease, including hypertension in Ghana, particularly in light of the under-resourced health systems (Callaghan et al., 2010; Lekoubou et al., 2010). The use of task shifting has several documented benefits in the context of HIV/AIDS management (Callaghan et al., 2010); in the context of hypertension, task shifting will help to address the systems level factors

related to health care worker shortage (Labhardt et al., 2010; Lekoubou et al., 2010), and may be effective in improving blood pressure outcomes (Mendis et al., 2010; WHO, 2002).

What is not clear, however, is how patients' perceptions of hypertension and interventions to manage hypertension influence clinical outcomes. Previous research has suggested that patients may construct understandings of their illness and treatment that differ with those of physicians and health care providers (Kleinman et al., 1978; Taylor et al., 2012), a discordance that may worsen clinical outcomes (Cohen et al., 1994; Heurtin-Roberts & Reisin, 1986; Ogedegbe et al., 2004). In the context of hypertension, physicians' beliefs usually stem from the biomedical model, where hypertension is seen as a chronic illness that requires lifelong treatment (Heurtin-Roberts & Reisen, 1992), whereas patients may perceive hypertension as a disease of "nervousness" that causes increased blood pressure (Heurtin-Roberts & Reisen, 1992). In a study of explanatory models of illness in Nigerian patients with hypertension, Taylor and colleagues (2012) found differences between participants' own understanding of the serious nature of hypertension, the need for long-term treatment, and the desire to take medication long-term, when compared to biomedical models of illness. Other studies in the United States have shown that a considerable number of patients have expectations stemming from non-biomedical models (Ogedegbe et al., 2004), which was associated with poorer treatment compliance (S Heurtin-Roberts & Reisen, 1992). Few studies have set out to examine perceptions of hypertension among patients enrolled in on-going treatment programs in sub-Saharan Africa (Odusola et al., 2014; Salako, Ajose, & Lawani, 2003), and given the burden of hypertension and associated health consequences, this is an important gap to address (Ogah & Rayner, 2013). Thus, the purpose of this study was to explore patients' perceptions of hypertension and treatment in the context of an on-going task-shifting strategy in Ghana. Specifically, we set out

to answer 1) What are perceptions of hypertension among patients participating in an on-going task-shifting strategy for hypertension management? 2) What are perceived enablers and/or barriers to hypertension self-management among patients participating in the intervention? and 3) What are factors that nurture a favourable environment for sustained self-management of hypertension?

4.3 METHODS

This study was conducted as part of our ongoing Task Shifting Strategy for Hypertension control in Ghana (TASSH), which is described elsewhere (Ogedegbe, Plange-Rhule, et al., 2014a). Briefly, this cluster randomized trial involves 757 patients receiving care at 32 health care centers in the Ashanti Region of Ghana. The program evaluates the comparative effectiveness of the implementation of the WHO Package of Essential Non-communicable Disease Intervention for Primary Care (WHO-PEN) program (Mendis et al., 2010) on cardiovascular risk assessment (CVD) and hypertension control (Intervention Group), versus provision of health insurance coverage (Control Group), on blood pressure reduction. A total of 64 nurses (2 from each of the 32 study sites) have been trained in the delivery of the WHO-PEN package. Patients in the intervention and control group received follow-up care from the nurses every three months. Blood pressure outcomes are evaluated at baseline, 12 months, and 24 months (Ogedegbe, Plange-Rhule, et al., 2014a). In collaboration with Kwame Nkrumah University of Science and Technology (KNUST), the purpose of this study was to assess patients' perceptions of hypertension and self-management of hypertension in the context of TASSH. Given the link between patient perceptions of illness with clinical outcomes, a better understanding in this area can assist with planning, designing and implementing interventions to account for patients' needs and beliefs, which can ultimately lead to more effective chronic

disease management.

4.3.1 Participants and recruitment

For initial recruitment to TASSH, potentially eligible participants were identified at community health clinics and district hospitals, and were referred to community health nurses by physicians. Full eligibility criteria are described elsewhere (Ogedegbe, Plange-Rhule, et al., 2014a). We employed purposive sample of current TASSH patients. Patients were contacted either by phone or by a TASSH nurse during follow-up visits. Patients were provided transportation to the interview site (Ogedegbe, Plange-Rhule, et al., 2014a). A total of 42 patients participated in interviews for the current study.

4.3.2 Data Collection

Basic demographic information was collected, including age, sex, and education level. Participants completed in depth interviews conducted by the TASSH research coordinators. All interviews were conducted in the local dialect of the Ashanti region, Twi, and then translated into English for transcription purposes. Interviews were guided by the Relationships and Expectations domain of the PEN-3 Cultural Model, and contained fourteen questions addressing patients' perceptions of TASSH, the beneficial and negative aspects of the program, barriers to self-management of hypertension, how TASSH has helped them to manage hypertension, and their confidence in their ability to continue to maintain adequate blood pressure control at the end of TASSH. These questions addressed the three sub-constructs of the Relationships and Expectations domain: 1) perceptions of hypertension 2) enablers or barriers to self-management of hypertension, and 3) nurturing factors that foster favorable environments for long-term hypertension management. All interviews were conducted individually and lasted up to 45 minutes.

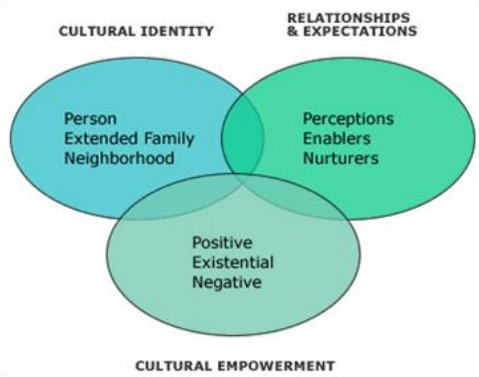
4.3.3 Data analysis

Data were coded using both open and axial coding techniques (Corbin & Strauss, 1990). During open coding, two members of the research team read through each transcript, pulling out key words and phrases related to the study objectives. These key terms were compared across responses from each participant and across responses to the same questions. Together, the research team decided on final labels for the identified concepts and broke the data down into categories based on thematic similarities. After open coding, concepts were grouped into sub-themes based on similarity, and then more broadly into larger themes through axial coding. Sub-themes and themes were cross-checked, and final thematic categories were established.

Data were initially inductively coded without the guide of an existing theoretical framework. According to Patton (Patton, 2002), it is important to conduct this phase of analysis without the presupposition of a particular framework to allow flexibility in data exploration and discovery. Subsequently, data were analyzed deductively using the PEN-3 cultural model as a guide. Developed in 1989, and further updated in 1994, the PEN-3 cultural model which takes into consideration the cultural and social factors influencing health, has grown in popularity in the design and implementation of culturally relevant public health interventions targeting minority populations (Airhihenbuwa, 1995). The acronym PEN-3 (see Figure 6) represents the three domains of the model; 1) Cultural Identity (Persons, Extended Family and Neighborhood); 2) Relationships and Expectations (Perceptions, Enablers, and Nurtures); and 3) Cultural Empowerment (Positive, Existential, and Negative). The current study focuses specifically on the Relationships and Expectations domain to examine perceptions, enablers, and nurturers related to blood pressure control. Using the PEN-3 as a guide allowed for a rich, and comprehensive data

analysis that accounted for individual, social, and cultural factors influencing hypertension management in patients.

Figure 6: The PEN-3 Cultural Model



4.4 RESULTS

A total of 42 patients participated, 23 male and 19 female, with a mean age of 61.7 years. Seven patients reported receiving up through primary education, 14 up through secondary education, and four tertiary, with the rest reporting no formalized education. Based on guidance from the Relationships and Expectations domain of the PEN-3 Cultural Model, three themes were prevalent: patients' perceptions of hypertension and hypertension management, enabling factors influencing hypertension management, and the intervention as nurturing lifestyle change. Table 4 summarizes these three themes.

Table 4: Patient quotations reflecting PEN-3 Cultural Model constructs

PEN-3 Construct	**Example**
Perceptions	"To have hypertension will reduce the quality of life. You get tired easily, and you have to take meds for long with side effects."
	"I'm doing better now and if not for TASSH I would have been dead by now."
	"I will be fine [after TASSH ends] with the education given me during counselling but the drugs are my problem."
Enablers	"the nurse was convincing and her personal relationship drove me to attend."
	"Patience and accessibility of TASSH staff was extremely helpful. My community had never received any education on the importance of diet and exercise and I believe it to be a great blessing for my community."
	"money for buying fruits and veggies is difficult; some are natural grown but others have to be purchased."
Nurturers	"I take my meds, I have modified my dietary habits. I have not been falling ill since TASSH started. I feel healthy."
	"I have seen improvement in my health following these modifications; I am doing them because I have realized that they help my health."
	"We need assistance for communities in planning and organizing around financial access to medication and increased awareness in community. Community is open to taking great ownership of their care and should be aided in doing this. Not knowing how to fend for themselves in case of TASSH team withdraw is concern."

4.4.1 Perceptions of hypertension and hypertension management

The patients' beliefs and their knowledge about hypertension and its management can influence whether they adopt and ultimately sustain behaviors that are emphasized in the trial. When asked what hypertension was, patients stated *"It's when blood is not circulated well because veins are blocked. This can cause dizziness and black outs,"* and "*It's a disease that is caused when one is emotionally tensed or stressed*." There was a general perception that "*To have hypertension will reduce the quality of life. You get tired easily, and you have to take meds for long with side effects*." Patients did recognize hypertension to have serious impacts on their health and daily life, and discussed the importance of mitigating these effects in order to improve their quality of life. Patients' knowledge of the severity of hypertension emerged when describing reasons for participating in the TASSH program; one patient described "*I believe high blood pressure can kill me so since I was told, I decided to take part*." Another patient said: "*I know the program will help me improve my health. My health is a priority and I want to stay healthy."*

Nonetheless, many patients did not understand the magnitude of hypertension nor methods of managing it before TASSH. One patient noted that "*the educational component, with respect to diet and exercise*" was the most helpful part of TASSH. Another patient stated that because of TASSH he "*understands [lifestyle changes] as critically important to a healthy lifestyle and to prolonging life and good health. I had never been taught anything about its importance until the TASSH study came along*." Others discussed that they have gained knowledge about hypertension, and that sticking to the recommendations provided by TASSH nurses has improved their blood pressure. "*I have already seen evidence of its effectiveness that is, my weight loss and energy levels, and want that to continue*." Another patient expressed that

"*I haven't been ill since joining the program. I feel stronger and healthier*." Finally, one patient shared the sentiment that "*I'm doing better now and if not for TASSH I would have been dead by now*."

Despite, notable gains in knowledge, some patients had the misperception that hypertension is a disease that can be "cured." One patient said: "*It's a disease that if I follow the counselling given and take my drugs, I will be healed*." Another patients expressed his sentiment that "*The team [study team] should give all of us drugs till we are healed or the high blood pressure reduces*." These statements reflect that, while general knowledge of hypertension and its causes were adequate, some patients did not understand that hypertension is a lifelong illness that can be managed, but not completely cured.

Patients also discussed challenges moving forward after the TASSH program comes to an end. One patient described *"I was anxious about the prospect of the program coming to an end, but believe I will be able to maintain changes made so far because I understand their importance to maintaining health."* Although the patients were largely confident that they could manage their lifestyle behavior changes, they remained nervous about the withdrawal of the TASSH team and the consequences that this may have on their adherence to the program. One patient stated that he *"fears [his] health might return to initial state if TASSH ends."* Majority of patients were confident that they could maintain the behavior and lifestyle changes they learned through counselling: *"I will be fine with the education given me during counselling but the drugs are my problem."* As indicated by this patient, TASSH provides patients with medication that many are not confident they can get once the program ends. In fact, one patient stated *"I might die because I don't have money to buy the drugs,"* indicating the severity of medication access among some patients. Though majority of patients felt education and behavioral counseling were effective,

their confidence in overcoming structural and economic barriers, such as medication access, was low.

4.4.2 Enabling factors influencing hypertension management

The way in which individuals perceive the intervention, their relationship with participating others, and the degree of commitment to the intervention or organization can influence individuals' willingness to use the intervention. Although patients in the TASSH program noted their commitment to maintain lifestyle behavior changes, they also discussed the attentiveness of the TASSH nurses as a primary reason for their initiating and continuing participation in TASSH. One patient said: "*the nurse was convincing and her personal relationship drove me to attend*." Another patient noted that "*The nurses gave a detailed and patient explanation of the program*," which motivated his participation. In addition to providing assistance with recruiting patients into the program, TASSH nurses served as a support system during the program. One study noted the importance of social context and climate during intervention implementation, and based on patient responses (Glisson et al., 2008); it is clear that the TASSH nurses facilitated a welcoming and supportive environment, which reflected their dedication to the program and subsequently patient involvement. A patient stated that "*the nurses always comfort me and give me advice*." Another patient discussed that "*patience and accessibility of TASSH staff was extremely helpful*. *My community had never received any education on the importance of diet and exercise and I believe it to be a great blessing for my community*." Furthermore, the nurses gave patients individual attention and made the program seem more personal. "*I enjoy the personal care from the nurses and project staff*." Another patient discussed that "*adjustments to medication according to health status made care feel more personal,"* and "*the attentiveness of nursing staff and frequent communication with them*" was

helpful.

4.4.2.1 Barriers. As previously discussed, financial difficulties related to obtaining anti-hypertensive medications were voiced by several patients. However, financial concerns were not limited solely to medication. Some patients expressed difficulties obtaining healthy foods: "*money for buying fruits and veggies is difficult; some are natural grown but others have to be purchased*." Another patient said: "*not all healthy foods are available in my immediate surroundings so it is necessary to travel a few miles to buy them*." Indeed lack of access to healthy foods in local communities is a barrier for patients to adhere to hypertension management guidelines. "*The recommended foods are not always available in my community and I do not always have the means (logistically and financially) to obtain them*." Patients also had difficulty incorporating physical activity and other behaviors into their schedule because of time constraints. "*Most of us do not have time for ourselves and that can minimize the effect of the program*." Another patient said: "*I always feel a bit tired after work and my family too has been an obstacle*." Despite these notable barriers moving forward, patients expressed that the education and behavioral counseling component of TASSH was useful in educating them about hypertension and teaching them lifestyle skills that they are confident they can continue. "*I believe you've [TASSH] taught us well and we are practicing so we won't stop, and it [education] has been very helpful."*

4.4.3 Nurturing factors for hypertension management: The role of TASSH

TASSH focused on delivering motivational interviewing related to lifestyle changes and adherence planning to manage hypertension and promote healthy living (Ogedegbe, Plange-Rhule, et al., 2014a, 2014b). A patient summarized that because of the TASSH program "*I take my meds, I have modified my dietary habits. I have not been falling ill since TASSH started. I feel*

healthy." Another patient said: "*I have been watching my diet, I don't eat excess oil, salt and sweets. I have been keeping down my worries in order not to stress myself*." Physical activity modifications were made by participants as well, as described by one patient "*I consistently take walks during the day to supplement the amount of physical activity I get. Sometimes I forfeit the taxi and walk to and from places*." Another patient described the changes he had made in his life to incorporate exercise: "*I participate in cardio programs (aerobics) for students at my middle school, and I do daily push-ups in the morning*." Even patients who were already engaging in high levels of physical activity discussed how the program made them more aware of the benefits: "*I appreciate being able to return to rigorous activity in the form of farm labor, and I understand that to be a benefit to my health.*" Another participant said: "*I already had a high level of PA as a farmer, but appreciated the benefits of exercise of my 4 mile walk to work and farm labor."* Thus, TASSH helped promote awareness regarding positive behaviors that patients were already engaging in, and their importance to hypertension management. Moreover, among patients who previously were not as physically active, TASSH underscored the importance of adopting physical activity, which many of them did.

