The Relationship between Family Support and Medication Adherence among Hypertensive Patients in Kenya

by

Shangzhi Xiong

Graduate Program in Global Health
Duke Kunshan University and Duke University

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Xuefeng Zhong

Thesis submitted in partial fulfillment of
the requirements for the degree of
Master of Science in the Graduate Program
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2018

ABSTRACT

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Abstract

Background

Hypertension (HTN) is a serious public health problem causing an enormous disease burden globally. Non-adherence to medication among hypertensive patients has been identified as one of the major contributors to the poor control of blood pressure (BP). Despite the paucity of reliable, up-to-date data on hypertension in Kenya, existing literature suggests high HTN prevalence in that nation. Additionally, the control of hypertension in Kenya faces many challenges, including the low medication adherence rates among its hypertensive population.

Hypertension as a chronic disease requires long-term disease management, including taking medication daily and making important lifestyle changes. The role of family support for patients during this life-long process has been a topic of interest among many researchers.

The overarching goal of this study is to determine the quantitative and qualitative association between family support and medication adherence among hypertensive patients in Kenya.

Methods

A mixed-method cross-sectional study was conducted in three healthcare facilities in Nairobi, Kenya. A questionnaire and in-depth follow-up interview were included to achieve the quantitative and qualitative goals respectively.

The questionnaire consisted of five sections: demographic information; health and medical information; medication adherence measurements; family support and family function measurements; and BP measurements.

The in-depth follow-up interview was conducted among patients who were willing to participate after the questionnaire survey. An interview guide was designed to lead the semi-structured individual interview with a focus on exploring how family members may contribute to patients' HTN management.

Descriptive statistics were used to describe the patient profiles; Fisher's exact test and Chi-square test were used to compare the level of medication adherence and family support among different subgroups of patients; bivariate logistic regression was used to determine the predictors of medication adherence; and multiple logistic regression was used to examine the independent association between family support/function and medication adherence. Grounded theory was used to guide the thematic analysis of the qualitative data.

Results

A total of 104 patients participated in the study. The majority of participants were female (n = 71, 68.27%) and urban residents (n = 95, 91.35%), with a mean age of 56.61 (SD = 11.70).

The overall control rate of HTN among the patients was low, with only 33.98% of them under control. The percentage of highly adherent patients determined by the Morisky Green Scale was 55.77% and was 26.92% as determined by the Hill-Bone Scale. Based on the Perceived Social Support from Family Scale, most of the patients (82.69%) reported strong family support. The majority of patients (77.88%) were determined to have "functional" families by the Family Function APGAR Scale, and 22.12% had dysfunctional families. Both the bivariate logistic regression and multiple logistic regression generated non-significant results for the association between family support/function and medication adherence using either scale.

Three major themes were generated from the qualitative analysis: patients' family relationship and situation, patients' perceptions about HTN and medication, and patients' family in HTN management. The qualitative results suggested that patients' support from their family members is promising in improving HTN control and medication adherence. However, a low level of health knowledge among patients and their families may present substantial barriers to HTN patients' medication adherence.

Conclusion

Despite strong family support and a good family function level, HTN patients in Kenya have low medication adherence and are in a critical situation concerning BP control. Lack of health knowledge, limited involvement in patients' HTN care, and unavailability and unaffordability of antihypertensive medicines are important obstacles that compromise the positive effects of family support on HTN control in Kenya. Future HTN control interventions in Kenya should prioritize providing better health education to the patients and their families, raising people's awareness for hypertension screening and treatment, and further engaging patients' families in HTN care. Additionally, the Kenyan government should enhance its healthcare system to ensure people's accessibility to hypertension medicines and services.

Keywords: hypertension control, medication adherence, family support, family function, Kenya

Dedication

I dedicate this work to my caring family. Thanks to my father, Wangxin Xiong, and my mother, Xianglan Li, for their constant love and support. To my other family members who brought me warmth and contributed to who I am.

I also dedicate the work to my friends. My lovely classmates at DKU who have fought with me in every battle during my graduate studies. My precious old friends back in high school and college who have brought me enormous joy and courage.

Most importantly, I dedicate this work to all the hypertensive patients in Kenya, who was willing to take part in this project and shared their stories with me. I will pay back this commitment with my continuous efforts in Global Health.

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Abbreviations

APHRC	African Population and Health Research Center
BP	Blood Pressure
DBP	Diastolic Blood Pressure
DKU	Duke Kunshan University
HIV	Human Immunodeficiency Virus
AIDS	Acquired Immune Deficiency Syndrome
HTN	Hypertension
LMIC	Low-and-Middle Income Country
MOH	Ministry of Health
NCD	Non-Communicable Diseases
SBP	Systolic Blood Pressure
SSA	Sub-Saharan Africa
WHO	World Health Organization

1. Introduction

1.1 Hypertension Burden in Sub-Saharan Africa and the World

Hypertension (HTN) is a major public health problem affecting approximately over 1 billion people globally, contributing to excess morbidity, mortality, and direct and indirect health costs to the health care system. The World Health Organization (WHO) refers to hypertension as the "silent killer" worldwide (WHO, 2013). Global Burden of Disease data in 2016 showed that high systolic blood pressure (SBP) contributes to 8.88% of global Disability-Adjusted Life Years (DALYs), and high SBP is a risk factor responsible for nearly one fifth of global deaths (IHME, 2016). A recent comparison study even found that the loss of DALYs associated with high blood pressure increased from 95.9 million in 1990 to 143.0 million in 2015 (Forouzanfar, Liu, Roth, & et al., 2017).

There have been drastic increases in HTN prevalence in low and middle-income countries (LMICs), accompanied by low levels of awareness, treatment, and control in the populations (Fuentes, Ilmaniemi, Laurikainen, Tuomilehto, & Nissinen, 2000). In contrast to the common idea that HTN is more of a disease of the affluent, HTN is an increasingly severe threat for people in Sub-Saharan Africa (SSA) (Lim et al.). In the meantime, most SSA countries are still under a high burden of infectious diseases, such as HIV/AIDS, tuberculosis, and malaria. As a result, the combined disease burden in

those settings is causing an even greater economic burden (Gaziano, 2005; S. O. Oti, 2013), indicating urgent need for better control of hypertension.

1.2 Medication Adherence and Hypertension Control

1.2.1 Medication Adherence

Various studies have been conducted to address the problem of HTN, and non-adherence to medication among hypertensive patients has been identified as one of the major contributors to the poor control of blood pressure (BP). Medication adherence commonly refers to whether patients who have been diagnosed of a specific disease take their medications as prescribed, and whether they continue to take a prescribed medication (Ho, Bryson, & Rumsfeld, 2009).

1.2.2 Consequences of Medication Nonadherence

Early in 2003, the WHO emphasized in its medication adherence report that non-adherence to treatments is the most important cause of failure to achieve BP control (Sabete, 2003). Studies indicate that non-adherence to antihypertension medication results in poor control of BP and is thus a potential risk factor for cardiovascular conditions and all-cause mortality (S. Kim et al., 2016). Dragomir et al. (2010) corroborated this by demonstrating that low adherence contributes to increased risks of coronary disease, cerebrovascular disease, and chronic heart failure by 7%, 13%, and 42% respectively. Their study also found that low adherence to antihypertensive agents

led to a significant increase in hospitalization rates, generating greater healthcare costs which increase patients' financial burdens.

On the other hand, adherence to antihypertensive medication contributes to reductions in the prevalence of HTN and related complications. Studies have found that, after adjusting for confounding factors, adherence to antihypertension medications is significantly associated with better blood pressure control (Degli Esposti et al., 2002; Yue, Bin, Weilin, & Aifang, 2015). Higher levels of medication adherence have also been associated with a 34% reduction in the risk of heart failure among patients with HTN (Corrao et al., 2015).