Participants discussed that these lifestyle modifications resulted in improvements in health, thus motivating them to adhere to their treatment guidelines. "*I have seen improvement in my health following these modifications; I am doing them because I have realized that they help my health*." Many patients expressed that as a result of TASSH, they feel more confident in their ability to manage their blood pressure. One patient noted that "*I have control over my entire health now,"* while another stated "*I will manage myself better concerning hypertension."* Patients felt that the behavior modification counseling and education given by the TASSH program was sufficient for them to be able to sustain the behavior. "*I believe [TASSH] taught us*

well and we are practicing so we won't stop, and it has been very helpful." Another patient expressed, "*since I have been given the counselling my life style has changed."*

As a result of the education and motivational counseling given by TASSH nurses, majority of patients felt confident in their ability to manage their blood pressure after the intervention. Patients said "*I will be fine and healthy and can manage my blood pressure*," and "*Changes have been made and will be sustained. Improvements to this point make me confident and resolved to adhere to advice and sustain the changes*." Furthermore, TASSH educated many patients on their condition which improved their awareness and confidence in management. "*TASSH made me aware of the necessity for healthy eating and helped me discern my left from my right about timing of meals and dieting*." Thus, patients incorporated TASSH guidelines to make changes they felt could be sustained.

The notion of community involvement in TASSH and hypertension management was discussed a nurturing factor as well. One patient discussed involving communities in ownership of TASSH to prevent problems with access to medication upon TASSH ending: "*We need assistance for communities in planning and organizing around financial access to medication and increased awareness in community. Community is open to taking great ownership of their care and should be aided in doing this. Not knowing how to fend for themselves in case of TASSH team withdraw is of concern."* As indicated by the behavioral and lifestyle changes, patients are willing to take control of their hypertension management, however systems level barriers to medication (e.g. cost, health insurance) prevent them from having access. Working with communities to find ways to mitigate these barriers could help patients improve long-term hypertension management. Another patient discussed the concerns of TASSH withdrawal more broadly in the context of hospital systems in Ghana: "*I will do well to maintain my BP but the*

shortfall in hospital management compared with TASSH may negatively influence my standing. Meds are expensive. Hospitals are not very hospitable." Furthermore, even patients who received medication from other health centers preferred the medication provided by TASSH because of lesser side effects; "*alternative medication provided by NHIS coverage has undeniable side effects, I perceive less improvement with the NHIS option*." Thus, TASSH not only provides essential services for hypertension management, but also an organized structure in which patients feel welcome.

4.5 DISCUSSION

The current study set out to examine patients' perceptions of hypertension and its management in the context of TASSH using the Relationships and Expectations domain of the PEN-3 cultural model. Findings were grouped into three different categories in accordance with PEN-3 constructs: perceptions of hypertension, enablers of hypertension management, and the role of the nurturing lifestyle change in the TASSH program. The results of this study show how the interplay between patients' perceptions and experiences with an intervention can influence how they adopt the intervention, which can ultimately have implications for clinical outcomes (Ogedegbe et al., 2004). This knowledge can promote a better understanding when planning, designing and implementing interventions focusing on the enablers and nurturers to more effectively help manage hypertension. This study is unique in that it examined patients' perceptions of an ongoing task-shifting program. While there are studies that have examined explanatory models of disease from patients' perceptions (Taylor et al., 2012), few have investigated how participants in an ongoing task-shifting program perceive the program itself and the effects it has on disease control and management. The interplay of patients' perceptions, the role of nurses, lifestyle change, and challenges moving forward reflect the various domains

of the PEN-3 cultural model, showing how cultural and social factors coalesce to influence health. Individuals' perceptions of hypertension and of the TASSH program itself exist within the Relationships and Expectations domain, which encompasses individuals' perceptions. Furthermore, the role of nurses as supporters aligns with this same domain, as nurses served as enablers and nurturers both for the intervention itself and for the patients as they adopted the lifestyle changes to manage hypertension.

Overall there was a general consensus about the utility of the education portion provided by the TASSH program. One of the challenges met with hypertension education was some patients' belief that hypertension can be "cured," as opposed to recognizing that it is a chronic condition that needs to be managed overtime. The educational component also improved patients' self-efficacy, as many of them discussed that they can manage their hypertension more effectively after participating in TASSH. Moreover, the motivational interviewing, individual counseling, and follow-ups provided several of the patients with enough support that they were confident in their ability to continue their behaviors (e.g. increased, physical activity, dietary changes) without TASSH. Indeed, patients were able to make lifestyle changes to incorporate the behaviors they learned in TASSH. The nurses served as a tremendous support system with their attentiveness to patients, and were enablers to patients' ability to adapt their lifestyle to manage hypertension. Patients did express concern about withdrawal of the TASSH team, and the effect that this may have on medication provision and availability. Majority of patients were confident that they could manage the behavioral portion of the intervention themselves once the intervention ended, due to the education and counseling they received. However, access to medication and financial burdens were factors that patients could not entirely control, and were sources of concern pending the withdrawal of the TASSH team.

Our result regarding the nurses as enablers complements those of previous studies, such as Glisson et al., (2008) who discussed the importance of social climate in intervention implementation. A supportive environment with strong ties between stakeholders can facilitate and optimal implementation climate, which ultimately can improve the implementation of the intervention (Damscroder et al., 2009). Additionally, prior work has shown the importance of positive patient provider interactions in managing chronic diseases. For instance, Murphy and colleagues (Murphy, Chuma, Matthews, Steyn, & Levitt, 2015) found that negative provider interactions affected patients' ability to accept their condition, as well as their motivation to engage with providers about behavioral and lifestyle changes needed to manage diabetes. Patients also noted the lack of sufficient counselling and discussed that they wanted providers to spend more time educating them on the disease and management, as they felt ill-equipped to handle it themselves. In our study, patients felt that the TASSH nursing staff did indeed provide the necessary support for behavioral and lifestyle changes to manage hypertension. Other studies have also noted the importance of patient follow-up in helping to maintain behavioral and lifestyle changes to control hypertension (Goudge, Gilson, Russell, Gumede, & Mills, 2009; Iwelunmor et al., 2014). Indeed, in South Africa Goudge et al. (2009) found that over half of the households surveyed could not afford regular follow-up care; in some cases families had no income and depended on gifts from friends and other family members to afford health care (Goudge et al., 2009). Majority of these cases received intermittent treatment at best. Even among households with the means to seek care, only half of the participants were treated regularly for a chronic condition.

Though there is evidence that hypertension is becoming an increasing problem throughout Ghana and other sub-Saharan African countries, few studies have explored how

patients perceive the hypertension and management in the context of ongoing efforts to control and manage the disease. Our work complements the few studies that have examined this. For instance, in Nigeria, Odesolu et al. (2014) conducted an evaluation of adhering to hypertension medication among insured patients. Specifically, they investigated patients' perceptions of factors that may inhibit or facilitate the ability to prescribe anti-hypertensive medication, and patients' views of factors that may inhibit or facilitate the ability to adhere to behavioral recommendations. They found that important facilitators to medication adherence, and thus hypertension control over time, included the continued provision of health insurance, trust in "western" medication and doctors, as well as knowledge of negative consequences associated with hypertension. Factors that were thought to inhibit treatment adherence included inconvenient clinic operating times, long wait times, and medication side effects (Odusola et al., 2014). Our results expand upon this research, addressing patients' perceptions of hypertension and experiences in a task-shifting intervention with nurses and the primary caregivers to explore how the intervention affects hypertension management in practice. Indeed, we found that patient-provider interactions (patient-nurse interactions) were an important facilitator in improving education and awareness about hypertension management and control. As SSA faces such a severe shortage of health care providers, especially physicians, many patients do not have adequate time with physicians to address their concern related to hypertension and other diseases (Kalipeni, Semu, & Mbilizi, 2012a). Even among patients in this study, some were unaware that they had hypertension until told by the TASSH nurses, despite a physician referral. Although the referring physician had completed the assessment and determined a diagnosis of hypertension, this was not communicated with the patient in many cases. By shifting hypertension management responsibilities from physicians to nurses in the TASSH program, patients were allowed more

time with their provider to understand their condition, how to manage hypertension, and ask necessary questions. This fostered a strong relationship with the TASSH nurses which ultimately motivated patients to adhere to hypertension management protocol, and fostered their confidence that they could continue to maintain the necessary lifestyle changes even after the withdrawal of TASSH. It is possible that task-shifting could be a mechanism by which to combat the physician shortage and provide more individualized care to patients, which may result in better adherence and disease management.

4.5.1 Limitations

There are noteworthy limitations to this study. First, as the sample size is relatively small, generalizability of findings may be limited. Furthermore, there is a risk of social desirability bias. As study personnel were involved in the interview process, patients may have felt pressured to provide certain responses. Despite these limitations, this study is one of the few that has used qualitative inquiry to examine patients' perceptions of disease within an on-going evidence based intervention in a low-resource setting. This study underscores importance issues to address as current interventions move forward and future ones are developed, particularly in light of the physician shortage and severely under-resourced health systems in developing countries (Kalipeni et al., 2012).

4.5.2 Conclusion

Though this study highlights the importance of patient provider relationships and individuals' confidence in behavior change maintenance, we cannot ignore the role of health systems factors in maintenance of blood pressure control, such as health insurance provision and medication availability. Furthermore, this supports using comprehensive models (e.g. PEN-3; socio-ecological) for health promotion approaches. These approaches suggest that single

interventions are generally not enough to promote healthier behaviors. Thus, a mixture of different interventions targeting different levels of change is needed overtime to ensure optimal outcomes. The results of this study suggest that factors at various levels, such as individual knowledge, patient-provider communication, access to care, and national health insurance and medication policies should be incorporated into interventions moving forward. Addressing more than one of these areas is necessary to enable long term maintenance of blood pressure outcomes following an intervention. Local communities in sub-Saharan Africa provide a unique opportunity to employ task-shifting methods to improving hypertension when incorporated into the existing health care system. With more insight into the specific factors that inhibit or facilitate maintenance of blood pressure control, future community based interventions can be designed and implemented; however, it is important to note that some barriers cannot be addressed at the community level alone, and require the incorporation of government workers and policy makers.

CHAPTER 5: PAPER 2

Social Determinants of Health and Intervention Outcomes in a Task-Shifting Strategy for Hypertension

5.1 ABSTRACT

Background: One of the challenges to optimal hypertension management in Ghana is the extreme shortage of physicians. Task-shifting, or rational movements of clinical duties from physicians to non-physician health care workers, is one potential mechanism for mitigating the consequences of these shortages. Currently in Ghana, a community-randomized trial (TASSH) task-shifting clinical duties for hypertension management to community health nurses is underway.

Objective: While many interventions examine differences between treatment and control group, few examine factors within the intervention group that made certain patients more successful than other. Thus, the purpose of this study was to examine for whom and under what conditions that TASSH intervention was most effective for hypertension management.

Methods: Patients randomized to the intervention group (n=368) were assessed at baseline, 6 months, and 12 months follow-up. Outcome variables of interest were: change in systolic blood pressure from baseline to 6 and 12 months, respectively, and blood pressure control (BP < 140/90) at each time point. Predictor variables were: gender, urban/rural region, education, physical activity, and medication adherence. Multiple linear and logistic regression were conducted using STATA 14.

Results: Female gender and urban region of residence were the most consistent predictors of blood pressure outcomes. Furthermore, interactions between gender and region of residence were significant for blood pressure change and control and 6 and 12 months. Women in urban regions

had the greatest decrease in systolic blood pressure at both time points, as well as higher rates of blood pressure control.

Conclusion: These results provide important information regarding patient factors associated with greater improvements in health within the intervention group of an on-going task-shifting trial. The findings can be used to inform this and other interventions to tailor delivery based on patient factors, particularly region and gender.

5.2 INTRODUCTION

By the year 2020, 75% of deaths in sub-Saharan Africa will be attributable to hypertension (Kearney et al., 2005). One of the challenges in effective management of hypertension is the severe lack of health care professionals, exacerbated by the "brain drain," or the migration of skilled health care providers from developing to developed countries (Mendis et al., 2010). In response to this severe shortage, particularly of physicians, a cluster randomized trial is on-going in Ghana to assess the effects of task-shifting on hypertension management and control. Task-shifting is defined as the rational movement of clinical duties from highly skilled health care workers (e.g. physicians) to less skilled workers (e.g. nurses, pharmacists, community health workers). The TAsk-Shifting Study for Hypertension (TASSH) in Ghana shifts clinical duties for hypertension from physicians to nurses following the World Health Organization (WHO) Package of Essential Non-communicable disease protocol in the intervention group, compared to the control group receiving usual care at their respective health clinics (Ogedegbe, Plange-Rhule, et al., 2014a). The WHO-PEN package contains four steps: 1) inquiry about the patient's history (e.g. heart attack, stroke, lifestyle behaviors, diabetes); 2) physical and laboratory experiments (including blood pressure (BP) measurements, fasting glucose, cholesterol); 3) estimation of cardiovascular disease risk based on risk charts provided by WHO

(categorized as low, medium, or high); 4) initiation of drug therapy, lifestyle counseling, and follow-up visits (Mendis et al., 2010; Ogedegbe, Gyamfi, et al., 2014). Nurses are then responsible for providing appropriate care and health education based on a patient's risk status, and referring complicated cases of hypertension to physicians for further consultation. Patients are followed up every three months for a year, and then again at 24 months.

Evaluation of TASSH will provide evidence of the comparative effectiveness of task-shifting versus usual care in a clinical setting. However, few studies examine factors specifically within the intervention group to address the question: for whom and under what conditions was the intervention most effective? Thus, this study will examine this question specifically within the intervention group.

5.3. THEORETICAL FRAMEWORK

The framework for this study is the WHO's Social Determinants of Health Framework, which emphasizes the conditions in which people are born, work, age and grow. They are delineated into three different categories: governance, structural, and intermediary. Governance factors refer to broad political, social and cultural factors that influence conditions that influence health. Structural determinants are mechanisms that generate stratification and social class divisions in the society, and factors that define individual socioeconomic position within hierarchies of power, prestige, and access to resources. Intermediary determinants are means through which structural mechanisms or determinants operate, such as material circumstance (e.g. housing and neighborhood quality), psychosocial circumstances (e.g. social support), and behavioral and biological factors (e.g. nutrition, age, other genetic factors) (WHO, 2008); thus

intermediary determinants are thought to mediate the relationship between structural determinants and health outcomes.

As patients recruited for the TASSH intervention are from the same region, governance factors are consistent across patients. Therefore, structural and intermediary factors are the focus for this study. Noteworthy structural determinants include gender, region of residence, and education. A systematic review of 11 studies in Ghana demonstrated that, typically, hypertension prevalence was lower in women than men (Addo et al., 2012). Other studies throughout sub-Saharan Africa have also supported this. In Nigeria, Kadiri et al. (Kadiri et al., 1999) found the prevalence of hypertension in men and women to be 9.8% and 8.1%, respectively. More recent reviews have also supported a slight increase in prevalence of hypertension in men and women (16.8% and 15.7%, respectively) (Twagirumukiza et al., 2011). Treatment and detection rates of hypertension are also typically higher in women than men, however there is evidence that blood pressure control rates are better in men than women after treatment is initiated (Cappuccio, Micah, et al., 2004). Region of residence (e.g. urban or rural areas) also has implications for blood pressure outcomes, as urban areas have higher prevalence of hypertension (Armstead, Andersen, et al., 2010). Indicators of socioeconomic status, such as poverty and education have important associations with hypertension; poverty poses a tremendous barrier to hypertension management, as many individuals cannot pay for anti-hypertensive medication. Mendis and colleagues noted that 'the fact that most patients have to pay out of their own pocket for consultation and medications either fully or in part, is likely to have a negative impact on long-term management of hypertension (Mendis et al., 2004, p. 1).' Furthermore, educated individuals are at a lower risk of hypertension and its complications due to better knowledge of self-care and better employment opportunities (Guwatudde et al., 2015; Pires et al., 2013).

At the intermediary level physical inactivity, unhealthy diet, smoking, and alcohol use associated with increased likelihood of hypertension (Oladimeji et al., 2014). Medication adherence is also critical, as poor compliance can decrease the effectiveness of treatment, leading to treatment failure, which subsequently leads to an increase in the use of scarce healthcare resources and overall expenditures (Mendis et al., 2010; Ono et al., 2006). Ceasing medication use, or low adherence rates are also associated with increased mortality rates among hypertensive patients (Ogedegbe, 2008).

This study examined outcomes of the TASSH intervention guided by the social determinants of health framework, specifically investigating the aforementioned determinants and the effects as predictors of blood pressure change and blood pressure control. Additionally, this study examined: 1) under which conditions TASSH was most effective through moderation, and 2) whether intermediary determinants of health mediated the relationship between structural determinants and health outcomes, based on the SDH framework.

5.4 METHODS

5.4.1 Variables

5.4.1.1 Structural determinants. Patients reported the highest level of education attained, which was recoded as one of the following: none, primary (1-6 years of school), secondary (7-12 years of school), or tertiary (beyond secondary school); this will be treated as an ordinal variable. Gender was self-reported by patients as male or female. Both gender and education were self-reported by patients. Patients' region of residence was a binary variable (urban/rural) determined from the clinic attended, recorded on their charts.

5.4.1.2 Intermediary determinants. Age was reported by participants in years and cross-checked with patient charts, and was treated as a continuous variable. Height and weight were measured at clinic visits without shoes, using a tape measure and digital scale and patients' body mass index (BMI) was computed. BMI was assessed as a continuous variable and as a proxy for diet, as patient food recall logs were inconsistent and often incomplete. Alcohol use was assessed by asking how many drinks on average a patient had each day, which was used to compute an average number of alcoholic beverages per week.

Medication adherence to prescribed hypertensive drugs was assessed using a modified version of the Self-Reported Medication-taking Scale (SRMS), developed and validated by Morisky et al. (1986). This scale consists of five questions with yes/no responses. Scores were computed with a range of 0-5, with higher scores indicative of better medication adherence.

Patients completed the Global Physical Activity Questionnaire (GPAQ) developed by the WHO to assess physical activity in low-middle income countries (WHO, 2008). Data on physical activity were only collected at 6 and 12 months. The GPAQ consists of 16 questions measuring moderate physical activity, vigorous physical activity, and sedentary behavior. Respondents indicated whether they participate in moderate and vigorous physical activity, respectively, at work and during recreational activities. If yes, respondents indicated the number of days per week and the average minutes of physical activity per day. Participants also indicated the average number of minutes per day they engage in physical activity as a means of transportation (e.g. walking or bicycling), which was considered moderate activity by the WHO (WHO, 2008). Total minutes of all physical activity per week were computed based on daily estimates.

Blood pressure readings were taken following the American Heart Association guidelines (Pickering et al., 2005). Three BP readings were taken with the patient sitting comfortably, using

an automated BP machine. The average of the three readings was used as the BP measure for each visit. This same procedure occurred at all study visits; however, information on physical activity was only collected at 6 and 12 months, thus only data from baseline, 6, and 12 months are analyzed for the current study. The two outcome variables will be systolic blood pressure (SBP) change, assessed from baseline to 6 months and baseline to 12 months. Systolic blood pressure was the primary outcome of the TASSH trial, and is most indicative of health status which was why it was the focus of this analysis instead of diastolic blood pressure (Ogedegbe, Plange-Rhule, et al., 2014). Change in systolic blood pressure was measured by subtracting the value at 6 and 12 months, respectively, from the baseline value. The second outcome variable is blood pressure control at 6 and 12-months. Blood pressure control is defined as systolic blood pressure < 140 mm Hg and diastolic blood pressure < 90 mm Hg. Though TASSH evaluates patients at 3, 6, 9, 12, and 24 months, physical activity and medication adherence were assessed only at 6, 12, and 24 months. This study only focused on 6 and 12 month follow-up as the 24 month follow-up is currently underway.

5.4.2 Statistical analysis

Multiple linear regression was conducted to assess the impact of social determinants on blood pressure change at 6 and 12 months, respectively. Mean change is blood pressure was assessed as a continuous variable. Blood pressure control was treated as a dichotomous variable (0=not controlled; 1=controlled) and was the dependent variable in binary logistic regression. Control was assessed separately at 6 and 12 months. Differences in hypertension at baseline were also accounted for as an independent variable, as blood pressure at baseline could impact the

level of change seen, as the likelihood of achieving control. The researcher controlled for differential baseline bias by including baseline SBP as an independent variable in all models.

After initial models were run, interaction terms between structural determinants of health and intermediary determinants were created if the variables were statistically significant or marginally significant in the initial regression models. This was to avoid oversaturating the model with unnecessary interaction terms. Initial significance and effect size determined whether a variable was treated as the independent variable or the moderator, as moderators typically have smaller effect sizes (Jose, 2013).

The researcher also predicted that intermediary determinants of health would mediate the relationship between structural determinants and health outcomes based on the SDH framework (WHO, 2008). However, none of the models run met the initial criteria for mediation as specified by Baron and Kenny (1986), and further tests for mediation were not pursued.

5.5 RESULTS

5.5.1 Demographic information

A total of 368 patients participated in the intervention condition of TASSH. Three hundred and three participated in the follow-up at 6 months and 301 at 12 months. Mean age at baseline was 59.19 (SD=12.48), with 140 men (38%) and 228 women (62%) participating. Majority of patients (n=237; 64.4%) resided in rural regions and 131 (35.6%) lived in urban regions. Thirty five percent of participants received no education (n=114), and 44% only received primary education (n=144).

5.5.2 Blood pressure outcomes

Average SBP at baseline was 156.9 mm/Hg (SD= 11.75). Mean systolic pressure for men and women was 155.13 (SD=.11.76) and 158.03 (SD=11.62) mm/Hg, respectively. This difference was not significantly different at baseline. Average SBP at 6 months was 138.25 (SD=19.46) mm/Hg, which was significantly different than mean SBP at baseline (t= 15.38; p < .001). Average SBP at 12 months was 137.37 (SD=17.98) mm/Hg, which was significantly different from baseline (t=17.08; p < .001), but not from blood pressure at 6 months (t= .58; p > .05). For women, mean SBP at 6 months was 137.2 (SD=19.4) mm/Hg and for men 139.9 (SD= 19.3) mm/Hg. The difference in SBP between men and women was not significant at 6 months, however the difference in mean change in SBP from baseline to 6 months was marginally significant (t = 1.93; p =.05) between women (20.04 mm/Hg; SD=19.2) and men (15.7; SD=18.2). Mean SBP for women at 12 months was 135.05 (SD=17.7) mm/Hg compared to men with mean SBP of 141.08 (SD= 17.85) mm/Hg. This difference was statistically significant (t=2.97; p < .01). Change in SBP from baseline to 12 months was significantly different between men and women: 13.9 (SD=16.57) and 23.06 (SD=17.12), respectively (t= 4.73; p < .001).

At 6 months, 157 (42%) patients achieved blood pressure control. One hundred and one women (44.3%) and 56 men (40%) achieved blood pressure control. At 12 months, 176 (47.8%) of patients achieved blood pressure control. Fifty three percent of women (n=121) and 39% of men (n=55) had controlled blood pressure.

Table 5: Descriptive statistics for blood pressure

	Mean SBP- mm/Hg (SD)			Proportion (%) with BP Control		
	Men	Women	Total	Men	Women	Total
Baseline	155.13 (11.76)	158.03 (11.62)	156.8 (11.75)	N/A	N/A	N/A
6 months	139.9 (19.3)	137.2 (19.4)	138.25 (1.41)	40%	44.3%	42%
12 months	141.08 (17.85)	135.05 (17.71)	137.37 (17.98)	39%	53%	47.8%

5.5.2.1 Blood pressure change at six months. Results of multilevel linear regression accounting for clinic nesting with change in SBP from baseline to 6 months revealed female gender (B= 6.22; $p < .01$), medication adherence (B= 4.19; $p < .05$) and BMI (B= -0.763; $p < .01$) as significant predictors. Women had greater changes in SBP than men. Furthermore, baseline SBP was significant, as those with higher baseline SBP had greater BP changes (B= .413; $p < .001$). A level 2 interaction term between gender and region of residence was created, as urban residence showed marginal significant with blood pressure change. This interaction term was significant in the multilevel linear regression (B= -10.67; $p < .05$); women in urban regions showed the greatest change in SBP (margin = 28.00; t= 11.10; $p < .001$), significantly greater than men in urban regions. The main effect of gender was not significant after the interaction term was added, however the main effect of urban residence was positively associated with SBP change (B= 8.5; $p < .01$). See Table 6.

There were no significant interactions between gender and medication adherence, and this interaction term was removed from the model to avoid saturation.

5.5.2.2 Blood pressure change at twelve months. Results of multilevel linear regression accounting for clinic nesting with change in SBP from baseline to 12 months revealed female gender (B= 8.95; $p < .001$),medication adherence (B= 5.14; $p < .05$), and baseline SBP (B= .449; $p < .001$) to be significant predictors of blood pressure change. Women and individuals with better medication adherence showed greater changes in SBP. Also, individuals with higher baseline SBP had greater change in blood pressure. Though region of residence was not significant in the initial regression, it did have a significant interaction with gender (B = -11.69; $p < .01$). Women in urban regions had significantly greater change than men in urban regions (margins = 24.46; t=8.44; $p < .001$). The main effect of gender was not significant when the interaction term was added. There was no significant interaction between gender and medication adherence and it was removed from the model to avoid saturation. See Table 6.

Table 6: BP change baseline to 6 months and baseline to 12 months

	Baseline to 6 months				**Baseline to 6 months with interaction terms**				**Baseline to 12 months**				**Baseline to 12 months with interaction terms**			
Predictor	Coef	Standard Error	95% CI		Coef	Standard Error	95% CI		Coef	Standard Error	95% CI		Coef	Standard Error	95% CI	
			Upper	Lower												
Age	-.119	.103	-.393	.012	-.216*	.103	-.418	-.014	-.141	.113	-.362	.079	-.149	.111	-.367	.067
Baseline SBP	.413***	.097	.222	.603	.401***	.096	.212	.589	.449***	.093	.264	.632	.434***	.093	.253	.616
Female	6.22**	2.65	1.03	11.42	1.42	3.37	5.18	8.02	8.95***	2.66	3.72	14.18	3.89	3.29	-2.55	10.33
Urban	4.32	2.41	-.395	9.05	8.50**	3.01	2.61	14.41	-3.71	3.04	-9.67	2.24	1.21	3.54	-5.74	8.16
Education	-.381	1.54	-3.39	2.63	-.418	1.53	-3.91	2.10	-1.09	1.54	-4.12	1.92	-1.39	1.52	-4.37	1.59
BMI	-.565*	.234	-1.02	-.106	-.594***	.232	-1.04	-.139	-.237	.226	-.681	.205	-.304	.224	-.743	. 136
Medication adherence	4.61*	1.99	.688	8.52	4.33	1.98	.458	8.22	5.14**	1.78	1.65	8.63	4.32*	1.78	.841	7.81
Physical activity	.003	.057	-.108	.115	-.003	0.56	-.114	.107	.002	.063	-.122	.127	.008	.0623	-.115	.131
Alcohol Use	.299	.370	-.426	1.02	.231	.367	-.488	.951	.318	.362	-.391	1.02	.329	.357	-.370	1.03
Female*Urban	---	---	---	---	-10.67*	4.70	-19.91	-1.46	---	---	---	---	-11.69**	4.57	-20.66	-2.72
Adjusted R2: .152					Adjusted R2: .167				Adjusted R2: .195				Adjusted R2: . 217			

5.5.2.3 Blood pressure control at six months. Significant predictors of BP control at 6 months included BMI (B= -.021; $p < .05$), baseline SBP (B= -.014; $p < .05$), and urban region of residence (B= .147; $p < .05$). Though the effect size was minimal, individuals with higher BMI were less likely to achieve BP control, and individuals with higher levels of baseline SBP were less likely to achieve BP control. Though gender was not significant in the initial regression, the interaction between gender (female) and region of residence (urban) was significant (B= -.343; $p < .05$). Females in urban regions showed significantly greater chances of BP control than males in urban regions. See Table 7.

5.5.2.4 Blood pressure control at twelve months. Gender was a significant predictor of blood pressure control at 12 months (B = .250; $p < .01$), with females more likely to have controlled blood pressure than males. Baseline SBP was a statistically significant predictor, though the effect size was minimal (B= -.009; $p < .01$). Though region of residence was not statistically significant in the initial regression, it did show a significant interaction with gender (B = -.352; $p < .05$). Females in urban regions had significantly greater likelihood of achieving blood pressure control than men in urban regions. The main effect of gender was not significant once the interaction term was added. See Table 7.

Table 7: BP control at 6 and 12 months

	BP Control 6 months				**BP Control 6 months with interaction terms**				**BP Control 12 months**				**BP Control 12 months with interaction terms**			
Predictor	Coef	Standard Error	95% CI		Coef	Standard Error	95% CI		Coef	Standard Error	95% CI		Coef	Standard Error	95% CI	
			Upper	Lower							Upper	Lower			Upper	Lower
Age	-.002	.002	-.007	.003	-.003	.003	-.002	.002	-.001	.003	-.007	.005	-.002	.003	-.008	.005
Baseline SBP	-.014***	.003	-.019	-.008	-.014***	.003	-.014***	.003	-.009**	.003	-.014	-.003	-.009**	.003	-.015	-.004
Female	.099	.076	-.049	.247	-.051	.096	.099	.076	.250**	.079	.095	.405	.098	. 097	-.092	.289
Urban	.147*	.069	.012	.282	.281**	.088	.147*	.069	-.040	.101	-.238	.157	.107	.110	-.109	.323
Education	.033	.044	-.052	.119	.016	. 044	.033	.044	-.042	.046	-.132	.047	-.048	.045	-.137	.040
BMI	-.021*	.007	-.033	-.007	-.022**	.007	-.021*	.007	-.008	.007	-.021	.005	-.009	.007	-.023	.003
Medication adherence	. 089	.057	-.026	.197	.078	. 057	. 089	.057	.099	.052	-.004	.203	.073	.053	-.031	.176
Physical activity	-.001	.001	-.005	.001	-.002	.002	-.001	.001	.001	.002	-.003	.005	.001	.002	-.002	.005
Alcohol Use	.008	.017	-.013	.028	.006	.010	.008	.017	.008	.011	-.012	.029	.009	.011	-.011	.031
Female*Urban	---	---	---	---	-.343*	.134	---	---	---	---	---	---	-.351*	.136	-.617	-.085
AIC: 267.56; BIC: 300.44					AIC: 293.77; BIC: 327.71				AIC: 267.56; BIC: 300.44				AIC: 261.85; BIC: 298.02			

5.6 DISCUSSION

The WHO-PEN package provides a simple and effective protocol for assessing and managing hypertension. In this trial, the WHO-PEN protocol was implemented in 16 health clinics and delivered to 368 patients, with a significant reduction in systolic blood pressure between baseline and 6 months, and baseline and 12 months. Furthermore, at 12 months follow-up just under half of the patients had attained blood pressure control. This study suggests that task-shifting clinical duties related to hypertension management to community health nurses using diagnosis and treatment algorithms provided by the WHO-PEN protocol can be an effective method of aiding blood pressure control.

The primary aim of this study was to examine how social determinants of health influence intervention effectiveness. Gender showed the strongest associations, both with blood pressure change and blood pressure control at 12 months, with a likelihood of a greater systolic blood pressure reduction and a greater chance of control in women. This result is interesting as there is conflicting evidence in the literature regarding whether men or women have been control. For instance, (Cappuccio, Micah, et al., 2004) found that men generally had better blood pressure control after initiating anti-hypertensive medication treatment than women, yet, a recent systematic review found that blood pressure in Africa was generally better controlled in woman than men (Kayima, Wanyenze, Katamba, Leontsini, & Nuwaha, 2013). However, a large meta-analysis of hypertension treatment trials did not find any evidence that men and women obtained different levels of protection from a variety of anti-hypertensive medications, and did not find significantly different blood pressure outcomes based on sex (Turnbull et al., 2008). Thus, the issue of gender differences in hypertension has been the focus of a large body of research.