1.2.3 Factors Influencing Medication Adherence

Existing studies have been conducted to determine the factors that influence medication adherence among hypertensive patients. As summarized in Diagram 1, there are three major kinds of attributable factors that cause non-adherence: disease-related factors, patient-related factors, and medication-related factors. Disease-related factors include the severity of symptoms, disease duration, and comorbidities (Calderon-Larranaga et al., 2016; Veronesi et al., 2007; Yue et al., 2015). Patient-related factors include gender, age, forgetfulness, awareness, relevant knowledge, and mental health (Holt et al., 2013; Khan, Shah, & Hameed, 2014; E. Y. Kim et al., 2007; Lemstra & Alsabbagh, 2014). Medication-related factors include drug tolerability, complexity of the

regimen, and side effects (Tedla & Bautista, 2016; Veronesi et al., 2007). Notably, for some of the variables such as gender, age, and the disease duration, there are inconsistencies among studies about the direction of effects on patients' medication adherence.

In order to lower blood pressure among hypertension patients, reduce the risks of cardiac events, and decrease the burden from hospitalization, it is critical to tackle those factors that influence patients' medication adherence and improve hypertensive patients' medication adherence levels.

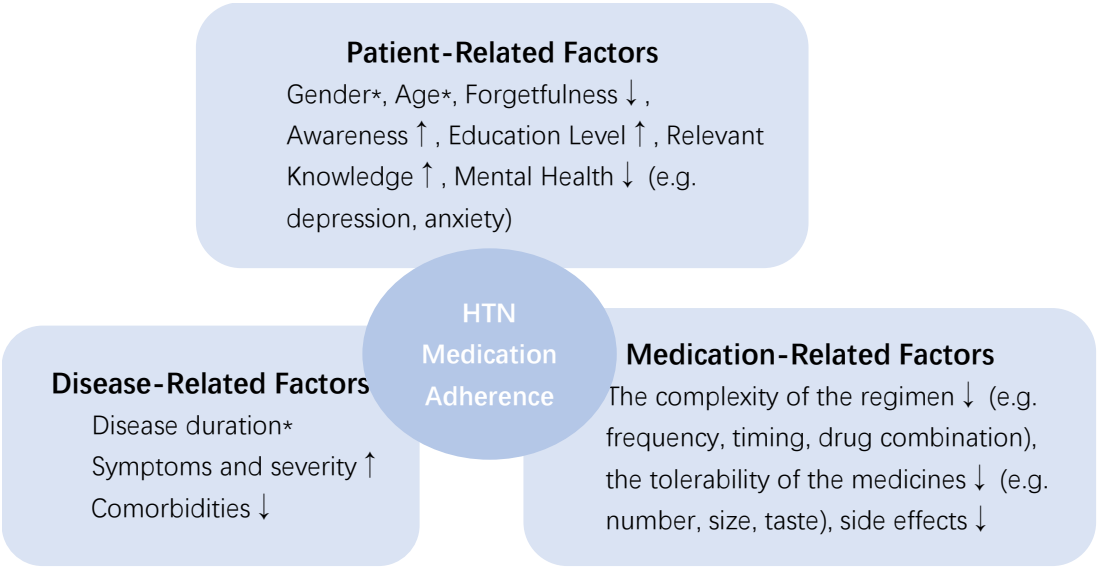

Figure 1: Factors Influencing Medication Adherence

↑ Factors positively associated with medication adherence level

↓ Factors negatively associated with medication adherence level

* Factors with inconsistencies about the direction of their influences on medication adherence

1.3 Hypertension Control in Kenya

1.3.1 Prevalence of Hypertension in Kenya

Despite the paucity of reliable, up-to-date data on HTN in Kenya, existing literature suggests high disease prevalence of HTN in the nation. One population-based cross-sectional study shows that the prevalence of HTN in urban Kenya reached 22.8% (20.7, 24.9) in 2013 (Joshi et al., 2014), which is comparable to the US, where the age-adjusted HTN prevalence was 29.1% in 2011~2012 (Nwankwo, Yoon, Burt, & Gu, 2013), corroborating the claim indicated earlier that HTN is no longer just a disease of wealthier, developed countries. Another study also showed that the average BP among Kenyan people increased from 125 mmHg in 1990 to around 130 mmHg in 2010 (Stevens et al., 2012).

1.3.2 Challenges in Kenya's Hypertension Control

The control of HTN in Kenya also faces many challenges. Insufficiency in the detection rate, health disparity among different populations, comorbidities with other diseases, poor living conditions, a low level of accessibility to healthcare, and low medication adherence rates among HTN patients all substantially contribute to the difficulty for HTN control in Kenya.

Firstly, there is daunting insufficiency in the awareness of HTN in Kenya (Samuel O Oti et al., 2013). One population-based survey conducted in an urban slum in

Nairobi discovered that the age-adjusted prevalence of HTN among the urban slum population in Nairobi was 23%, and the prevalence of pre-HTN was 60% (Joshi et al., 2014). However, what is disproportionate to such a high prevalence is the low detection rate of only 20%, and the proportion of subjects who had ever experienced BP screening was only one third (Joshi et al., 2014). It means that the majority of the hypertensive and pre-hypertensive population in the community are not aware of their conditions, which would lead to the continuing progression of BP related diseases.

Secondly, there is huge disparity in the prevalence of HTN among different demographic groups. One cross-sectional study conducted by the African Population and Health Research Center (APHRC) suggested that the prevalence, awareness, treatment, and control level of HTN in Kenya were different among different gender, age, education, ethnicity, wealth, and occupation groups (Samuel O Oti et al., 2013). For example, the prevalence of HTN among females is significantly higher than among males; older people have almost double the risks of younger people; and people of Kambo ethnicity are also of significantly higher risk of HTN (Samuel O Oti et al., 2013). Disparities in the different demographic groups indicates strong health inequalities in Kenya and results in further challenges to interventions that aim to achieve universal effectiveness for Kenya's HTN control.

Thirdly, studies in Kenya show that HTN is highly correlated with diabetes. One study suggested that one seventh of the hypertensive patients are also diabetic (Joshi et al., 2014), and another stated that people with diabetes are more likely to also suffer from HTN (Hulzebosch, van de Vijver, Oti, Egondi, & Kyobutungi, 2015). As a result, the comorbidity of HTN and diabetes further exacerbates the disease burden on patients and their families.

Fourthly, the control of HTN in Kenya is further challenged by the high prevalence of poor living conditions and low accessibility to healthcare. As the capital of Kenya, Nairobi consists primarily of urban slums. Specifically, approximately 60% of urban residents in Nairobi live in slums and similar-level conditions which are characterized by relatively insufficient infrastructures and limited access to healthcare (UN habitat, 2006). Such conditions add to the obstacles for Kenya's hypertensive patients to seeking care from healthcare centers and adhering to the treatments (van de Vijver, Oti, Agyemang, Gomez, & Kyobutungi, 2013).

Finally, in contrast to the high burden of HTN, the medication adherence level among the HTN patients in Kenya is low. A descriptive study conducted in the slum area in Kenya revealed that the level of medication adherence among hypertensive patients is very low as a result of low perceived need to take the medicines,

unaffordability, and other factors (Hulzebosch et al., 2015). Low level of medication adherence thus becomes an important barrier to Kenya's HTN control.

1.4 The Role of Patients' Family in Chronic Disease Control

Chronic diseases such as HTN require long-term disease management including taking medication daily and changes to lifestyle, specifically in refraining from certain harmful activities. The role of the patient's family throughout this life-long process has been a topic of interest for many researchers.

Many studies have identified the important role of patients' families in chronic disease management. Early in 1988, Russell et al. found that the results of the diabetic patients' diabetes-specific family-interaction scale were the "strongest and most consistent predictors" of their regimen adherence (Glasgow & Toobert, 1988). L. Fisher et al. found that family characteristics are significantly related with patients' self-care behaviors, and that interventions for disease control should take family norms, structures, and emotion management into consideration (L. Fisher et al., 2000). Cheryl et al. found that a supportive family environment is helpful for diabetic patients in sustaining healthy diet habits among older African American adults (Cheryl, Vivian, & Deborah, 2003).

1.4.1 Family Support

An important indicator of family support is the level of patients' perceived support from their family (hereinafter referred to as family support). The Perceived Social Support from Family (PSS-Fa) Scale invented by M. E. Procidano and K. Heller is a commonly used measurement to determine the level of family support (Procidano & Heller, 1983). A systematic review about social support and chronic disease self-management found two studies using the PSS-Fa Scale that showed positive relationships between family support and diabetic medication adherence (Mary, 2003). Another study by Oluwaseun S. Ojo et al. conducted in Western Nigeria found that strong perceived family support was an independent predictor of controlled BP (Ojo, Malomo, & Sogunle, 2016).