In various African settings, women typically have better care-seeking practices for chronic diseases including hypertension (Hjelm & Nambozi, 2008; Mufunda, Albin, & Hjelm, 2012). Indeed, women generally have higher rates of hypertension awareness and treatment initiation than men (Cappuccio, Micah, et al., 2004). One potential reason for this is that women may be screened for hypertension during their reproductive years, especially if they become pregnant, and continue to be monitored for any changes in blood pressure over the years (Pereira, Lunet, Azevedo, & Barros, 2009). Another reason for this difference in outcomes by gender could be related to gender norms in health care, namely that the majority of community health nurses delivering the WHO-PEN protocol were female. While we cannot determine this definitively, gender norms and expectations have been shown to influence health care seeking behavior and behavior change related to disease prevention and management (Ehrhardt, 2009). Research shows that men experience social pressure "to endorse gendered societal prescriptions such as the strongly endorsed health-related beliefs that men are independent, self-reliant, strong, robust and tough" (Courtenay, 2000; Golombok, 1994; Martin, 1995; Williams, 1990). Furthermore, Courtenay (2000) discusses how social constructions of gender and power can contribute to poorer men's health outcomes. The author argues that power relationships are located within health behavior, among other practices, through which demonstrations of patriarchy can be made possible. For instance, men might dismiss health concerns and reject healthy behaviors in order to demonstrate masculinity. When a man does experience illness "it can reduce a man's status in masculine hierarchies, shift his power relations with women, and raise his self-doubts about masculinity" (Charmaz, 1995). Indeed, in the context of the TASSH intervention, it could be that men were not willing to take health advice from female nurses, as these interactions would upset the typical hierarchy of male-female power dynamics. It is also

possible that men over-reported health behaviors so as to appear to be following recommendations. Preliminary analyses showed that women reported significantly less physical activity at 12 months than men, despite the fact that they had significantly higher proportions of blood pressure control. It is possible that reporting bias played a role in the minimal statistical effect that physical activity and medication adherence had for blood pressure outcomes. This is purely speculative though, as we cannot determine that male-female power dynamics were the root cause of the difference in male and female blood pressure outcomes. These results do suggest however that gender may be an important considering in developing and implementing future interventions.

While gender was a strong predictor of blood pressure outcomes, region of residence showed significant associations in moderation analyses for blood pressure change and blood pressure control at 12 months. Thus, the effect of gender became more pronounced when region was considered. The results indicated that women in urban regions had significantly greater change in SBP and likelihood of blood pressure control. This is surprising as individuals in urban regions typically have poorer health outcomes. However, men in urban regions had the smallest decrease in blood pressure, which compliments the large body of literature documenting the adverse effect of urbanization on hypertension (Armstead, Andersen, Adams-Campbell, Herbert, & Muna, 2010; BeLue et al., 2012; Duboz et al., 2012). Systematic reviews have reported a higher prevalence of hypertension in urban areas when compared to rural regions (Addo et al., 2012; Addo et al., 2007). Furthermore, management and control is challenging in urban regions as urbanization exacerbates stress exposure as well as social deprivation, and financial constraints, which can contribute to poor blood pressure outcomes (Sodjinou et al., 2007). It is noteworthy that women in urban regions demonstrated the greatest change in systolic blood

pressure and greatest rates of control, while the opposite was seen in men. It may be that nurses were successful in targeting some of these factors among women in urban regions, but not among men. Moreover, while urban areas typically have higher prevalence of hypertension and lower rates of control, there is greater access to health care in urban regions (Kalipeni et al., 2012). In addition to being more receptive to community health nurses' behavioral counseling and motivational interviewing, women in urban regions may have had greater access to health care resources for follow-up advice, medication access or other aspects of hypertension management. While this cannot be determined from the current data, these results provide support for region specific tailoring of interventions, perhaps focusing on lifestyle changes for behaviors more common in urban regions, as well as promoting healthy coping mechanisms to deal with higher stress levels.

There were limited effects of intermediary determinants on blood pressure change and blood pressure control. Medication adherence showed associations with blood pressure change; those with better adherence were more likely to have greater blood pressure change. This is consistent with the large body of research supporting the importance of medication compliance in managing hypertension (Mendis et al., 2010; Ogedegbe, 2008; Ono et al., 2006). Other intermediary determinants of interets, including physical activity, and drinking, did not show significant associations with blood pressure change or control. Furthermore, we wanted to investigate the impact of smoking on blood pressure outcomes, however this variable was dropped from the analysis due to a limited number of cases. Though it was predicted that these factors would influence blood pressure outcomes based on the current literature (Mendis et al., 2010; Oladimeji et al., 2014; Ono et al., 2006), it is not suprising that structural determinants consistently showed more associations as these factors are broader, social aspects that create

stratifications and different classes in society, thus influencing health from a more top-down appraoch (WHO, 2010a). Additionally, individuals with greater SBP at baseline showed a greated decrease in SBP at 6 months and 12 months, yet were less likely to achieve BP control. This is not surprising, as greater BP reductions are expected in indiviuals with higher BP, despite the fact that they have farther to go in terms of achieving and maintaining BP control.

5.6.1 Limitations

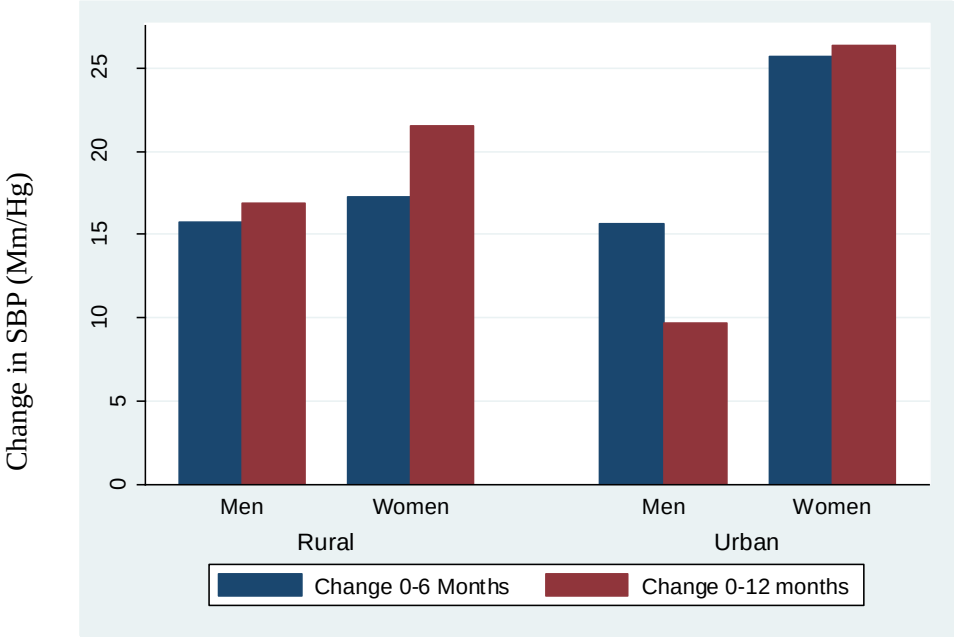
There are limitations of this study that are worth discussing. First, as this was part of a longitudinal study, missing data are inevitable. The researchers used maximum likelihood estimation methods in order to account for missing data; however it is possible that those who were lost to follow-up or who provided incomplete data would have contibuted information that may have changed the study results. Second, many of the measures required self-reported data from patients, including medication adherence, physical activity, smoking, and drinking. These measures could be subject to recall bais, as well as social desirability bias as participants may have provided answers they believed the researchers wanted to hear. Though a notable limition, given the nature of the research study, it was not possible to conduct more in depth assessments of these behaviors as this study followed several hundred patients over five years in low-resource settings.

5.6.2 Conclusion

Despite these limitations this study does offer valuable insight about the infleunce of social determinants of health on intervention outomes, providing information in response to the question “for whom and under what conditions is the TASSH intervention most effective?” The results indicate that delivery of the WHO-PEN package by community health nurses was most

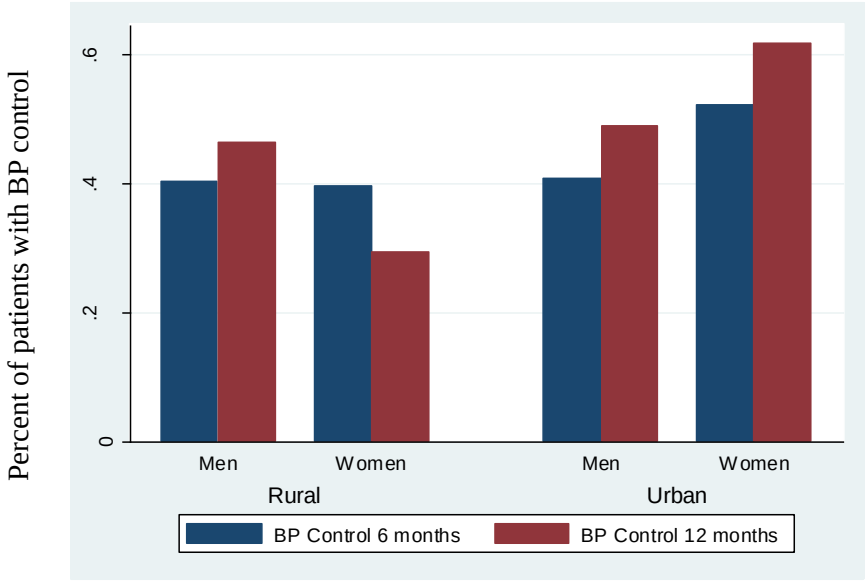
effective for women, specifically in urban areas. Moving forward, it will be necessary to study how interventions can best be tailored to suit the needs of different sub-populations (e.g. men and women; urban and rural regions). It does appear that task-shifting hypertension related clinical duties to community health nurses is an effective method for managing blood pressure control, and could potentially be used moving forward to address the physician shortage in Ghana and other parts of sub-Saharan Africa.

Figure 7: Predicted mean change in SBP by region and gender



*Change in SBP was measured by subtracting SBP at 6 months from baseline and SBP at 12 months from baseline

Figure 8: Percent with blood pressure control by region and gender



CHAPTER 6: PAPER 3

Sustaining nurse-led task-shifting strategies for hypertension control in Ghana: A concept mapping study of community health nurses perceptions

6.1 ABSTRACT

Background: The use of task-shifting is an increasingly widespread delivery approach for health interventions targeting prevention, treatment and control of hypertension in adults living in sub-Saharan Africa (SSA). Addressing a gap in the literature, this research examined the sustainability of an ongoing TAsk-Shifting strategy for Hypertension (TASSH) from the perspectives of community health nurses (CHNs) implementing the program.

Methods: We used concept-mapping, a mixed-methods participatory approach to understand CHNs' perceptions of barriers and enablers to sustaining a task-shifting program. Participants responded to focal prompts, eliciting statements regarding perceived barriers and enablers to sustaining TASSH, and then rated these ideas based on importance to the research questions and feasibility to address. Twenty eight community health nurses (21 female, 7 male) from the Ashanti region of Ghana completed the concept mapping process.

Results: Factors influencing sustainability were grouped into 5 categories: Limited Drug Supply, Financial Support, Provision of Primary Health Care, Personnel Training, and Patient-Provider Communication. The limited supply of anti-hypertensive medication was considered by CHNs as the most important item to address, while providing training for intervention personnel was considered most feasible to address.

Linking Evidence to Action: This study's findings highlight the importance of examining nurses' perceptions of factors likely to influence the sustainability of evidence-based task-shifting

interventions. Nurses' perceptions can guide the widespread uptake and dissemination of these interventions in resource-limited settings.

Keywords: task-shifting; community health nurses; stakeholder analysis; hypertension; Ghana

6.2 INTRODUCTION

Although Sub-Saharan Africa (SSA) bears 24% of the world's diseases, it only has access to 3% of the world's global health workforce (Ibrahim & Damasceno, 2012). Resources are scare and personnel with the expertise to address the burden of diseases such as hypertension are limited. In fact, the doctor to patient ratio in Sub-Saharan Africa is 1:13,000, falling far below the world standard of 1:5,000 (Mayosi, 2013). In Ghana, the ratio is far worse. For every one doctor there are 93,000 patients of the population (Mayosi, 2013). Ghanaian health care workers who are not able to find stable employment at home are also leaving the country and going abroad in search of work, thus contributing to the decline in the number of available skilled health care workers. It is reported that 56% of trained physicians and 24% of nurses from Ghana are working abroad, lending to the phenomenon called the "brain drain" (Kalipeni et al., 2012). System-level barriers like these make it difficult for implementing physician-centered health interventions focused on addressing the burden of hypertension in countries like Ghana (Iwelunmor et al., 2014).

One approach to mitigating hypertension in Ghana is task shifting, defined as the rational distribution of primary care duties from physician to nurses or other non-physician healthcare providers (Ogedegbe, Gyamfi, et al., 2014). In order to maximize resources and personnel, tasks are shifted from highly trained health care professional such as physicians to a less highly trained personnel, such as nurses (Ogedegbe, Gyamfi, et al., 2014). With task-shifting from physicians to nurses, a qualified nurse could prescribe medication for, and treat a patient with hypertension,

just as a physician would (WHO, 2007). Especially with the shortage of physicians in Ghana, this method could prove to be an efficient approach.

This strategy is not entirely new and has been used in other studies, including HIV/AIDS and diabetes in Sub-Saharan Africa (Boullé et al., 2013; Callaghan et al., 2010). In the context of hypertension management, task-shifting to nurses has shown to be efficacious in several settings. In Cameroon, Labhardt et al. tested the effectives of integrating care of hypertension by shifting clinic duties to "non-physician" clinician facilities and found a decrease in both systolic and diastolic blood pressure (Labhardt et al., 2010). Another study in Nigeria shifted hypertension clinic management duties to pharmacists, and found improved blood pressure control, decreased treatment failure, and increased patient satisfaction (Erhun et al., 2005). Finally, in South Africa, nurse-led risk reduction programs were found to be effective as they enhanced early detection and referral of hypertension and improved nurses' knowledge of hypertension (Katz et al., 2009).

In response to the severe shortage of health care workers, low rates of hypertension detection, treatment, and management, a cluster randomized task-shifting strategy for hypertension (TASSH) control is currently being conducted in 32 community health centers in Ghana (Ogedegbe, Plange-Rhule, et al., 2014a) This study evaluates among hypertensive patients who receive care in community health centers, the comparative effectiveness of the implementation of the WHO PEN program targeted at cardiovascular risk assessment and hypertension control (intervention group), versus provision of health insurance coverage (control group), on blood pressure reduction at 12-months and sustainability at 24-months (Ogedegbe, Plange-Rhule, et al., 2014a). While the findings will provide needed information with respect to comprehensive cardiovascular risk reduction and hypertension control in Ghana, what is lacking is evidence of whether interventions such as TASSH can be sustained beyond the initial

implementation period. As many community based interventions are "one-shot" trials with little or no plan for long-term sustainability, and can in some cases cause more harm than benefit if implemented for only a short period of time (Shediac-Rizkallah & Bone, 1998), understanding stakeholders' (e.g. community health nurses) perceptions of how interventions can be sustained beyond initial implementation can offer crucial information for developing sustainable health programs (Iwelunmor et al., 2016). Since community health nurses are the cornerstone of this project's implementation, the purpose of this study was to explore their perceptions of factors that would influence the sustainability of the task-shifting strategy for blood pressure control in Ghana.

6.3 METHODS

6.3.1 Participants

A group of nurses trained in the TASSH protocol was invited to participate in this study while attending training at Kwame Nkrumah University of Science and Technology. The investigative team met with the nurses attending the TASSH training session and explained via a bilingual English-Twi translator that the goal of the project was to identify factors that will influence the continuation of TASSH. Following consent, the investigators asked participants to complete the concept mapping steps. The data from this were then entered into Concept Systems Global Max Software® (Concept Systems, Inc, Ithaca NY) and subsequently analyzed. Inclusion criteria for the study were that participants be at least 18 years of age and participating in the TASSH training program. Twenty eight nurses attending the training session participated in the concept mapping (21 females, 7 males; mean age: 28.13). Smaller groups are more conducive to

concept mapping methods, detailed below, which is the rationale for the small sample size (Trochim, 2007)

6.3.2 Ethics approval and consent to participate

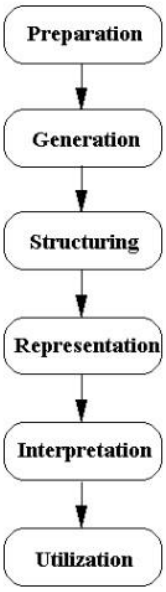
Ethical approval to conduct this study was obtained by the University of Illinois-Urbana Champaign Institutional Review Board. All participants provided informed consent prior to participation, and were informed that there were no consequences for refusal to participate or withdrawing from the study.

6.3.3. Concept mapping methods

To understand how nurses perceived barriers and facilitators to sustainability, we used concept mapping methods. Concept mapping is a structured, participatory mixed-methods approach to data collection, which creates visual and graphic representations expressed entirely in the language of participants (Trochim, 2007). Though concept mapping has been described in the literature, (Burke et al., 2005; Burke, Carron, & Eys, 2006; Trochim, 2007) briefly it is a six-step process that integrates group process activities on a topic of interest with several multivariate quantitative analytical tools (multidimensional scaling and hierarchical cluster analysis) to produce both statistical and graphical representation of a conceptual framework generated by participants (Burke et al., 2005). Concept mapping procedures consist of five steps and then utilization of results: 1) Preparation: Participants are familiarized with the general process of concept mapping and the focal question for the research is identified (e.g. *A specific factor that influences the sustainability (or continuation) of TASSH is*….). 2) Generation: Recruited participants address a focal question by generating a large number of statements in response. Members of the investigative team review the list of generated statements to remove

duplicate ideas; 3) Structuring: Participants sort the generated statements into different groups based on perceived similarity. Based on this, participants are able to choose clusters that best represent what they feel to be enablers/barriers to sustaining TASSH and hypertension management. Then participants rank the statements in terms of importance to the focus statement and feasibility to address. 4) Representation: Concept Mapping Software is used to create concept maps using multidimensional scaling (MDS) and hierarchical cluster analysis (HCA). 5) Interpretation: Participants are invited back to interpret and discuss the final cluster maps; 6) Utilization: The findings are discussed to determine the best ways in which the maps and reports can inform the focal question (Green, Fettes, & Aarons, 2012). See Figure 9 for an outlined process of concept mapping. The current study will describe steps one through five, as the utilization phase of the concept mapping approach is still underway. The involvement of participants in each stage of data collection and the final interpretation is a unique aspect of concept mapping the promote trustworthiness of the data, or that the presentation of the data reflect what the participants intended (Burke et al., 2005; Burke et al., 2006; Rosas & Kane, 2012). Furthermore, reliability is facilitated by applied, structured, quantitative methods to qualitative data (Rosas & Kane, 2012; Trochim, 2007).

Figure 9: Outline of the concept mapping process

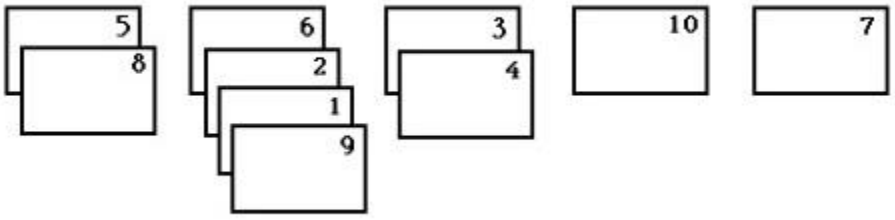


6.3.3.1 Brainstorming. The researchers used the following prompt to stimulate discussion of factors influencing TASSH sustainability: *"Based on your experience, what factors will help to promote the long-term continuation (or sustainability) of the TASSH program in Ghana?"* Brainstorming sessions were conducted one-on-one with study coordinators fluent in Twi, the dialect of the Ashanti region. In response to the focus statement, participants were asked to provide concise statements that described factors related to continuation of the TASSH program. A total of 118 statements were generated by participants. The investigative team eliminated duplicate statements, edited statements for clarity or combined similar statements that reflected nurses' perception of factors influencing the continuation of TASSH, which left 78 distinct statements.

6.3.3.2 Sorting and rating. The statements from the brainstorming session were placed on individual index cards and randomly re-ordered for concept mapping sorting. TASSH nurses

worked in pairs to sort the statements into conceptually similar groups that they generated. Participants were also given a list of the statements, randomly ordered, and were asked to rate the importance and feasibility of each statement on separate 5-pont scales. Importance rating ranged from 1, relatively unimportant to 5, extremely important, and for feasibility-1- not at all feasible to 5-extremely feasible compared to all other statements. For instance, for each statement nurses were asked "how important is this to continuation of TASSH," and "how feasible is this to address?" See Figure 10 for sample sorting.

Figure 10: Sample sorting and rating



6.3.4 Analysis

After participants sorted statements into similar conceptual groups and completed importance and feasibility rating, two investigators entered the data into Concept Systems software, which was used for the analysis. There are three steps involved in the concept mapping analysis. First, The software used multidimensional scaling (MDS) to create a two-dimensional "point map" that illustrates the distances between the statements generated for each set of sort data (Trochim, 2007). Statements that are closer together on the map were more likely to have been sorted together, and thus were more similar from participants' perspectives; statements with

further distances were less likely to be sorted together (Kruskal, 1964). As a measure of how well the MDS solution maps the original data, we calculated the "stress value." A lower stress value indicates a better fit of the MDS point map to the original data (Rosas & Kane, 2012). Second, hierarchical cluster analysis (HCA) was used to partition statements from the point map into clusters based on similarity. At this stage, the researchers reached a consensus of how many clusters to use in the final representation, as the number of clusters can range from one to N number of statements. The resulting maps show the individual statements in a two dimension space, with more similar statements closer to each other as well as how the clusters partition the map (Burke et al., 2006; Rosas & Kane, 2012).

6.3.5 Interpretation

In the interpretation phase, the investigative team examined the different cluster solutions to determine the best number of clusters and grouping of statements. Typically, in concept mapping, the participants themselves review the cluster map solution. However, due to limited access to technology the researchers were unable to present the digital cluster maps to the nurses for review. This included examining the point map to understand which statements are most related to each other, examining the cluster maps to determine which clusters of statements were rated most important to the focus statement, examining the pattern-matching to determine key areas to target based on high ratings, and examining the go-zones to determine the area of most importance for each stakeholder group (Green et al., 2012).

Go Zone matrices assign x- and y-axes to sets of importance and feasibility rating by participants where each statement is assigned coordinates based on its respective mean rating. Lines in the Go Zone matrix, which correspond to the mean rating for each axis, divide the graph

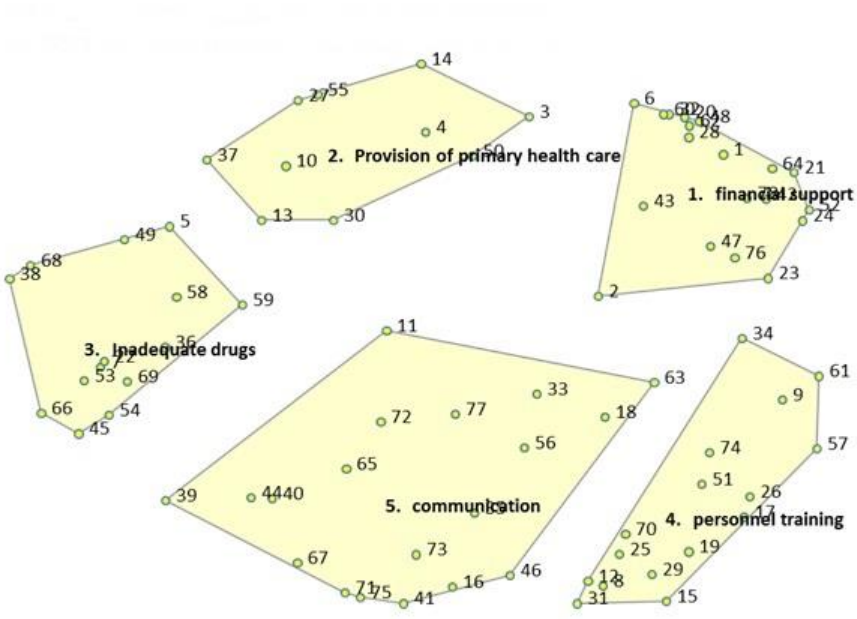
into four quadrants (low/low, low/high, high/low, and high/high). Items in the top right quadrant are those that were rated as highly important to continuation of TASSH, and feasible to address. Items in the bottom left quadrant are those that were rated as not important for sustaining TASSH, and not feasible to address. Following the assumption that high ratings are ideal, the high/high quadrant is considered the Go Zone as it contains those ideas rated most highly on both criteria (i.e. importance and feasibility for continuing TASSH long-term) (Parker et al., 2011).

6.4 RESULTS

6.4.1 Cluster map solution and interpretation

Our concept mapping analysis yielded a stress value of 0.33, indicating that the final map was acceptable. The final concept mapping solution included five dimensions that together characterized the way community health nurses understood factors likely to influence the sustainability of evidence-based task-shifting strategies for hypertension control. The five clusters (See Figure 11) included: Financial Support (19 statements), Provision of Primary Health Care (10 statements), Inadequate Drugs (14 statements), Communication (19 statements), and Personnel Training (16 statements). Each statement is presented in Table 10 with a corresponding number on the point map.

Figure 11: Final cluster map based on participant sorting



Each of the four clusters identified by TASSH nurses represented. Numbers correspond to statements that were sorted into each category. Items that are closer together indicate higher degrees of similarity based on sorting.

Salient factors from the Financial Support cluster include "*governmental assistance*" (item 48), "*support from ministry of health and government*" (item 28), and "*increasing resource base*" (item 23). These statements reflect the need for support from policy makers and government structures to provide financial support and increase the available resources for local clinics to successfully assist patients with hypertension management. Other relevant statements such as "*motivational packages for nurses*" (item 52), "*national benefits for nurses*" (item 24), and "*monetary motivation*" (item 21) reflect the necessity to improve the benefits for key program staff, particularly community health nurses implementing the program. These statements reflect their desire for compensation for the additional workload they undertake, especially as the nurses perform TASSH duties in addition to their regular clinic expectations.

By offering additional compensation (item 76, "*incentive packages*"), nurses felt that they would be more inclined to continue their duties with TASSH.

Important statements in cluster two, Provision of Primary Health Care, included "*transport availability*" (item 4) and "*long distance for patients*" (item 3). These statements reflected some of the challenges that nurses believed patients faced in obtaining basic primary health care services, namely distance to clinics and inadequate transportation. Salient items related to Inadequate Drugs included "*running out of medication*" (item 53), "*availability of drugs*" (item 22), and "*not refilling medication*" (item 54). Indeed, difficulty in continually providing appropriate anti-hypertensive medication to all clinics was seen as a tremendous challenge in keeping the TASSH program afloat. While the National Health Insurance Scheme (NHIS) does provide anti-hypertensive medications, there were issues with the "*medication side-effects*" (item 66), which discouraged patients from proper adherence.

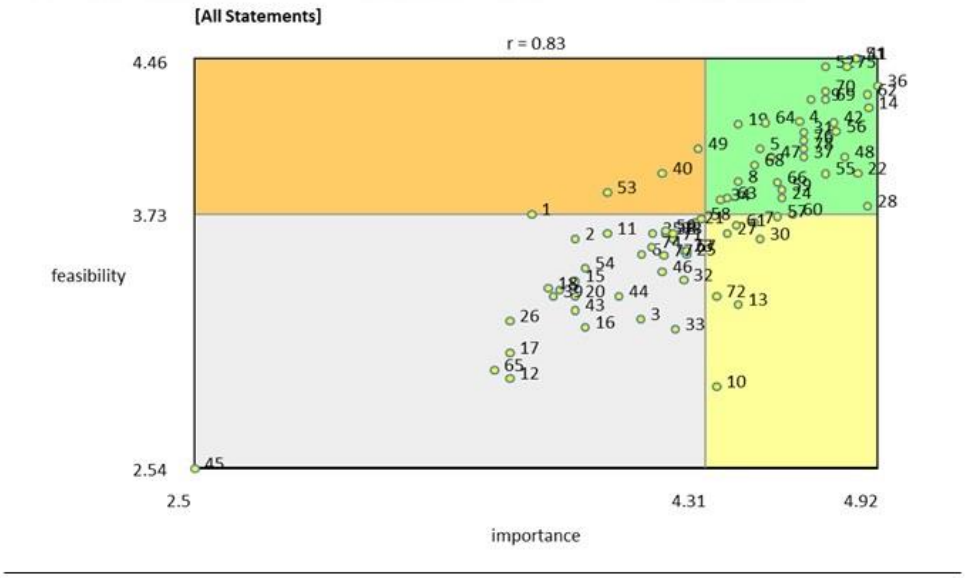
Another cluster identified by the TASSH nurses was Communication. Noteworthy items in this cluster included "*good interpersonal relationships between clients and nurses*" (item 41), "*good communication skills*" (item 75), and "*home visits and counseling*" (item 56), highlighting the importance of the relationship between the TASSH nurses and patients in sustained hypertension management. Challenges that the nurses discussed included "*lack of cooperation among various leaders*" (item 73), "*difficult/non-compliant patients*" (item 65), and "*low levels of health education for patients*" (item 46). Important factors in the final cluster, Personnel Training, included "*the competency of nurses and [the TASSH] team*" (item 31), "*frequent training for staff*" (item 19), and "*lack of certification for nurses*" (item 51). These items indicated the perceived importance of training among the community health nurses, and the need to offer continuing education to ensure that nurses are providing treatment in accordance with

best practices. Furthermore, the nurses indicated the importance of "*training physicians in supplementary TASSH protocol*" (item 15) and "*engaging more community and enrolled workers*" (item 74), underscoring the importance of having additional support to successfully work with patients to manage hypertension overtime.

6.4.2 Go Zones

Figure 12 provides the Go Zone matrices for all statements. Go-Zone matrices create four quadrants based on whether statements were rated above or below the mean for importance and feasibility, creating four different zones: high importance/high feasibility, high importance/low feasibility, low importance/high feasibility, and low importance/low feasibility. Of all statements, the one rated highest for importance was item 36, "*continued administration of medication."* Item 51, "*lack of certification for nurses*" was rated most feasible to address. Item 45, "*herbal medication usage by patients*" was considered to be the least important and the least feasible to address. Other items that were rated with low feasibility included item 12, "*involving medical doctors* and item 10, "*difficulty in extending to other regions*." Item 65, "*difficult/non-compliant patients*" was rated as low importance to sustaining TASSH.

Figure 12: Go-Zone matrices



Items in the upper right quadrant represent those ranked highly in terms of importance and feasibility. Items in the lower right quadrant were ranked highly important, but not feasible. Each item number corresponds to the statement number in Table

6.5 DISCUSSION

This study extends research on evidence-based task-shifting strategies, by exploring nurses' perceptions of factors likely to influence their sustainability in limited resource settings. Using concept mapping strategies, a total of 78 statements were generated and grouped into five clusters that reflect financial support, provision of primary health care, inadequate drugs, communication, and personnel training.

Although TASSH nurses generally agreed on the importance and feasibility of the generated ideas, the findings indicate that two specific categories of factors, namely personnel training (e.g. lack of certification for nurses) and communication (e.g. good communication skills) were considered the most feasible to address, while still being of notable importance to

sustaining the TASSH intervention. Training for community health nurses in particular was discussed as highly important to ensure that patients are receiving the highest quality care. Similarly, communication between patients and providers is essential to ensuring compliance with treatment regimens as well as accurate understanding of hypertension and the necessary steps to manage it from patients' perspectives. This echoes previous findings from other studies examining chronic disease management in sub-Saharan Africa. For instance, Murphy and colleagues discovered that negative interactions with providers influenced patients' motivation to engage in behavioral and lifestyle changes necessary for diabetes management. These patients also indicated that they did not receive sufficient counselling, and noted that they wanted providers to spend more time on education so that they felt better equipped to manage diabetes themselves (Katherine Murphy, Chuma, Mathews, Steyn, & Levitt, 2015).

Furthermore, our study found difficulties with provision of primary care as well as adequate mediation provision. Particularly, lack of transportation and far distances to clinics served as a barrier to adequate access to primary care services necessary to manage hypertension. This is similar to the findings from Goudge and colleagues in South Africa (Goudge, Gilson, Russell, Gumede, & Mills, 2009). They found that over half of surveyed households could not afford regular follow-up care, and in some cases, where households had no income, they relied on gifts from family and friends to afford health care services. Even among households in which individuals could afford to seek care, only half of individuals were regularly treated for chronic conditions; in general, the majority of cases with chronic illness received intermittent treatment at best. Weaknesses at the health care system, especially financial constraints, were noted as barriers to sustaining the TASSH program and providing continued assistance with hypertension management. This impacts the ability of clinics to provide adequate medication coverage and

patients' ability to afford and access medication. Though statements from the financial support and medication clusters were ranked as highly important by most nurses, they were not seen as barriers that could be surmounted with little difficulty or cost. Interventions designed to address these more upstream barriers at the health systems level will be necessary to facilitate the sustainment of current and future intervention to manage hypertension in the long term.