1.4.2 Family Function

Another dimension to consider is the family function level. Smilkstein et al. defined family function as an individual's satisfaction with five components of family function: Adaptation (i.e. utilization of intra and extrafamilial resources), Partnership (i.e. sharing of decision making), Growth (i.e. emotional maturation through mutual support), Affection (i.e. caring or loving relationship), and Resolve (i.e. commitment to devote time to each other) (Cárdenas, Vallbona, Baker, & Yusim, 1987; Smilkstein, 1978; Smilkstein, Ashworth, & Montano, 1982). Many studies have been conducted to examine

the association between family function level and people's health status and disease control. Kenneth et al. identified family dysfunction in their study as the best predictor for intrapartum complications and low birthweight among low-income black women (Reeb, Graham, Zyzanski, & Kitson, 1987). Family function has also been found to be associated with glycemic control (Konen, Summerson, & Dignan, 1993).

1.4.3 Patients' Family and Hypertension Control

As an overarching branch of chronic diseases, studies have also been conducted to determine the role of patients' families in HTN control. The qualitative study by Rosana et al. found that family involvement in patients' BP control was important, and that patients' lack of family support may destabilize the treatment plan (Costa & Nogueira, 2008). Ojo et al. determined the importance of family support in a quantitative way. Their study in western Nigeria showed that family support can be motivative for hypertensive patients to sustain their adherence to therapeutic plans, and that patients with strong perceived family support were about five times more likely to have better BP control than respondents with no or weak family support (Ojo et al., 2016). One study conducted in Spain found significantly better treatment adherence among those who "saw their relatives daily or nearly daily," which was defined in that paper as family support (Redondo-Sendino, Guallar-Castillon, Banegas, & Rodriguez-Artalejo, 2005).

So far, few studies have been conducted to determine to association between hypertensive patients' family support/function and their level of medication adherence.

1.5 Study Goals

1.5.1 Literature Summary

Diagram 2 presents a graphic summary of the literature review. Three domains of factors—disease-related factors, patient-related factors, and medication-related factors—influence hypertensive patients' medication adherence level, which further influences patients' HTN control outcome. At the same time, according to existing evidence, patients' families may help to increase patients' medication adherence level and thus contribute to HTN control, by tackling these three kinds of factors. For example, communications among family members may increase patients' knowledge about HTN (patient-related factor), families' emotional support may help patients overcome the intolerability of medicines (medicine-related factor), and families' reminders may mitigate patients' neglect of HTN because of lack of symptoms (disease-related factor).

Family support and family function will both be investigated in our study as a triangulation for the general construct of "the role of hypertensive patients' family and their family environment."

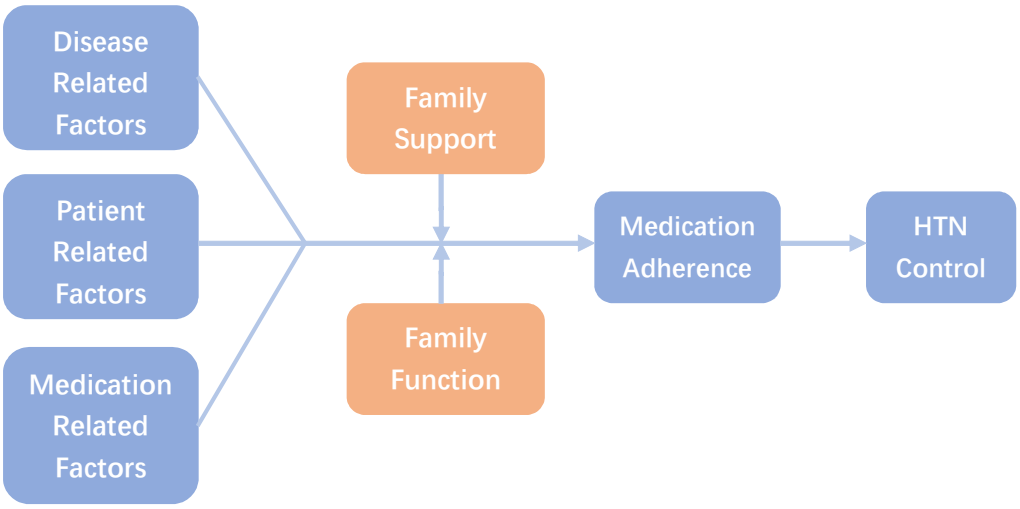

Figure 2: Graphic Summary of Literature Review on Medication Adherence

1.5.2 Study Objectives

The overarching goal of this study is to determine the quantitative and qualitative association between family support and medication adherence among hypertensive patients in Kenya.

Based on the existing literature, the present study hypothesizes that there is a positive relationship between family support and the level of medication adherence among hypertensive patients. In other words, the more support the hypertensive patients receive from their family, the more likely they are to adhere to doctors' prescriptions and suggestions.

Specifically, there are three major research objectives and their sub-objectives of this study:

1. To determine the overall levels of HTN control, medication adherence, family support, and family function among hypertensive patients in Kenya
    a) To compare the levels of the variables in different subgroups of patients
    b) To compare the results of patients' medication adherence determined by different adherence measurements
2. To examine the quantitative association between family support/function and medication adherence
    a) To identify other significant predictors for medication adherence
    b) To determine the independent association between family support/function and medication adherence
3. To qualitatively explore how hypertensive patients' families influence their medication adherence
    a) To explore the hypertensive patients' family conditions and relationships
    b) To further determine patients' perceived barriers to medication adherence
    c) To explore patients' opinions on how to improve their HTN control status

2. Methodology

2.1 Study Design

The study applies a mixed-method cross-sectional study design. A questionnaire and an in-depth follow-up interview were conducted to achieve the quantitative and qualitative goals respectively. The quantitative part of the study used questionnaires to determine patients' demographic characteristics, health conditions, medication taking behavior adherence to hypertension treatment, family support and family function, and blood pressure control. In the qualitative part that followed, by applying an in-depth interview method, we implemented further exploration of how those factors influenced patients' adherence to treatment, and what the possible solutions were to improve HTN control among the study population.

2.2 Study Setting and Participants

2.2.1 Study Setting

The study was conducted in three health facilities in Nairobi, Kenya —Lunga Lunga Hospital, Uhai Neema Hospital, and Korogocho Health Center.

2.2.2 Study Population

The study population of interests is Kenya's hypertensive patients who have been diagnosed of HTN and are prescribed to take anti-hypertensive medicines.

2.2.3 Sample-size

As an exploratory cross-sectional study of the relationships between variables of interest, we used the law of large numbers (i.e., > 30 for continuous variables and ~100 for categorical variables) to decide the sample size. For the in-depth interviews, we intended to conduct 15 or until we reached information saturation.

2.2.4 Sampling Strategy

The sampling strategy that was used in this study was convenient sampling. The researchers, with the assistance of the clinic personnel, approached hypertensive patients when they visited the clinics.

2.2.5 Inclusion Criteria

i. Patients diagnosed of hypertension

ii. Adult (> 18 years old)

iii. Able to provide informed consent

iv. Patients who can speak at least English or Kiswahili

2.2.6 Exclusion Criteria

i. Patients who are severely ill

ii. Patients who have trouble communicating with reseachers

2.3 Data Collection Tools

2.3.1 Questionnaire

The questionnaire includes five major sections (Appendices 1/2).

The first part inquires to the demographic features of the participants, including their gender, age, race, family composition, and family income. The variables were used to describe the demographic profile of the patients, and some were included in analytical analysis as covariates.

The second part is about the participants' health and medical conditions, such as their hypertension history, medication situation, and other health conditions. The variables were used to describe the health and disease profile of the patients, and some were included in analytical analysis as covariates.

The third part measures the level of adherence to hypertension treatments, which is the primary outcome variable of the study.

The fourth part measures patients' family support and family function levels, which are the primary independent variables of the study.

The fifth part of the questionnaire is the BP measurement, filled by researchers after measuring each patient's BP. Two readings for both systolic pressure and diastolic pressure were recorded. The BP values were used to determine the BP control status of the patients.