6.5.1 Implications

Despite evidence of the increasing need to address hypertension in Ghana, few studies have explored how key stakeholders such as community health nurses perceive factors influencing disease management, and even less have explored their perceptions on the barriers or facilitators influencing the sustainment of evidence-based interventions on hypertension control. This study thus provides novel information and implications that are crucial as health care professionals and researchers move forward in developing, implementing, and evaluating interventions for hypertension management and control in Ghana. From these results we can see that feasible items to address in the near future include issues related to nurses' training and communication with patients to ensure adherence to lifestyle guidelines and continued participation in the program. Longer-term, more challenging barriers that are equally as important to sustainability include financial support to ensure adequate provision of medication, payment and incentives for intervention staff, and extending the program to other regions of the country.

6.5.2 Limitations

This study does have some limitations that are worth noting. Due to the small sample size, the generalizability of these results is limited. Furthermore, the concept mapping processing

was intensive and required several hours of participation, which may have prohibited more nurses from participating. Though the TASSH program was generous in allowing us to allocate part of the training workshop to the concept mapping process, the high workload of the nurses may have deterred more from participating. However, this study provides an example of a participatory approach and process that could be replicated in other settings to understand the myriad of factors likely to influence the sustainability of task-shifting strategies for hypertension control.

6.5.3 Conclusions

The study findings highlight the importance of examining nurses' perceptions of factors likely to influence the sustainability of evidence-based task-shifting interventions in low, middle, income countries. The use of concept mapping provides an innovative framework for the development of sustainable evidence-based task-shifting interventions for hypertension control that are not only relevant to nurses implementing these interventions, but also for the patients involved in their care and for the organizations and systems in which they work. The concept map generated by this study can be used to engage stakeholders to better understand factors influencing the sustainability of evidence-based task-shifting interventions for blood pressure control. It may also assist in the widespread implementation and dissemination of evidence-based nurse-led task-shifting strategies for hypertension control in Ghana and other sub-Saharan African countries.

Table 8: Brainstorming statements sorted into their final cluster

Cluster	Number	Statement (number corresponds to item number on cluster map)
1. Financial Support	1.	Delayed salary payment
	2.	Aged participants
	6.	Socio-economic factors
	20.	Financial support for patients
	21.	Monetary motivation
	23.	Increasing resource base
	24.	National benefits for nurses
	28.	Support from ministry of health and government
	32.	Financial difficulties on the side of patients
	42.	Motivation for both clients and nurses, such as payment of bills
	43.	Poverty
	47.	Motivation of participants
	48.	Governmental assistance (financial)
	52.	Motivational packages for nurses
	60.	Lack of finance
	62.	Support from NGOs
	64.	Pay more salary to nurses
	76.	Incentive packages
	78.	Motivate patients by providing transport
2. Provision of primary health care	3.	Far access for patients/villages/towns
	4.	Transport availability for coordinators
	10.	Difficulty extending to other regions
	13.	Wide coverage of program
	14.	NHIS provision
	27.	Difficulty in NHIS acquisition
	30.	Transport (bicycles, motorbikes, vans)
	37.	Extended duration of program
	50.	Lack of transportation to training center
	55.	Health insurance provision
3. Inadequate drugs	5.	Availability of needed logistics
	7.	Provision of drugs to all facilities
	22.	Availability of drugs (continuous supply)
	36.	Continued administration of medication
	38.	Delayed laboratory results
	45.	Herbal medication usage
	49.	Short duration of program
	53.	Running out of medication
	54.	Not refilling medication
	58.	Reduced waiting period at facility
	59.	Lack of availability of needed materials
	66.	Medication side effects
	68.	Laboratory materials
	69.	Provision of medication

Table 8 (cont.)

4. Communication	11.	Open recruitment
	16.	Poor behavior of non-study nurses in the absence of study nurses
	18.	Tagging patients for identification
	33.	Patients' unwillingness to join
	35.	Coordinators to join in home visits
	39.	Separating folder may lead to loss of clinical and drug history
	40.	Separating clinic from regular OPD
	41.	Good interpersonal relationship between clients and nurses
	44.	Inadequate health care
	46.	Low levels of health education for patients
	56.	Home visits and counseling
	63.	Add more patients
	65.	Difficult/non-compliant patients
	67.	Difficulty contacting/convincing patients
	71.	Poor contact/communication
	72.	Lack of unit at faculty for study
	73.	Cooperation among various leaders
	75.	Good communication skills
	77.	Poor cooperation from patients
5. Personnel training	8.	Difficulty in maintaining already trained staff
	9.	Difficulty in increasing number of patients
	12.	Involve medical doctors
	15.	Train physicians in supplementary TASSH protocol
	17.	Fixed role of nurses at facilities makes work difficult
	19.	Frequent training for staff
	25.	Health educators and centers
	26.	Increasing numbers of nurses
	29.	Education
	31.	Competency of nurses and team
	34.	Socializing events for staff and clients
	51.	Lack of certification for nurses
	57.	Ensuring privacy is granted
	61.	Support from individuals (selected nurses and patients)
	70.	One-on-one counseling (motivational interviews; health education)
	74.	Engaging more community and enrolled workers

Statement numbers correspond to numbered items on cluster map.

CHAPTER 7: DISCUSSION

In this chapter, an overview of the study purpose is presented, as well as an overall summary of Papers 1, 2, and 3, presented in Chapters 4, 5, and 6, respectively.

This study was conducted as part of an evaluation of a TAsk-Shifting for Hypertension (TASSH) intervention in Kumasi, Ghana, with the ultimate goal of training community health nurses to diagnosis, treat, and assist patients with hypertension management, thus alleviating physician workload. Given the increased concern over the rise of non-communicable diseases in sub-Saharan African countries such as Ghana (Bosu, 2010; Mayosi, 2013), and the severe physician shortage in the region (Kalipeni, Semu, & Mbilizi, 2012), this study attempted to explore how individual, structural, and health system factors impacted the uptake of a task-shifting strategy to improve hypertension. While the findings of TASSH will provide needed information with respect to comprehensive cardiovascular risk reduction and hypertension control in Ghana, it was unclear how stakeholders (e.g. patients, health care providers) perceived this intervention, how intervention outcomes were influenced more broadly by social determinants of health, and how this intervention could be sustained over time, if successful. This study was guided by the following questions:

1. How do patients perceive hypertension and an on-going task-shifting strategy to promote hypertension management?
2. How do social determinants of health influence intervention outcomes among patients participating in the TASSH intervention?
3. What is the role of nurses trained in the WHO-PEN package in sustaining the TASSH intervention and ultimately hypertension management?

This project was guided by the WHO's Social Determinants of Health Framework (WHO, 2008), which describes the influence of intermediary (individual), structural (social stratification), and

governmental factors on health and well-being across lifespans. This study builds off previous work highlighting the importance of social determinants of health at the individual, structural, and health systems level and their influence on hypertension management (Addo et al., 2012; Armstead, Anderson, Adams-Campbell, He´bert, & Muna, 2010; Kadiri et al., 1999). Although there is a large body of literature regarding determinants of hypertension and factors that enable or hinder lifelong management, few studies have explored how hypertension management is influenced in the context of an on-going task-shifting intervention. Specifically, understanding how patients perceived the intervention itself, specific social determinants that were predictive of better outcomes among those receiving the intervention, and stakeholders' perceptions of barriers and facilitators to sustaining the intervention long-term provides unique insight for hypertension management in Ghana, in light of the rise of non-communicable diseases and a dearth of physicians.

Together, the three aims of this study depicted patients' perceptions and experiences with an on-going task-shifting intervention, patient outcomes after initial intervention implementation, and providers' experiences with the intervention and their understanding of barriers and facilitators to sustaining optimal blood pressure management. Utilizing a mixed methods approach allowed for a rich understanding of patients' and providers' perceptions within the broader context of social determinants of health.

7.1 SUMMARY OF PAPER 1

Paper 1 focused on exploring participating patients' perceptions of the TASSH program, including knowledge obtained from the TASSH education, lifestyle behavior changes, and barriers and facilitators to maintaining any changes over time to manage their hypertension.

Previous studies have indicated the importance of patients' perceptions of disease and treatment, as patients tend to come from a cultural understanding of disease, which often does not align with providers' perspectives from a biomedical model (Kleinman et al., 1978; Ogedegbe, 2008; Taylor et al., 2012). This discordance can worsen treatment outcomes over time, as studies have shown that patients with beliefs about disease differing from their health care providers have poorer treatment compliance over time, and thus worse health outcomes (Heurtin-Roberts & Reisen, 1992; Heurtin-Roberts & Reisin, 1986). Furthermore, acceptability of an intervention from a patient's standpoint is predictive of intervention uptake and behavior chance, as patients are less likely to conform to health practices that are not accepted in their culture or that do not align with their belief system (Joshi, Santo, & Redferm, 2014).

The PEN-3 Cultural Model guided the development of an in-depth interview guide as well as qualitative data analysis of patients' perceptions of the TASSH program. The PEN-3 cultural model was designed to take into consideration the cultural and social factors influencing health, and has grown in popularity in the design and implementation of culturally relevant public health interventions targeting minority populations (Airhihenbuwa, 1995). The acronym PEN-3 represents the three domains of the model; 1) Cultural Identity; 2) Relationships and Expectations and 3) Cultural Empowerment. This study was guided specifically by the Relationships and Expectations domain, which is composed of three sub-constructs: perceptions, or beliefs and values held by people about a condition, enablers, or resources that promote or hinder behavior change, and nurturers, referring to the role of family and friends or other forms of social support, and their ability to make a positive or negative impact (Airhihenbuwa, 1995). In the context of hypertension, using a cultural model as an explanatory framework is essential, as many patients come from a non-biomedical perspective, perceiving hypertension to be a

disease of "nervousness" , without understand the biological underpinnings of the disease, or the lifestyle changes necessary to manage it. Moreover cultural models provide a better understanding of patients' subjective experience, or how they perceive, understand, and interpret hypertension and their experience with diagnosis, treatment, and management. The PEN-3 Cultural Model was used to create an 11 question interview guide, which promoted patients to describe their perceptions of TASSH, the beneficial and negative aspects of the program, barriers to self-management of hypertension, how TASSH has helped them to manage hypertension, their confidence in their ability to continue to maintain adequate blood pressure control at the end of TASSH, and how well they perceived TASSH to address their hypertension needs. Patients also provide basic demographic information including age, sex, and highest level of educational attainment. Forty two patients were interviewed by bilingual Twi-English speakers. Data were transcribed in English and coded using open and axial coding techniques, with the PEN-3 Cultural Model as a guide.

Results were grouped into three overall themes: perceptions of hypertension and hypertension management; enabling factors influencing hypertension management; and nurturing factors for hypertension management. Overall, patients had a strong understanding of what hypertension was, and the negative ways in which it would impact their health. Prior to the TASSH intervention many patients described that they were not aware of the importance of behavior change for hypertension management, and involvement in TASSH improved their overall awareness and health. Patients did however perceive challenges with hypertension management after the conclusion of the program: *"I was anxious about the prospect of the program coming to an end, but believe I will be able to maintain changes made so far because I understand their importance to maintaining health."* Though many were confident that they

could maintain their behavior changes, they were unsure about medication access: *"I will be fine with the education given me during counselling but the drugs are my problem."*

The findings further indicated that, from patients' perspectives, the TASSH program was crucial to enabling their ability management of hypertension and overall health in a variety of ways. First, the program provided essential education on not only what hypertension was, but contributing factors that can be managed with lifestyle changes. Patients discussed that the educational component of TASSH helped them understand the importance of physical activity and dietary changes, such as sodium reduction and increasing intake of fruits and vegetables. Though there was discussion of certain barriers to maintaining these lifestyle changes, such as affordability of and access to healthy foods, and time constraints which prohibit exercise in some cases, the majority of patients were confident that they could sustain their behaviors changes after the conclusion of TASSH.

Nurturing factors for hypertension management included the availability and attentiveness of the TASSH nurses; patients described how the nurses were one of the critical, positive aspects of the program, as they provided the necessary support and information for patients to successfully reduce their blood pressure. Some patients described that previous health care providers had not delivered sufficient information or counseling with regard to hypertension and hypertension management, and in fact, certain patients noted that they were unaware of their hypertension status prior to being enrolled in the TASSH program. The motivational interviewing and consistent communication provided by the nurses helped patients overcome many of the barriers to hypertension awareness, diagnosis, treatment, and management that they had previously encountered in the health system. Though the environment in which patients received care was shown to be important in our study as well as others (Goudge et al., 2009;

Katherine Murphy et al., 2015), additional factors beyond the control of the program were seen as barriers by patients, including financial constraints, particularly with regard to medication access.

These results expand upon the current body of literature, examining perception of barriers and enablers to hypertension management (Odusola et al., 2014). In rural Nigeria, Odulsola et al., (2014) interviewed insured patients regarding their perceptions of inhibitors and facilitators to adhering to hypertension treatment, specifically medication adherence and behavioral changes. Similar to this study, they found a variety of factors at the level of health systems, patients, and social support that influenced treatment adherence. Odulsola and colleagues described how patients found it difficult to adherence to treatment due to limited medication availability at local pharmacies, and far distances to medical centers. Similarly patients in the TASSH intervention noted difficulties with regular medication supply as a barrier to hypertension management. Dislike of medication side effects, such as swelling, lethargy, and frequent urination have also been described in the literature as a primary motivate for non-adherence to medication (Marshall et al., 2012). Indeed some patients in TASSH noted that they encountered undesirable side effects from the medication, particularly from the medication provided by the National Health Insurance Scheme, as opposed to TASSH. Patients were more willing to continue using the medication provided by TASSH, because, as stated by one patient: *"the alternative medication provided by NHIS coverage has undeniable side effects, and I perceive less improvement with the NHIS option."*

Odulsola et al. also described that patients were under the impression that hypertension could be "cured" and that the need for treatment was temporary (Odulsola et al., 2014). Indeed, many patients in the TASSH intervention did not understand hypertension to be a life-long

condition that requires continuous management, and instead perceived it as a condition that could be "cured." However, the education provided by the nurses helped many participants to realize the importance of sustained behavior change over one's lifespan in order to manage the disease. Furthermore, many patients noted the health consequences they experienced from having hypertension such as dizziness and inability to concentrate, and also were aware of the more serious consequences that could occur if their condition remained unmanaged. Other studies have found inadequate time with health care providers to be a barrier to hypertension management, as patients are often unable to see a physician for a period of time long enough to have their questions and concerns addressed (Kalipeni et al., 2012). The interactions between patients and nurses were also noted as a critical aspect of the TASSH program, as it allowed patients to have more time to discuss their condition with a health care provider, and ensure that they fully understood the course of treatment. This also fostered more trust between patients and providers, which made patients more willing to adhere to the nurses' recommendations.

The results of this study provide a preliminary framework for interventions moving forward to remove barriers that patients face in hypertension management in the Kumasi region of Ghana. First, more attention can be paid to patient education, especially as patients in TASSH were receptive to the educational material and counseling provided by the nurses. This suggests that patients having difficulty managing their medication and behavioral changes may benefit from further education about the nature of hypertension, why medications need to be taken regularly, what could make regular medication use easier (e.g., side effects, dosing, alternative medications, frequency of clinic visits), how patients deal with social, cultural, or religious barriers to taking medication, and logistic challenges faced in getting refills on time (Odusola et al., 2014). Additionally, patients with difficulty maintaining behavior changes may benefit from

further counseling about the positive impact of salt reduction, health diet, and exercise, and how they could use existing dietary and physical-activity related practices at the local level to help them implement behavior changes (Odusola et al., 2014).