2.3.2 Interview Guide

We conducted semi-structured interviews after the questionnaire survey, based on a pre-defined interview guide (Appendix 3/4). The interview guide was designed with the intention to further explore the situation of the patients' blood pressure control, how family support influences their medication adherence, and what might be the solutions to improve the patients' medication adherence.

2.3.3 Translation

Both the questionnaire and interview guide were translated from English into Swahili to fit the need of better communication with local people.

We had one translator who had no knowledge about this project translate the instruments from English to Swahili and had another translator, who also did not have any related information, back-translate it into English. We had a meeting with the two translators and compared the back-translated English versions of instruments and the original English versions. We made revisions to the Swahili instruments based on the consensus between the two translators.

2.4 Data Collection Procedure

Four researchers took part in the data collection procedures, including two English-only speakers and two local researchers who can speak both English and

Swahili. Depending on the patients' language preferences, they were approached by researchers of the different language capacities.

Before disseminating the questionnaires to the participants, we made sure to obtain the patients' informed consent for participating in the survey. Researchers gave each patient a hard copy of the informed consent form in the language that the participants felt comfortable with, either English or Swahili, and went through it with them in their language of choice. Participants could ask researchers any questions concerning the project at any time.

After receiving the participants' informed consent, researchers disseminated the tablet-based electronic questionnaires to the patients. The participants could choose the language of the questionnaire based on their preferences. To make sure that participants understood the questions correctly, the researchers stayed with the participants and assisted them with any doubts they had about the questions.

After participants submitted their filled questionnaires to the researchers, the trained researchers would help the patients measure their blood pressure twice and recorded the results on the last part of the questionnaire.

After the survey, the participants were invited to the individual in-depth interviews. An independent informed consent form was provided to the willing interviewees to obtain their willingness to be interviewed and recorded. The interviewer

used professional recording software on their cell phones, and the audio recordings were deleted immediately after the transcriptions were completed.

2.5 Variable Definitions

2.5.1 Medication Adherence

The primary outcome variable of the study is the level of medication adherence. Medication adherence was measured by two validated scales in this study: the Morisky Green Levine Medication Adherence Scale (thereinafter referred to as Morisky Green Scale) (Beyhaghi, Reeve, Rodgers, & Stearns, 2016), and the Hill-Bone Compliance to High Blood Pressure Therapy Scale (M. T. Kim, Hill, Bone, & Levine, 2000). The Morisky Green Scale consists of four yes or no questions (Appendix 1/2, part 3, question 1~4). For each question, yes is coded as 1, and no as 0. The sum of the codes of the four questions is categorized into three levels, where 0 stands for high adherence, 1 or 2 stands for medium adherence, and 3 or 4 for low adherence. In later analysis, due to the small percentage of patients reporting low adherence, I combined the two categories "low adherence" and "medium adherence" to "low and medium adherence", in order to ensure the quality of regression models.

The Hill-Bone Compliance to High Blood Pressure Therapy Scale has 14 questions (Appendix 1/2, section 3, question 5~18). The scale consists of three subscales: the medication-taking adherence subscale with nine of the questions (question 5, 6, and

12~18), the healthy-diet adherence subscale with three of the questions (question 7~9), and the appointment-keeping adherence with two of the questions (question 10 and 11). Our data analysis only uses the results of the Hill-Bone Medication-Taking Adherence subscale (hereinafter referred to as Hill-Bone Scale). Each item of the Hill-Bone Scale can be answered on a 4-point Likert-scale, which is coded as 1 = none of the time, 2 = some of the time, 3 = most of the time, and 4 = all the time. The total scores on the scale range from 9 to 36 with higher scores reflecting poorer adherence to antihypertensive drug therapy. Scores equal to 9 are labeled as "perfect adherence," and scores higher than 9 are labeled as "non-perfect adherence" (Alsolami, Correa-Velez, & Hou, 2015).

2.5.2 Family Support and Family Function

The primary explanatory variables of interest to our study are the patients' family support and family function levels. Family support level was measured by the Perceived Social Support from Family (PSS-Fa) Scale (Procidano & Heller, 1983). It is a 20-item self-report scale, with each of the questions having three options: "yes," "no," or "I don't know" (Appendix 1/2, section 5.1). Each "yes" is coded as 1 while other responses are coded as 0. Items 3, 4, 16, 19, and 20 are reverse coded, wherein a "no" response is scored as 1 and other answers as 0. The range of the summated scores is 0~20, which is categorized as strong family support (≥ 11), weak family support (7–10), and no family support (≤ 6) (Ojo et al., 2016).

The Family Function level was measured by the Family Function APGAR Scale (Smilkstein, 1978) (Appendix 1/2, section 5.2). The response options of the 5-item scale describe the degree of the individual's satisfaction of his/her family function on a 3-point scale ranging from 0 (hardly ever), to 1 (some of the time), to 2 (almost always). Higher scores indicate greater satisfaction with family functioning. The summative scores range from 0 to 10, wherein scores less than 6 are categorized as "Dysfunctional" and scores equal to or higher than 6 as "Functional" (Reeb et al., 1987; Smilkstein, 1978).

2.5.3 Other Variables

The means of the two readings of systolic and diastolic blood pressure were calculated respectively to determine the blood pressure control status, wherein patients with systolic BP lower than 140 mmHg and diastolic BP lower than 90 mmHg are defined as having "controlled" BP, while patients with systolic BP from 140~160 mmHg or diastolic BP from 90~100 mmHg are defined as having "Stage 1" high blood pressure, and patients with systolic BP higher than 160 mmHg or diastolic BP higher than 100 mmHg are designated as having "Stage 2" high blood pressure.

2.6 Data Management and Analysis

A mixed method analytical strategy is applied in the data analysis process. For the quantitative analysis, descriptive statistics were used to describe the patients' profiles. Means and standard deviation were used to describe the continuous variables,

and frequencies and percentages were used to describe the categorical variables (objective 1). Fisher's exact tests and Chi-square tests were used to determine the significance of differences in family support, family function, and medication adherence levels among different demographic subgroups of patients (objective 1a and 2a). Chi-square tests were also used to compare the results of different adherence measurements (objective 1b). Bivariate logistic regressions were applied to identify significant predictors of medication adherence (objective 2 and 2a). Finally, multiple logistic regressions were applied to determine the independent associations between predictors and patients' medication adherence (objective 2b).

For the qualitative analysis (objective 3, 3a, and 3b), after the interviews were transcribed, thematic analysis was used for the qualitative data. We used grounded theory to guide the iterative process of qualitative analysis. The researcher conducted the coding of the transcripts after being immersed with the contents. Major themes were then identified based on the coding results, and key information and patterns were elicited afterwards.

The questionnaire software used for data collection was survey CTO (version 1.402). All data transfer was conducted through Duke BOX. The statistical analysis was conducted by using Stata SE 64, and the qualitative analysis of data was based on NVivo 11.

2.7 Ethical Consideration

The study was approved by the IRB committees of Duke Kunshan University, Africa Population Health Research Center (APHRC), and the Ethics and Scientific Research Committee of African Medical and Research Foundation (AMREF).

3. Quantitative Results

This chapter presents the quantitative results of the data collection from the 104 sampled patients. The first section of this chapter is the quantitative description of the profile of sample patients. First, we will present the patients' demographic characteristic profile, followed by their health and disease information profile. Then we will describe the patients' medication-taking behavior and medication adherence status (objective 1), followed by the overall family support and family functioning profile of sampled patients (objective 1).

The second section of this chapter presents the level of family support and family function in different demographic subgroups of the patient sample (objective 1a).

The third section of this chapter discusses the consistency of the results from three different measurements of medication adherence: the Morisky Green Levine Adherence Scale (MGLS), the Hill-Bone Medication-Taking Adherence Scale (Hill-Bone scale), and the 80% Cut-Off Point Adherence Scale (objective 1b).

The fourth section of this chapter presents the level of medication adherence in different demographic subgroups of the sample patients, determined by MGLS and Hill-Bone scale respectively (objective 1a).

The fifth section of this chapter shows the results of bivariate logistic regression of potential determinants of medication adherence using the two medication adherence scales (objectives 2 and 2a).

The last section of this chapter presents the multiple logistic regression of predictors of medication adherence using four logistic models (objective 2b).

3.1 Profiles of Study Participants

3.1.1 Demographic Profile of Study Participants

A total of 104 hypertensive patients participated in the questionnaire survey, with 9 of them from Uhai Neema Hospital, 45 of them from Lunga lunga Hospital, and 50 from Korogocho Health Center. The patients' detailed demographic characteristics are shown in Table 1. More than half of the participants are females (68.3%) with the majority being urban residents (91.4%). The mean age of sample patients is 56.6, with the standard deviation (SB) being 11.7. The overall education level of the sampled patients is low, with most patients having no more than primary education. Half of the sample patients were unemployed, with 39.4% of the patients having no formal family income. The majority of patients were married (66.4%). Almost all the patients were Christian, with only two exceptions, one of them being Muslim, and the other one Hindu. Most of the participants live with their family members (92.3%), and among those, most of them

live with their offspring and/or spouse, while a minority of them live with their older family members. Eight of the participants (7.7%) live alone.

Table 1: Demographic Profile of Study Participants

	Male (n=33)		Female (n=71)		Total (n=104)	
	N	**%**	**N**	**%**	**N**	**%**
Age (missing=3)						
Mean (SD)	60.7 (10.2)		54.7 (11.9)		56.6 (11.7)	
≤50 years old	6	18.8	25	36.2	31	30.7
51~60 years old	13	40.6	22	31.9	35	34.7
> 60 years old	13	40.6	22	31.9	35	34.7
Residency						
Rural	2	6.1	7	9.9	9	8.7
Urban	31	93.9	64	90.1	95	91.4
Education						
No formal schooling	2	6.1	13	18.3	15	14.4
< Primary school	8	24.2	33	46.5	41	39.4
Primary school complete	9	27.3	7	9.9	16	15.4
≥Secondary school	14	42.4	18	25.4	32	30.8
Employment						
Employed	22	66.8	30	42.3	52	50.0
Unemployed	11	33.3	41	57.8	52	50.0
Monthly Income						
Median (IQR)	6000 (14000)		2000 (5000)		3000 (10000)	
No income	9	27.3	32	45.1	41	39.4
≤ 5000 KSh	6	18.2	22	31.0	28	26.9
> 5000 KSh	18	54.6	17	23.9	35	33.7
Marriage Status						
Married	32	97.0	37	52.1	69	66.4
Unmarried	1	3.0	9	12.7	10	9.6
Divorced	0	0.0	9	12.7	9	8.7
Widowed	0	0.0	16	22.5	16	15.4
Religion						
Christian	31	93.9	69	97.2	100	96.2
Others (Muslim/Hindu)	2	6.1	2	2.8	4	3.9
# of family members the patient lives with						
Mean (SD)	4.4 (2.8)		3.7 (2.2)		3.9 (2.4)	

0	3	9.1	5	7.0	8	7.7
1~4	13	39.4	38	53.5	51	49.0
>4	17	51.5	28	39.4	45	43.3
Who the patient lives with						
Alone	3	9.1	5	7.0	8	7.7
Mother	2	6.1	6	8.5	8	7.7
Father	1	3.0	2	2.8	3	2.9
Spouse	25	75.8	27	38.0	52	50.0
Son	24	72.7	42	59.2	66	63.5
Daughter	24	72.7	49	69.0	73	70.2
Grandchild	5	15.2	22	31.0	27	26.0
Cousin	0	0.0	0	0.0	0	0.0
Others*	1	3.0	5	7.0	6	5.8

* For those who live with "Others": two females lived with their nephews, three lived with friends, and one male lived with his brother.

3.1.2 Disease and Health Profile of Study Participants

Table 2 shows the patient profile with their disease and health information. Most of the participants reported their perceived health status as being good (42.3%) or fair (43.3%), while only a few of them reported poor (8.7%), very good (4.8%), or excellent (0.96%). The overall duration of the patients' HTN condition is long, with the mean duration being 5.9 years (SD = 6.9), and only 24.3% of the patients had been diagnosed with HTN for less than one year. The duration of the patients taking medication is consistent with their duration of HTN diagnosis, with only a few exceptions. The overall control rate of HTN among the patients is low, with only 34.0% of them under control, while 29.13% of them are at stage one HTN and 37.0% of them at stage two HTN.

Hospital and primary health center are both important places for the patients' hypertension diagnosis (50.0% and 45.2% respectively).

Most of the patients answered that they thought medication adherence for hypertension is very important (86.5%), while just some patients thought it is only moderately important (6.7%), somewhat important (2.9%), or a little important (2.9%). One patient thought it is not important (0.96%). The majority of the patients had their blood pressure measured monthly (71.2%), and by medical professionals in the clinics (92.3%). Most of the patients (82.7%) reported that there were no side effects of the medicines they were prescribed, while 18 patients had certain levels of side effects. No patient reported very severe side effects. More than half of the patients agreed (51.0%) or strongly agreed (14.4%) that hypertension influenced their quality of life.

In terms of the patients' own perceived level of HTN-related knowledge, 49.0% of the patients thought they had good knowledge, 27.8% reported very good or excellent, and 23.1% of the patients thought they had fair or poor knowledge about HTN. Patients' opinions about their families' HTN knowledge is generally lower. More than half of the patients thought their families' knowledge was fair or poor (33.7% and 19.2% respectively), while only 6.7% of the patients though their families had very good or excellent knowledge.

More than half of the patients (60.6%) did not have any comorbidities. The most common comorbidity in the sample was diabetes (18.3%). The mean duration for the comorbidity was 7.4 years (SD = 6.4). Most of the patients (73.1%) were not covered by health insurance.

Table 2: Disease and Health Profile of Study Participants

	Male (n=33)		Female (n=71)		Total (n=104)	
	N	**%**	**N**	**%**	**N**	**%**
Perceived Health Status						
Excellent	1	3.0	0	0.0	1	1.0
Very Good	2	6.1	3	4.2	5	4.8
Good	16	48.5	28	39.4	44	42.3
Fair	10	30.3	35	49.3	45	43.3
Poor	4	12.1	5	7.0	9	8.7
Duration of having HTN (years) (missing=1)						
Mean (SD)	4.4 (4.1)		6.5 (7.8)		5.9 (6.9)	
< 1 year	7	21.9	18	25.4	25	24.3
1~2 years	8	25.0	10	14.1	18	17.5
2~5 years	7	21.9	16	22.5	23	22.3
> 5 years	10	31.3	27	38.0	37	35.9
Duration of taking anti-HTN medicines (years) (missing=3)						
Mean (SD)	4.0 (4.0)		5.8 (7.3)		5.3 (6.5)	
< 1 year	8	25.8	21	30.0	29	28.7
1~2 years	8	25.8	7	10.0	15	14.9
2~5 years	7	22.6	19	27.1	26	25.7
> 5 years	8	25.8	23	32.9	31	30.7
Blood pressure (mmHg) (missing=1)						
Systolic BP mean (SD)	149.2 (24.5)		147.9 (20.6)		148.3 (21.8)	
Diastolic BP mean (SD)	89.3 (12.3)		89.2 (12.8)		89.2 (12.6)	
Controlled	12	36.4	23	32.9	35	34.0
Uncontrolled-Stage 1	9	27.3	21	30.0	30	29.1
Uncontrolled-Stage 2	12	36.4	26	37.1	38	36.9
Places of HTN diagnosis						
Primary Health Center	14	42.4	33	46.5	47	45.2
Hospital	14	42.4	38	53.5	52	50.0
Others*	5	15.2	0	0.0	5	4.8