Despite the importance of individual patient education and counseling, there are many barriers that cannot be solved at the patient level alone. Medication access and financial resources for program materials are essential moving forward, and solutions will have to be found at the health systems level in order to mitigate some of the obstacles patients face. While financial barriers are challenging to address in resource constrained settings, moving forward it is important to facilitate leadership support, both in terms of financial support and human resources (Damschroder et al., 2009). Additionally, developing innovative ways of training nurses and community health workers in task-shifting that do not require large external funding sources is needed. One potential strategy is to incorporate task-shifting and the WHO-PEN package training in the nursing school curriculum. This would ensure that all new nurses entering the workforce would be trained in task-shifting for hypertension, and possible other chronic illnesses, without requiring additional on-site education and training as the TASSH program provides now. Moving forward, novel mechanisms of incorporating training that do not require large amounts of external funding or additional programming should be considered to overcome some of the contextual barriers in resource constrained settings. Indeed, these results do suggest that shifting clinical duties from physicians to nurses was perceived favorably by patients. In the long term, task-shifting interventions such as TASSH could help mitigate the effects of the physician shortage of the growing prevalence of hypertension and hypertension morbidity and mortality in Ghana.

7.2 SUMMARY OF PAPER 2

The TASSH program was created to respond to the physician shortage, as it is one of the top barriers to hypertension management in Ghana. TASSH provided training for community health nurses to apply to WHO-PEN package to diagnosing, treating, and managing hypertensive patients. Nurses were responsible for providing appropriate care as per the algorithms outlined in the WHO-PEN package, and referring more complicated cases of hypertension to physicians (Gbenga Ogedegbe, Plange-Rhule, et al., 2014a). There has been evidence of the effectiveness of task-shifting programs for hypertension management in other sub-Saharan Africa countries, involving shifting clinical duties to non-physicians (Labhardt et al., 2010), pharmacists (Erhun et al., 2005), and community health nurses (Katz et al., 2009). While these studies, as well as the TASSH study, have provided valuable information about the feasibility and effectiveness of task-shifting in low-resource settings, these studies have not specifically examined factors that make patients more successful than others in the intervention condition alone. Previous evaluations are primarily effectiveness comparisons of a treatment between the intervention and control group; however, a variety of social determinants among patients within the intervention group can have an impact on the treatment outcome.

Following the WHO's Social Determinants of Health Framework, the goal of Paper 2 was to explore how blood pressure outcomes differed by social determinants of health within the TASSH intervention group. Social determinants of health are divided into three categories. Structural determinants are mechanisms that generate stratification and social class divisions in the society, and factors that define individual socioeconomic position within hierarchies of power, prestige, and access to resources (Yao et al., 2013). Intermediary determinants are means through which structural mechanisms or determinants operate, such as material circumstance

(e.g. housing and neighborhood quality), psychosocial circumstances (e.g. social support), and behavioral and biological factors (e.g. nutrition, age, other genetic factors) (WHO, 2008). Finally, governance factors refer to broad political, social and cultural factors that influence conditions that influence health (WHO, 2008). As all patients in this study were from the same region of Ghana, had access to health clinics, and were provided health insurance, most governmental determinants were consistent across participants. Thus, only intermediary and structural determinants were examined in this paper.

This study aimed to provide information regarding the question "for whom and under what condition was the TASSH intervention most effective?" This study utilized data from 368 patients randomized to the TASSH intervention group at the initiation of the TASSH trial. Blood pressure measurements were taken at baseline, 6 months, and 12 months, with primary outcomes of change in SBP between baseline and 6 months, and baseline and 12 months, as well as blood pressure control (BP < 140/90) at 6 and 12 months. Social determinants of interests included both structural (education, gender, region of residence), and intermediary (physical activity, medication adherence, alcohol use, smoking). Determinants were chosen based on their implications for blood pressure and hypertension management described in many previous studies (Addo et al., 2012; Armstead, Anderson, et al., 2010; Kadiri et al., 1999; Mendis et al., 2004). Patients self-reported their highest level of education (no education, primary education, secondary education, tertiary education) and their gender. Patients' region of residence was determined from clinic location. Physical activity, medication adherence, current smoking status, and number of drinks per week were assessed based on self-report. Blood pressure was measured by community health nurses during baseline and follow-up visits, and was taken as an average of three readings with the patient sitting comfortably. Baseline SBP was controlled for in all

analyses. Interaction terms were created between significant or moderately significant determinants to address the question of "for whom and under what conditions" the TASSH intervention yielded the most effective outcomes.

The average SBP at baseline was 156.9 mm/Hg. At 6 months, average SBP was 138.25 mm/Hg, and at 12 months 137.37 mm/Hg. Both average SBP measurements at 6 and 12 months were significantly less than baseline. Regression analyses showed gender (female) to be one of the most consistent predictors of both change in SBP, as well BP control. Though region of residence was not consistently a predictor of blood pressure outcomes, the interaction between gender and region of residence was significant in all analyses; women in urban regions showed the greatest levels of SBP change and greater rates of blood pressure control. It is important to note that women in urban regions had higher baseline SBP than women in rural regions which could account for their greater decrease in SBP during the follow-up visits. Nonetheless, women overall showed superior outcomes in the TASSH intervention than men.

The issue of gender differences in hypertension has been a focus in the literature as a definitive conclusion has not been reached. Some studies have shown that there are differences in hypertension treatment outcomes between men and women (Cappuccio, Micah, et al., 2004; Kayima et al., 2013), while others indicate that there are no differences in outcomes of a variety of treatments (Turnbull et al., 2008). In African countries, women typically have better knowledge of their hypertension status due to screening that occurs during pregnancy (Cappuccio, Micah, et al., 2004; Pereira et al., 2009). Furthermore, it is more common for women to have better health-care seeking practices (Hjelm & Nambozi, 2008; Esther Mufunda, Björn Albin, & Katarina Hjelm, 2012; Mufunda et al., 2006) which may result from long standing gender norms which place upon men the expectation to be strong, resilient, and self-

reliant, which causes men to dismiss health concerns in many cases (Courtenay, 2000; Golombok, 1994; Martin, 1995; Williams, 1990). Additionally, as the majority of community health nurses providing care through the TASSH program were female, the role of female health providers providing health recommendations and diagnoses may have disrupted the typical hierarchy of male-female dynamics, leading to poor compliance of recommendations, or over-reporting health behaviors, such as medication and physical activity. Indeed, despite the long-standing literature noting the importance of medication adherence and physical activity for hypertension management (Mendis et al., 2010; Ogedegbe, 2008; Oladimeji et al., 2014; Ono et al., 2006), these two factors did not have a notable effect of blood pressure outcomes. This could have stemmed from the fact that self-report measures were used to collect these data, which may have biased the information. However, due to the longitudinal nature of the study, the number of patients, and the lack of resources in the study area, self-report measures were the most feasible methods of collecting data during the trial. Despite the fact that medication and physical activity did not differ based on men and women's self-report, women had far better blood pressure outcomes at both 6 and 12 months, suggesting that reporting bias may have played a role in the lack of effect of behavioral measurements.

The primary finding of this study was that women in urban regions by and large had better outcomes in the TASSH intervention than others. While the effect of gender may in part be explained by social constructions of gender and power (Courtenay, 2000; Golombok, 1994; Martin, 1995; Williams, 1990), the fact that women particularly in *urban* regions had the best outcome is surprising. Typically, individuals in urban areas have a greater risk of hypertension and lower rates of blood pressure control due to a variety of contextual factors such as increased stress, access to a Westernized diet, and high levels of poverty (Iwelunmor, et al., 2014).

However, urban areas have more health care resources, as rural regions are most severely impacted by the brain drain and physician shortage (Kalipeni et al., 2012). It may be that the TASSH intervention was more effective for women, and those in urban regions had more available pharmacies for medical access and greater access to health clinics for follow-up care and questions or concerns related to treatment. Though this cannot be determined by the current data, it is important to consider how contextual factors such as gender and region of residence can influence the effectiveness of hypertension management programs.

This paper offers a unique perspective on task-shifting interventions for hypertension control in SSA, as it is one of the first, to our knowledge, to specifically examine factors within the intervention group that contributed to more successful treatment outcomes. Previous examinations of task-shifting trials have focused primarily on outcomes in the intervention versus control group (Katz et al., 2009; Labhardt et al., 2010). However, as evidenced by these results, several characteristics of patients within the intervention group can impact health outcomes. Furthermore, using the Social Determinants of Health Framework, this paper situates relevant determinants of hypertension outcomes within the broader social context in which health occurs. This study specifically examined determinants at the intermediary, or patient level, and the structural, or social/community level, as all patients lived in the same region of Ghana under similar governance circumstances.

The findings underscore the importance of structural determinants of health, particularly gender, for task-shifting interventions to manage hypertension. Though the results of this study suggested minimal effects of behavioral factors, which are inconsistent with a large literature, this could be due to self-report error, if measurements for behaviors were not accurate. The findings do provide interesting information regarding the role of gender in influencing outcomes

of a task-shifting study. Particularly, as the majority of community health nurses were female, the gender of patients and providers could have influenced the patient-provider interactions, as well as patient compliance with medical advice, and self-reporting of behavioral outcomes. Moving forward, it may be necessary to account for patient and provider gender to tailor interventions to better suit patients' needs. Furthermore, the results also suggest that accounting for region of residence may be important too. Though it was not significant as an independent predictor, region of residence was often significant as part of an interaction term with gender. Indeed, women in urban regions showed the greatest change in SBP and had the greater proportion of blood pressure control. The interaction effects of these two variables are interesting as it suggests that the effect of gender may play a greater role than initially thought. Despite the conflicting evidence in the literature regarding the effect of gender in hypertension treatment, in this study, females consistently demonstrated better outcomes than males, and this effect was amplified when considering the interaction between gender and region of residence. Ultimately, while behavioral and lifestyle factors are of paramount importance in managing hypertension over time, structural factors such as gender and region of residence play a key role in management as well, and should be considered in the development of hypertension management interventions.

7.3 SUMMARY OF PAPER 3

While the first two studies provided valuable information with regard to how patients perceived the TASSH program, and specific factors that were most predictive of successful blood pressure outcomes, moving forward it is necessary to understand how the TASSH program can be sustained overtime to provide continued benefits to current and future patients. Due to the dual burden of communicable and non-communicable diseases faced by sub-Saharan Africa

(Mendis et al., 2004), as well as the severely limited health care workforce (Kalipeni et al., 2012), several donor-funded interventions have been initiated in the region with the hope of reducing the burden of disease. However, in light of decreasing funds from donors, governmental funders and policy makers are faced with the challenge of allocated extremely limited resources. Because of this, sustainability of interventions has become a concern, as funders and implementers recognize that creating interventions requiring substantial resources serves little purpose if it is not sustained long-term (Iwelunmor et al., 2016). Despite the large amount of assistance sub-Saharan Africa has received for health initiatives, sustainability has not received significant attention until recently (Shigayeva & Coker, 2015). Broadly, sustainability is defined as "continued use of intervention components and activities for the continued achievement of desirable health outcomes within the population of interest (Scheirer & Dearing, 2011, p 2060)." Shediac-Rizkallah and Bone's definition of sustainability builds off of this, incorporating three components: sustainability includes 1) continued benefits to participants when the program started and to new participants after initial funding is discontinued; 2) continued implementation of program activities in an organized manner after financial support has been discontinued; and 3) community empowerment to improve health by continuing the activities of the finished program (Shediac-Rizkallah & Bone, 1998). Accounting for these three components allows implementers to plan for "what is to be sustained, how or by whom, how much and by when" (Shediac-Rizkallah & Bone, 1998).

A recent systematic review revealed that only 19 studies of interventions in sub-Saharan Africa conducted analyses of program sustainability (Iwelunmor et al., 2016). Despite the increased attention to sustainability of health interventions in the last 5 years (Stirman, 2012), and the large amount of assistance to sub-Saharan Africa, there are still limitations in how

researchers approach intervention implementation and sustainability (Bhardwaj, 2015; Stirman, 2012). Nevertheless, sustainability is of paramount concern for sub-Saharan Africa for a variety of regions. Fist, SSA, bears the highest burden of disease in the world, and has the fewest financial and human resources to address this (BeLue, 2009). Thus, implementing interventions that can provide long-term support for communities is needed. Second, research has suggested that terminating an intervention due to expiring funds prior to program goals have been achieved is actually counterproductive for health outcomes, and poses and ethical dilemma (Shediac-Rizkallah & Bone, 1998). Finally, many interventions incur significant start-up costs in terms of financial resources and man-power, and funders of the intervention want to know whether their investments will help achieve long-term beneficial health outcomes (Iwelunmor et al., 2016). Because of the importance of sustainability of intervention, and the limited attention it is given particularly in sub-Saharan Africa, the goal of Paper 3 was to assess community health nurses' perceptions of factors that would facilitate or hinder the long-term sustainability of the TASSH program.

Conceptual mapping methods were used to understand how nurses perceived barriers and facilitators to TASSH sustainability. Concept mapping is a six step, structured, participatory approach that creates visual and graphical representations of participants' expressed thoughts (Trochim, 1989). Twenty eight community health nurses participated in the concept mapping process. Participants were given the following prompt to stimulate discussion of factors influencing TASSH sustainability: *"Based on your experience, what factors will help to promote the long-term continuation (or sustainability) of the TASSH program in Ghana?"* In response to this prompt, the participants generated 78 distinct statements after duplicates had been removed. Participants sorted these statements into categories based on similarities, and ranked each

statement on two separated 5-point scales in terms of importance to sustainability and feasibility to address. Data were analyzed using Concept Systems Software, which uses multidimensional scaling to create a point map of each statement based on similarities from participants' sorting, and hierarchical cluster analysis to partition the statements into distinct categories. Finally, Go Zone matrices are created which depicts the importance and feasibility ratings in four quadrants: low/low, low/high/, high/low, and high/high. The high/high quadrant is considered to be the most ideal, as items are ranked with high importance and high feasibility.

The Concept Mapping analysis yielded five categories of factors influencing sustainability of TASSH: Financial Support (19 statements), Provision of Primary Health Care (10 statements), Inadequate Drugs (14 statements), Communication (19 statements), and Personnel Training (16 statements). Items in the Financial Support category reflected the need to support from governmental structures and policy makers, as well as financial incentives for TASSH nurses, as their duties with the program were outside of their clinical responsibilities at their respective clinics. Salient statements related to Provision of Primary Heath Care highlighted difficulties that stemmed from lack of transportation for patients and great distances between clinics and patients, which hindered the ability to provide adequate primary care services. Statements in the "Inadequate Drugs" category underscored the challenges faced by running out of antihypertensive medication and not having a regular supply for patients. Furthermore, nurses described that medication side effects were barriers to success, and ultimately sustainability of the TASSH program. Noteworthy statements in the "Communication" cluster included the importance of promoting good patient-provider communication, particularly as many patients were not knowledgeable about hypertension. Finally, important items in the Personnel Training cluster included providing consistent training for TASSH nurses to ensure competency in the

TASSH protocol for hypertension management. Go Zone analysis revealed that "*continued administration of medication."*(Item 36) was rated as the most important, while "*lack of certification for nurses*" (Item 51) was rated as the most feasible to address.

The results of Paper 3 contribute to the literature on evidence-based task-shifting strategies, particularly with regard to how such strategies can be sustained overtime, after external funding expires. This study explored nurses' perceptions of factors likely to influence the sustainability of TASSH. Using Concept Mapping, we created visual and graphic depictions of the nurses' perceptions to express the results in the language of participants. Despite the rise in morbidity and mortality of noncommunicable diseases like hypertension in Ghana and other sub-Saharan African countries (Bosu, 2010), few studies have explored how ongoing initiatives to manage chronic diseases can be sustained over time. This study provides a unique insight and crucial information for program implementers developing, implementing, and evaluating interventions for hypertension management and control in Ghana. Immediate issues that can be addressed to promote program sustainability include nurses' training and communication with patients to ensure adherence to lifestyle guidelines and continued participation in the program. The structure of the Ghana Health Services, with the Community-based Health Planning Service (CHPS) offers a unique platform to continue to promote tasks-shifting initiatives. Through the CHPS program, community health officers (CHOs), or lay volunteer health workers, are trained to provide door-to-door basic primary care in hard to reach communities (Ghana Health Services, 2016). Moving forward, engaging this large network of CHOs to deliver the WHO-PEN package for hypertension and chronic illness management could be beneficial. Currently, CHOs are supervised by community health nurses; thus nurses trained in the WHO-PEN protocol could provide training to a large network of CHOs to enhance the capacity of TASSH. This represents

a feasible mechanism of incorporating more health care workers in the near future to promote sustainability of the program. Longer term issues include governmental financial support and a continuous supply of antihypertensive medication. The Concept Map created in this study as well as the importance and feasibility rating reflected in the Go Zones have implications for engaging stakeholders in understanding and articulating factors associated with sustaining task-shifting programs.