Perceived importance of medication adherence						
Very important	29	87.9	61	85.9	90	86.5
Moderately important	1	3.0	6	8.5	7	6.7
Somewhat important	1	3.0	2	2.8	3	2.9
A little important	1	3.0	2	2.8	3	2.9
Not important	1	3.0	0	0.0	1	1.0
Frequency of BP measurement						
Doesn't measure	2	6.1	1	1.4	3	2.9
Every 3~4 days	2	6.1	2	2.8	4	3.9
Every week	1	3.0	8	11.3	9	8.7
Every month	23	69.7	51	71.8	74	71.2
Less than every month	5	15.2	9	12.7	14	13.5
Person who help with the patients' BP measurement						
Oneself	1	3.0	1	1.4	2	1.9
Family members	1	3.0	1	1.4	2	1.9
Medical professionals	29	87.9	67	94.4	96	92.3
NGO volunteers	1	3.0	1	1.4	2	1.9
Severity of side effects from anti-HTN medicines						
Very severe	0	0.0	0	0.0	0	0.0
Moderately severe	1	3.0	3	4.2	4	3.9
Somewhat severe	1	3.0	5	7.0	6	5.8
Just a little	1	3.0	7	9.9	8	7.7
No side effects	30	90.9	56	78.9	86	82.7
The extent to which the patient agreed hypertension influenced his/her quality of life						
Strong disagree	1	3.0	2	2.8	3	2.9
Disagree	9	27.3	9	12.7	18	17.3
Neutral	4	12.1	11	15.5	15	14.4
Agree	14	42.4	39	54.9	53	51.0
Strongly agree	5	15.2	10	14.1	15	14.4
Patients' perceived level of his/her knowledge about HTN						
Excellent	3	9.1	6	8.5	9	8.7
Very good	4	12.1	16	22.5	20	19.2
Good	17	51.5	34	47.9	51	49.0
Fair	6	18.2	11	15.5	17	16.4
Poor	3	9.1	4	5.6	7	6.7
Patients' perceived level of his/her family's knowledge about HTN						
Excellent	0	0.0	2	2.8	2	1.9
Very good	3	9.1	2	2.8	5	4.8
Good	14	42.4	28	39.4	42	40.4
Fair	9	27.3	26	36.6	35	33.7
Poor	7	21.2	13	18.3	20	19.2

Comorbidities						
None	18	54.6	45	63.4	63	60.6
Diabetes	6	18.2	13	18.3	19	18.3
Ulcers	4	12.1	3	4.2	7	6.7
Arthritis	2	6.1	4	5.6	6	5.8
Other diseases**	3	9.1	6	8.5	9	8.7
Duration of having comorbidities (years) (missing=66)						
Mean (SD)	7.0 (5.2)		7.6 (7.1)		7.4 (6.4)	
< 1 year	1	7.7	3	12.0	4	10.5
1~2 years	0	0.0	3	12.0	3	7.9
2~5 years	6	46.2	8	32.0	14	36.8
> 5 years	6	46.2	11	44.0	17	44.7
Coverage of health insurance						
Yes	8	24.2	20	28.2	28	26.9
No	25	75.8	51	71.8	76	73.1

* Four males were first diagnosed with HTN from "other" places, including two of them from local NGOs, one from a pharmacy, and one from local volunteers.

** Patients with "other" diseases include two females with Asthma, two females with mental disorders, and another five patients with pneumonia, chest problems, stomach problems, kidney problems, and allergies, respectively.

3.1.3 Medication-taking Behavior and Adherence Profile of Study Participants

This section presents the patients' medication usage related situations; detailed information is provided in Table 3. The majority of patients were prescribed to take one (47.5%) or two (41.4%) pills per day. Among those who remember the number of kinds of medicines they were prescribed, most of the patients (72.0%) were prescribed to take only one kind of medicine, while 25.6% were prescribed two kinds, and 2.4% three kinds. The most commonly used medicines were HCTZ (39.8%) and Antenol (22.3%). Any other kinds of medicine were used in less than 5.0% of the patients. The overall mean score of

the 80% cut-off scale was 0.8 (SD = 0.4), and the percentage of adherent patients determined by this scale was 76.8%. The overall mean score of the Morisky Green Scale was 0.7 (SD = 0.9), and the percentage of highly adherent patients determined by it was 55.8%, medium-level adherent patients 39.4%, and low-adherence patients 4.8%. The overall mean score of Hill-Bone Scale was 11.3 (SD = 2.7), and the percentage of "perfectly adherent" patients determined by this scale was 26.9%.

Table 3: Medication-Taking Behavior and Adherence Profile of Study Participants

	Male (n=33)		Female (n=71)		Total (n=104)	
	N	**%**	**N**	**%**	**N**	**%**
# of kinds of anti-HTN medicines prescribed (missing=22)						
One	17	77.3	42	70.0	59	72.0
Two	5	22.7	16	26.7	21	25.6
Three	0	0.0	2	3.3	2	2.4
Kinds of anti-HTN medicines prescribed (missing=1)						
HCTZ	14	43.8	27	38.0	41	39.8
Antenol	5	15.6	18	25.4	23	22.3
Enalapril	1	3.1	4	5.6	5	4.9
Nifedipine	0	0.0	3	4.2	3	2.9
Acepril	0	0.0	2	2.8	2	1.9
Nifelat	0	0.0	2	2.8	2	1.9
Others*	1	3.1	1	1.4	2	1.9
Don't remember	15	46.9	24	33.8	39	37.9
# of pills prescribed to take per day (missing=5)						
One	14	46.7	33	47.8	47	47.5
Two	14	46.7	27	39.1	41	41.4
Three	2	6.7	5	7.3	7	7.1
Four	0	0.0	2	2.9	2	2.0
Six	0	0.0	2	2.9	2	2.0
80% cut-off scale (missing=5)						
Score mean (SD)	0.7 (0.5)		0.8 (0.4)		0.8 (0.4)	
Adherent	21	70.0	55	79.7	76	76.8

Non-adherent	9	30.0	14	20.3	23	23.2
Morisky Green Levine Medication Adherence Scale						
Score mean (SD)	0.6 (0.9)		0.7 (0.9)		0.7 (0.9)	
High adherence	20	60.6	38	53.5	58	55.8
Medium adherence	12	36.4	29	40.9	41	39.4
Low adherence	1	3.0	4	5.6	5	4.8
Hill-Bone Compliance to High Blood Pressure Therapy Scale						
Score mean (SD)	11.7 (3.8)		11.2 (2.1)		11.3 (2.7)	
Perfect adherence	7	21.2	21	29.6	28	26.9
Non-perfect adherence	26	78.8	50	70.4	76	73.1

* Other medicines the patients are prescribed include Ozical, Mixtard, Presartan H50, Vasopril, Lozart, etc.

3.1.4 Family Support and Family Function Profile of Study Participants

Table 4 shows the sampled patients' profile of their family support level and family function level determined by the Perceived Social Support from Family Scale (PSS-Fa) and the Family Function APGAR Scale respectively. The mean score of the PSS-Fa scale was 15.1 (SD = 4.9). Most of the patients (82.7%) reported strong family support, while 12.5% of the patients reported no family support and 4.8% weak family support. As for the family function level, the mean score determined by the APGAR scale was 8.1 (SD = 2.9). The majority of the patients (77.9%) were determined to have a "functional" family by the scale, and 22.1% were dysfunctional.

Table 4: Family Support and Family Function Profile of Study Participants

	Male (n=33)		Female (n=71)		Total (n=104)	
	N	%	N	%	N	%
Perceived Social Support from Family Scale (PSS-Fa)						
Score mean (SD)	16.6 (3.8)		14.5 (5.2)		15.1 (4.9)	
No Family Support	2	6.1	11	15.5	13	12.5
Weak Family Support	1	3.0	4	5.6	5	4.8
Strong Family Support	30	90.9	56	78.9	86	82.7
Family Function APGAR Scale						
Score mean (SD)	8.8 (2.4)		7.7 (3.0)		8.1 (2.9)	
Dysfunctional	4	12.1	19	26.8	23	22.1
Functional	29	87.9	52	73.2	81	77.9

3.2 Level of family support and function in subgroups of sampled patients

This section breaks down the 104 sampled patients into different demographic subgroups and shows the level of family support and family function within the subgroups. Fisher's exact test or Chi-square test was used to determine the significance of differences among the subgroups.

3.2.1 The Level of Family Support in Subgroups of Study Participants

Table 5 shows the detailed information about the level of family support in the demographic subgroups determined by the PSS-Fa Scale. Among the sampled patients, male patients (P = 0.084), aged between 51 to 60 (P = 0.40), living in rural regions (P = 1.000), with primary school education (P = 0.83), employed (P = 0.22), and with monthly

income higher than 5000 KSh (P = 0.17), show higher percentages of strong family support than their demographic counterparts. However, none of the differences in those subgroups were statistically significant according to their Fisher's exact P values. Patients who live with more than four family members had the highest percentage of strong family support, and patients who live alone had the lowest percentage of strong family support than other patients, but the difference in this group is also non-significant. The only statistically significant group is the marital status, as those who were married or widowed had a higher percentage of strong family support (87.0% and 87.5% respectively) than those who were not married or were divorced (50.0% and 77.8% respectively) (P = 0.018).

Table 5: The Level of Family Support in Subgroups of Study Participants

	No Family Support		Weak Family Support		Strong Family Support		Fisher's exact P value
	N	**%**	**N**	**%**	**N**	**%**	
Overall							
	13	12.5	5	4.8	86	82.7	
Age (missing=3)							
≤50 years old	4	12.9	4	12.9	23	74.2	0.084
51~60 years old	2	5.7	1	2.9	32	91.4	
> 60 years old	6	17.1	0	0.0	29	82.9	
Gender							
Male	2	6.1	1	3.0	30	90.9	0.40
Female	11	15.5	4	5.6	56	78.9	
Residency							
Rural	1	11.1	0	0.0	8	88.9	1.00
Urban	12	12.6	5	5.3	78	82.1	
Education level							

No formal schooling	3	20.0	1	6.7	11	73.3	0.83
< primary school	6	14.6	2	4.9	33	80.5	
Primary school	1	6.3	0	0.0	15	93.8	
≥Secondary school	3	9.4	2	6.3	27	84.4	
Employment status							
Employed	5	9.6	1	1.9	46	88.5	0.22
Unemployed	8	15.4	4	7.7	40	76.9	
Monthly income							
No income	7	17.1	2	4.9	32	78.1	0.167
≤ 5000 KSh	5	17.9	2	7.1	21	75.0	
> 5000 KSh	1	2.9	1	2.9	33	94.3	
Marital status							
Unmarried	2	20.0	3	30.0	5	50.0	0.018
Married	8	11.6	1	1.5	60	87.0	
Divorced	1	11.1	1	11.1	7	77.8	
Widowed	2	12.5	0	0.0	14	87.5	
Number of family members the patient lives with							
0	2	25.0	0	0.0	6	75.0	0.65
1~4	7	13.7	2	3.9	42	82.4	
>4	4	8.9	3	6.7	38	84.4	
Religion							
Christian	13	13.0	5	5.0	82	82.0	1.00
Others (Muslim/Hindu)	0	0.0	0	0.0	4	100.0	

3.2.2 Level of Family Function in Subgroups of Study Participants

Table 6 shows the detailed information about the family function status in the demographic subgroups determined by the Family Function APGAR Scale. Similar to the family support scale, among the sampled patients, male patients (P = 0.094), living in rural regions (P = 0.68), with primary school education (P = 0.96), employed (P = 0.098), and with monthly income higher than 5000 KSh (P = 0.171), are more likely to have

functional family status than their demographic counterparts, although none of the differences in those subgroups were statistically significant according to the Chi-square tests or Fisher's exact tests. In contrast to the family support scale, patients aged older than 60 (P = 0.68) have the highest percentage of functional family status than their counterparts, although this is also not significant. In accordance with the family support scale, patients who are married or widowed have a higher percentage of functional family status than those who are not married or are divorced. However, the difference is not significant in the family function scale (P = 0.163).

Table 6: Level of Family Function in Subgroups of Study Participants

	Dysfunctional		Functional		Pearson Ch2	P
	N	%	N	%		
Overall						
	23	22.1	81	77.9		
Age (missing=3)						
≤50 years old	8	25.8	23	74.2	0.76	0.68
51~60 years old	8	22.9	27	77.1		
> 60 years old	6	17.1	29	82.9		
Gender						
Male	4	12.1	29	87.9	2.8	0.094
Female	19	26.8	52	73.2		
Residency						
Rural	1	11.1	8	88.9		0.68*
Urban	22	23.2	73	76.8		
Education level						
No formal schooling	4	26.7	11	73.3		0.96*
< primary school	9	22.0	32	78.1		
Primary school	3	18.8	13	81.3		
≥Secondary school	7	21.9	25	78.1		
Employment status						

Employed	8	15.4	44	84.6	2.7354	0.098
Unemployed	15	28.9	37	71.2		
Monthly income						
No income	11	26.8	30	73.2	3.5272	0.17
≤ 5000 KSh	8	28.6	20	71.4		
> 5000 KSh	4	11.4	31	88.6		
Marital status						
Unmarried	5	50.0	5	50.0		0.16*
Married	14	20.3	55	79.7		
Divorced	2	22.2	7	77.8		
Widowed	2	12.5	14	87.5		
Number of family members the patient lives with						
0	2	25.0	6	75.0		0.88*
1~4	12	23.5	39	76.5		
>4	9	20.0	36	80.0		
Religion						
Christian	23	23.0	77	77.0		1.00*
Muslim	0	0.0	3	100.0		
Hindu	0	0.0	1	100.0		

* Fisher's exact test P value

3.3 Comparing the Results of Different Adherence Measurements

This section shows the two by two comparison of the three different medication adherence scales: the Morisky Green Levine Adherence Scale, the Hill-Bone Medication-Taking Adherence Scale, and the 80% Cut-Off Point Adherence Scale.

3.3.1 Morisky Green Scale and Hill-Bone Scale Results Comparison

As shown in Table 7, almost all the patients identified as "perfectly adherent" by the Hill-Bone scale were also identified as having a high adherence level by the Morisky

Green Scale (96.4%), with only one exception (3.6%). However, among those who were identified as "non-perfectly adherent" by the Hill-Bone Scale, 40.8% of them were determined to have high adherence by the Morisky Green Scale. The Chi-square test shows that the two scales were highly correlated (P = 0.00).

Table 7: Morisky Green Scale and Hill-Bone Scale Result Comparison

		Morisky Green Levine Medication Adherence Scale	
	Levels	High (row percent)	Low to Medium (row percent)
Hill-Bone Medication taking Adherence Scale	Perfect	27 96.4	1 3.6
	Non-perfect	31 40.8	45 59.2

N= 104 Pearson chi2 = 25.7 Pr= 0.00

3.3.2 Morisky Green Scale and Pill-Count Scale Results Comparison

As shown in Table 8, among those who were identified to have high adherence by the Morisky Green Scale, 20.4% of them were determined to be non-adherent by the Pill Count Scale; among those who were identified to have low to medium adherence by the Morisky Green Scale, 73.3% of them were determined be adherent by the Pill Count Scale. The Chi-square test shows that there is no association between the two scales (P = 0.46).

Table 8: Morisky Green Scale and Pill-Count Scale Result Comparison

		80% cut-off point pill count measurement	
	Levels	Adherent (row percent)	Non-adherent (row percent)
Morisky Green Levine Medication Adherence Scale	High	43 79.6	11 20.4
	Low to Medium	33 73.3	12 26.7

N= 99 Pearson chi2 = 0.55 Pr = 0.46

3.3.3 Hill-Bone Scale and Pill-Count Scale Results Comparison

As shown in Table 9, among those who were identified to have perfect adherence by the Hill-Bone Scale, 16.0% of them were determined to be non-adherent by the Pill Count Scale; among those who were identified to have low to medium adherence by the Hill-Bone Scale, 74.3% were determined to be adherent by the Pill Count Scale. The Chi-square test shows that there is no association between the two scales (P = 0.32).

Table 9: Hill-Bone Scale and Pill-Count Scale Result Comparison

		80% cut-off point pill count measurement	
	Levels	Adherent (row percent)	Non-adherent (row percent)
Hill-Bone Medication taking Adherence Scale	Perfect	21 84.0	4 16.0
	Non-perfect	55 74.3	19 25.7

N= 99 Pearson chi2 = 0.98 Pr = 0.32

Due to the striking inconsistency between the 80% Cut-Off Pill Count Scale and the other two scales, and the acknowledged recall bias of the Pill Count Scale, the

following analyses are only based on the results of the Morisky Green Scale and Hill-Bone Scale.