Indeed, how interventions can be sustained beyond initial implementation is not well studied, nor investigated at the onset of many interventions (Iwelunmor et al., 2016). Studies that have reported successful implementation sustainability note the importance of engaging stakeholders through community ownership and mobilization. For instance, a physical rehabilitation network evaluation in Somaliland described the importance of a centralized community structure for facilitating program goals long-term (Blanchet et al., 2014). Another study in Zambia showed that program commitment and ownership facilitated health service delivery (Mbanefo, 2010). Finally, Rashed et al. found that community members felt a sense of pride in participating in a program to provide insecticide treated bed nets (Rashed, 1997). Community members reported that their sense of ownership increased because they felt they were having a direct impact on disease reduction, which further motivated them to continue the program. Thus, involvement of key stakeholders can facilitate crucial community support and ownership, which enables the program to be sustained long-term. In the case of TASSH, the nurses' perceptions and continued engagement can provide insight to guide the wide-spread uptake and dissemination of task-shifting strategies for hypertension management in Ghana.

7.4 CONCLUSION

The purpose of this chapter was to present an overview of the studies conducted in Papers 1, 2, and 3. The findings of this dissertation illustrate the importance of understanding the influence of individual, community, and health systems factors on hypertension management and the implementation of a task-shifting program for hypertension. Moving forward it will be necessary to develop a firmer understanding of these factors, including patients' perceptions of disease and treatment, intermediary and structural social determinants of health, and the role of health care workers, in order to develop, implement, and ultimately sustain effective interventions to manage hypertension in Ghana.

CHAPTER 8: CONCLUSION

In this chapter, a summary of the overall study, limitations, strengths, and future directions for hypertension management in Ghana is presented.

8.1 SUMMARY OF FINDINGS

Many recent studies have noted the rapid epidemiological transition occurring in low-middle-income-countries (LMICs), in which dual burdens of chronic, noncommunicable disease, and acute, infectious diseases occur in tandem (Islam et al., 2014). Of particular concern in LMICs is cardiovascular disease. The WHO estimated that in LMICs, 80% of deaths results from NCDs, with CVD being the biggest contributor (Islam et al., 2014). Additional estimates suggest that 30 million individuals in Africa have hypertension, and by 2020, 75% of deaths in the region will be attributable to hypertension. In Ghana specifically, hypertension is second leading cause of adult outpatient morbidity and mortality, making it of great concern to the country's health and wellbeing. Given that the growing NCD burden exists in the context of high rates of infectious diseases, such as malaria, tuberculosis, and HIV, the need to address NCDs is crucial.

Despite the urgent need to address NCDs such as hypertension, the physician shortage in sub-Saharan Africa makes regular monitoring for patient management a challenge (Mayosi, 2013). While task-shifting, or shifting clinical duties from physicians to other health care providers, has shown to be effective for CVD management (Ogedegbe, Gyamfi, et al., 2014; Ogedegbe, Plange-Rhule, et al., 2014a) there is still a great deal to be learned about individual and social factors that make these interventions successful. As part of this effort to address hypertension in light a limited supply of health care workers, the TAsk-Shifting for Hypertension study was initiated at 32 health centers and district hospitals in Kumasi, Ghana. In order to facilitate the continued implementation of TASSH, this study set out explore participating

patients' perceptions of the program, key determinants in predicting optimal blood pressure outcomes, and community health nurses' perceptions of how TASSH can be sustained.

There is a large literature supporting the notion that discordance between patient and provider beliefs is a critical barrier to disease management over time. Often providers' biomedical perspectives of disease are not fully understood or accepted by patients, which leads to poor treatment adherence (Ogedegbe et al., 2004). Indeed, the importance of patients' beliefs about hypertension and treatment was highlighted in paper 1. Using the PEN-3 Cultural Model, patients' perceptions of hypertension and hypertension management, enablers/barriers, and nurturers to hypertension management were explored. Patients' perceptions of hypertension aligned with the educational material presented by the TASSH nurses in terms of causes of hypertension, side effects, and ways to effectively manage hypertension. Furthermore, patients felt that the attentiveness of the TASSH nurses enabled their success in the program, and that the combination of the educational materials, motivation interviewing, and counseling provided a nurturing environment which fostered confidence that they could manage their hypertension. This information is crucial as it allows us to realize the implications of the TASSH program, including that it was well received by key beneficiaries.

While there were many positive enabling and nurturing factors that stemmed from the TASSH program, notable barriers beyond the patients' control included financial limitations and difficulty with regular medication access. Indeed, there is a large literature of the importance of social determinants of health at the individual (intermediary), social (structural), and governmental level, all of which operate together to influence health and health behavior (WHO, 2008). The findings of paper 2 indicated the importance of structural determinants of health, or those beyond the individual level. Most notably, gender was a strong predictor of both changes

in systolic blood pressure between 6 and 12 months, as well as blood pressure control at the respective time periods. Additionally, the interaction between gender and region of residence was a significant predictor of systolic blood pressure change and blood pressure control; women in urban regions had the greatest decreases in systolic blood pressure between baseline and 6 months, and baseline and 12 months, and were also more likely to have controlled blood pressure at 6 and 12 months. Despite the significance of these two variables, behavioral factors such as medication adherence and physical activity, that are often significant predictors of blood pressure outcomes (Oladimeji, Fawole, Nguku, & Nsubuga, 2014; Mendis et al., 2010; Ono, Oyekigho, & Adeleke, 2006), were not associated with blood pressure change or control in this study. While this could be a result of reporting error on the part of patients, the results do indicate the importance of structural determinants of health, such as gender and region of residence, for hypertension management in the context of interventions. Thus, as the TASSH program continues to expand and evolve, or as other programs are developed, accounting for how the program could be tailored based on gender and region could contribute to improving outcomes across various subgroups within the intervention.

As TASSH was successful in assisting patients with blood pressure reduction, and was favorably perceived by participants, moving forward it is necessary to understand how the program can be sustained in the long term. The findings of paper 3 are critical for informing the sustainability of TASSH, as they provide a visual and graphical depiction of key issues related to program sustainability that need to be addressed. Key concepts included financial support, provision of primary health care, inadequate medication access, personnel training, and communication. Salient items that emerged were the importance of governmental financial assistance, having a continuous supply of medication, increasing the number of personnel

involved in TASSH, providing continued training for TASSH personnel, and facilitating patient-provider communication. Continuing training for the TASSH personnel to ensure continuity in program delivery, and improving patient-provider communication were noted as the most important and feasible items to address in the near future. Challenges to address in the longer term include sustainable mechanisms of financing the programs, preferably from the government, to allow the program to expand to other regions, hire more personnel, and provide a continuous supply of medication.

8.2 LIMITATIONS

There are several limitations of the study. First, the in-depth interviews were conducted among patients currently participating in the TASSH study and may be prone to bias, as participants may have altered their responses based on social desirability. Furthermore, selection bias was also a risk as patients with favorable experiences may have been more likely to agree than those with more negative experiences in TASSH. The concept mapping may also have been subject to these bias risks, as nurses currently facilitating the TASSH program participated.

Another important limitation is the use of patient self-report measures during follow-up visits to assess physical activity, medication adherence, alcohol use, and smoking. These measures are at risk for recall bias, which has the potential to skew study results. However, given the large number of patients, the limited resources in the area, and the length of time for follow-up, self-report measures were the best option for the study.

Finally, these results are limited to the TASSH study, and caution should be taken in generalizing these results to other contexts. The health care system and infrastructure in Ghana allowed for a task-shifting program like TASSH to be implemented at the community level, the

results may not be as applicable to other countries in sub-Saharan Africa with different health care infrastructures. However, the results to provide valuable information that can serve as a foundation for future inquiries in other regions.

8.3 STRENGTHS

Despite these limitations there are notable strengths to this study. First, this is one of few studies to examine stakeholder perceptions and patient outcomes in an on-going task-shifting intervention for hypertension management. Simultaneously examining perceptions and outcomes provides valuable information on whether perceived barriers and facilitators to hypertension management actually manifest as such over time. Second, to our knowledge, this study represents the first application of the PEN-3 Cultural Model to hypertension management in West Africa. The use of the PEN-3 Cultural Model allowed for an exploration of not only barriers to hypertension management, but also positive enablers and nurturers, particularly social support. Additionally, this model allowed us to understand how patients perceived hypertension in their cultural context.

Third, the use of concept mapping with community health nurses allowed for a unique opportunity in which barriers and enablers to sustaining the TASSH program over time were depicted visually and graphically in the language of participants. As sustainability of interventions is largely dependent on community stakeholders and community ownership (Iwelunmor et al., 2016), having an engaging dialogue that produces results accessible to stakeholders is critical moving forward. Finally, the use of multiple research methods (i.e. in-depth interviews, concept mapping, and quantitative analysis) offered imported insight on individual (e.g. patient beliefs and behaviors), socio-cultural (e.g. cultural understanding of

disease), and contextual factors (e.g. gender, region, health systems) that influence effective management of hypertension.

8.4 FUTURE DIRECTIONS

Increased interest in health in sub-Saharan Africa has received considerable attention in the literature for a variety of reasons. First, the area faces challenges associated with the dual burden of disease, in which high rates of infectious diseases are compounded by drastic increases in non-communicable diseases. Second, the region is in a severe health care worker shortage, particularly with limited access to physicians. Finally, over the years, many interventions have been implemented in sub-Saharan Africa, yet very few are sustained beyond their initial implementation period. This dissertation provides information that can contribute to future studies examining these challenges to good health in the region and contribute evidence to solutions to these challenges. As hypertension is one the most prevalent non-communicable diseases in sub-Saharan Africa, and specifically Ghana, future studies investigating effective and sustainable practices to manage hypertension are needed.

As evidenced in this study, training community health nurses to perform clinical duties related to hypertension diagnosis, treatment, and management was perceived favorably by patients, and facilitated improvement in knowledge and healthful behavior change. In developing new task-shifting interventions in different contexts, it is important to understand the perceptions of potential beneficiaries regarding hypertension, issues with hypertension management, and knowledge of hypertension and care. Because discordance between health care providers and patients results in poorer treatment compliance and worse health outcomes (Ogedegbe et al.,

2004), understanding these perceptions of intervention beneficiaries in necessary moving forward.

Future studies should also attempt to examine the various contextual factors that play a role in hypertension management. For instance, in addition to behavior modifications, it is important to examine the role of structural factors (e.g. gender, region of residence) in disease management. In the future this can be investigated in more detail by accounting for provider gender, education, years of experience, and typical patient load, as all of these could contribute to the quality of care patients receive. Additionally, subsequent studies can carefully examine the implementation fidelity of interventions, or the degree to which the intervention is implemented as intended (Breitenstein et al., 2010). This can be done through clinic observation, standardized protocol for clinic and program management, and finally assessing the perceived self-efficacy of health care providers in delivering the intervention.

As hypertension has increased dramatically in Ghana over the last several decades, developing, implementing, and sustaining strategies to promote blood pressure control over time are crucial. These strategies need to be developed with a thorough understanding of the context, which is resource constrained and challenged by a large burden of disease. Moving forward, it is paramount that these strategies are developed with sustainability in mind, so that they continue to provide community benefits after the initial implementation period. Continuously engaging stakeholders in dialogue about barriers and facilitators to hypertension management in the context of an intervention, acceptability of an intervention, and how the intervention will be implemented day-to-day is one strategy to account for this moving forward. Utilizing the CHPS network and training CHOs in the WHO-PEN protocol can provide a starting point for expanding the capacity of TASSH. Additionally, researchers and program implementers can

work with to facilitate buy-in from policy makers to support the program through a top-down mechanism.

8.5 IMPLICATIONS FOR BLOOD PRESSURE CONTROL

Despite the drastic rise in hypertension incidence in the 1970's, there has been little progress in Ghana with controlling blood pressure. Evidence suggests that hypertension remains a major health problem in Ghana, as the second greatest contributor to outpatient morbidity and mortality among adults (Mayosi, 2013). The findings of this study can be useful as strategies to overcome challenges to hypertension management, such as the extreme physician shortage, are developed and implemented moving forward. Indeed, the findings of paper 1 highlight that task-shifting clinical duties for hypertension from physicians to community health nurses, was seen as beneficial by patients, and as crucial for improving their health. Paper 1 also highlights challenges faced by patients, including inconsistent access to anti-hypertensive medication. This paper also describes positive aspects of the intervention and community that enable hypertension management, including the supportive role of the nurses and the social support provided by the TASSH program. This is important in the cultural context of Ghana, as well as other countries dealing with high burdens of hypertension, as emphasizing only changing negative perceptions and behaviors can be limiting because it fails to consider enabling and nurturing factors that might influence hypertension management.

In many instances, protocols for managing hypertension focus more on individual level behavior, which discounts the larger social and cultural context in which disease occurs. The findings of paper 2 support the need to focus on broader, structural factors such as gender and region of residence that may influence patients' willingness or ability to comply with treatment.

Thus more tailored approaches to hypertension management based on these broader contextual factors may be needed moving forward.

Finally, as interventions are developed and implemented, their ability to be sustained must be at the forefront of planning and implementation efforts. Paper 3 provides novel information that has implications for health can professionals and researchers moving forward in developing strategies for hypertension management. Important factors to address moving forward include consistent training for nurses and staff to facilitate positive communication with patients regarding adherence to behavior changes and continued participation in the program. Furthermore, community health nurses suggested that involving additional health care workers such as pharmacists, dieticians, and community health workers can assist with expanding the program's reach. Finally, more challenging, but equally important factors to address include sustained financial support and buy-in from local government and national policy makers to facilitate internal infrastructure and support for interventions.

In summary, given the resource constraints and the severe physician shortage faced by Ghana health systems and the dramatic rise in hypertension over the years, innovative mechanisms of controlling and managing hypertension are needed. Task-shifting is one potential mechanism to mitigate the negative impacts of the physician shortage. The WHO Package of Essential Non-communicable diseases provides a foundation for training community health nurses in managing hypertension. However, in light of the health system's severe resource constraints, there is a need to scale-up task-shifting interventions, such as TASSH to have a meaningful impact on hypertension management at a population level. Developing guidelines which serve to address the use of task-shifting at a national level may go a long way in

promoting hypertension management over time, and potentially reduce negative health consequences associated with hypertension.

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APPENDIX A: PATIENT INTERVIEW GUIDE

Part 1: Demographics

1. Health care center affiliation _____

2. Age:

3. Sex: Male_____ Female_____

4. Highest level of education:

Part 2: General questions

1. How did you hear about TASSH?
2. What made you decide to participate in the program?
3. Do you have hypertension?
4. [If yes] Who told you that you have hypertension?

Part 3: Perceptions

1. [If yes to 3 & 4] What does having hypertension mean to you?
2. Can you tell me how things have been going for you so far in TASSH?
3. Are you satisfied with the way you have been managing your hypertension?

Part 4: Enablers

4. What did you like about TASSH?
5. What did you dislike about TASSH?
6. What would you change about TASSH?
7. How do you picture yourself at this time next year after TASSH is over?
8. Do you think the changes you've made will be something that you'll be able to continue to do on your own if and when the program ends? Why or why not?
9. Can you use the information you have learned in TASSH to make those changes?

Part 5: Nurturers

10. Did TASSH community health nurses increase your awareness about your eating patterns? Can you tell me more about that?
    a. Have you changed how you eat? Can you explain how you changed?
    b. What are some of the good things you have done to change your diet?
    c. What do you think is/was the biggest obstacle to changing how you eat?
11. Did TASSH community health nurses make you think more about your physical activity? Can you tell me more about that?
    a. How do you feel about physical activity since participating in TASSH?

b. What are some of the good things you have done to maintain your physical activity since starting TASSH?
c. What do you think is the biggest obstacle to increasing your physical activity?