3.4 Prevalence of medication adherence in subgroups of sampled patients

This section shows the level of medication adherence of the sample patients in different demographic subgroups, determined by Morisky Green Scale and Hill-Bone Scale respectively. Fisher's exact test or Chi-square test was used to determine the significance of the differences among the subgroups.

3.4.1 Medication Adherence by Morisky Green Scale in Subgroups of Study Participants

Table 10 shows the detailed information about the medication adherence determined by the Morisky Green Scale in the demographic subgroups. For the comparison of medication adherence among the subgroups, none of the demographic parameters were significantly associated according to the Morisky Green Scale.

Table 10: Medication Adherence by Morisky Green Scale in Subgroups of Study Participants

	High adherence		Low to Medium adherence		Fisher's exact P
	N	%	N	%	
Overall					
	58	55.8	46	44.2	
Age (missing=3)					
≤50 years old	12	38.7	19	61.3	0.082
51~60 years old	23	65.7	12	34.3	
> 60 years old	21	60.0	14	40.0	
Gender					
Male	20	60.6	13	39.4	0.53
Female	38	53.5	33	46.5	
Residency					
Rural	5	55.6	4	44.4	1.00
Urban	53	55.8	42	44.2	
Education level					
No formal schooling	8	53.3	7	46.7	0.84
< primary school	24	58.5	17	41.5	
Primary school	10	62.5	6	37.5	
≥Secondary school	16	50.0	16	50.0	
Employment					
Employed	27	51.9	25	48.1	0.55
Unemployed	31	59.6	21	40.4	
Monthly income					
No income	24	58.5	17	41.5	0.51
≤ 5000 KSh	13	46.4	15	53.6	
> 5000 KSh	21	60.0	14	40.0	
Marriage status					
Unmarried	7	70.0	3	30.0	0.84
Married	37	53.6	32	46.4	
Divorced	5	55.6	4	44.4	
Widowed	9	56.3	7	43.8	
# of family members the patient lives with					
0	6	75.0	2	25.0	0.47
1~4	29	56.9	22	43.1	

>4	23	51.1	22	48.9		
Religion						
Christian	57	57.0	43	43.0	0.32	
Others (Muslim/Hindu)	1	25.0	3	75.0		

3.4.2 Medication Adherence by Hill-Bone Scale in Subgroups of Study Participants

Table 11 shows the detailed information about the medication adherence determined by the Hill-Bone Scale in the demographic subgroups. For the comparison of medication adherence among the subgroups, none of the demographic parameters were significantly associated according to the Hill-Bone Scale, but residency and marriage status showed a tendency to be associated (P = 0.057 and P = 0.064, respectively).

Table 11: Medication-taking Adherence by Hill-Bone Scale in Subgroups of Study Participants

	Perfectly adherent		Non-perfectly adherent		Pearson Ch2	P
	N	%	N	%		
Overall						
	28	26.9	76	73.1		
Age (missing=3)						
≤50 years old	24	77.4	7	22.6	1.23	0.54
51~60 years old	23	65.7	12	34.3		
> 60 years old	26	74.3	9	25.7		
Gender						
Male	7	21.2	26	78.8	0.80	0.37
Female	21	29.6	50	70.4		
Residency						
Rural	5	55.6	4	44.4		0.057*
Urban	23	24.2	72	75.8		
Education level						

No formal schooling	4	26.7	11	73.3		0.57*
< primary school	12	29.3	29	70.7		
Primary school	2	12.5	14	87.5		
≥Secondary school	10	31.3	22	68.8		
Employment status						
Employed	12	23.1	40	76.9	0.78	0.38
Unemployed	16	30.8	36	69.2		
Monthly income						
No income	12	29.3	29	70.7	1.65	0.44
≤ 5000 KSh	5	17.9	23	82.1		
> 5000 KSh	11	31.4	24	68.6		
Marital status						
Unmarried	4	40.0	6	60.0		0.064*
Married	15	21.7	54	78.3		
Divorced	1	11.1	8	88.9		
Widowed	8	50.0	8	50.0		
Number of family members the patient lives with						
0	12	29.3	29	70.7		0.71*
1~4	5	17.9	23	82.1		
>4	11	31.4	24	68.6		
Religion						
Christian	28	28.0	72	72.0		0.57*
Others (Muslim/Hindu)	0	0.0	4	100.0		

* Fisher's exact test P value

3.5 Bivariate Analysis for Medication Adherence

This section presents the results of the bivariate logistic regressions to identify potential determinants of medication adherence using the two medication adherence scales.

3.5.1 Bivariate Logistic Regressions of Medication Adherence Using the Morisky Green Scale

Table 12 shows the detailed results of the bivariate logistic regressions of medication adherence using the Morisky Green Scale. Patients prescribed to take more than two pills per day are significantly less likely to be adherent (OR = 0.14, CI = 0.05~0.83, P = 0.027). Patients with comorbidities other than diabetes are less likely to be adherent among the sampled patients, and the P value, although not significant, is very close to 0.05 (OR = 0.78, CI = 0.14~1.03, P = 0.056). No other variables included in the analysis showed significance or marginal significance.

Notably, regarding our variable of most interest, patients with strong family support are generally more adherent than patients with no or weak family support among the sampled patients, but the difference is not significant (OR = 1.32, CI = 0.48~3.7, P = 0.589). Patients with functional family status have a lower level of adherence than those with dysfunctional family status among the patients, but the difference is also not significant (OR = 0.96, CI = 0.38~2.5, P = 0.93).

Table 12: Bivariate Logistic Regression of Medication Adherence Using Morisky Green Scale

	Low to medium adherence		High adherence		OR	95% CI	P
	N	%	N	%			
Perceived Health Status							0.83
Very good/excellent health (ref)	2	33.3	4	66.7			
Good	18	40.9	26	59.1	0.72	0.12~4.37	0.72
Fair	22	48.9	23	51.1	0.52	0.09~3.15	0.48
Poor	4	44.4	5	55.6	0.63	0.07~5.35	0.67
Number of kinds of medicines							0.28
One kind (ref)	23	39.0	36	61.0			
More than one kind	12	52.2	11	47.8	0.59	0.22~1.55	0.28
Medicine kinds (missing=40)							0.61
HCTZ (ref)	12	38.7	19	61.3			
Antenol	7	53.9	6	46.2	0.36	0.15~2.00	0.36
HCTZ & Antenol	5	50.0	5	50.0	0.46	0.15~2.65	0.53
Others	6	60.0	4	40.0	0.31	0.10~1.80	0.25
Number of pills of medicines daily							0.040
One (ref)	16	34.0	31	66.0			
Two	21	51.2	20	48.8	0.22	0.21~1.16	0.11
More than two	8	72.7	3	27.3	0.14	0.05~0.83	0.027
Perceived importance of medication adherence							0.99
Very important (ref)	40	44.4	50	55.6			
Moderately important	3	42.9	4	57.1	1.07	0.23~5.04	0.94
Not that important	3	42.9	4	57.1	1.07	0.23~5.04	0.94
Side effects							0.29
Don't have side effects (ref)	36	41.9	50	58.1			
Have side effects	10	55.6	8	44.4	0.58	0.21~1.60	0.29
BP measurement frequency							0.41
At least weekly (ref)	8	61.5	5	38.5			
Monthly	31	41.9	43	58.1	2.22	0.66~7.44	0.20
Less than monthly	7	41.2	10	58.8	2.29	0.52~10.01	0.27
Perceived HTN knowledge							0.40
Poor or Fair (ref)	9	37.5	15	62.5			

Good	26	51.0	25	49.0	0.58	0.22~1.56	0.28
Very good/Excellent	11	37.9	18	62.1	0.98	0.32~3.00	0.97
Perceived Family's HTN knowledge							0.98
Poor or Fair (ref)	24	43.6	31	56.4			
Good	19	45.2	23	54.8	0.94	0.42~2.10	0.88
Very good/Excellent	3	42.9	4	57.1	1.03	0.21~5.06	0.97
The extent to which the patient agrees that HTN influenced his/her quality of life							0.88
(Strongly) disagree (ref)	8	38.1	13	61.9			
Neutral	7	46.7	8	53.3	0.70	0.18~2.69	0.61
Agree	25	47.2	28	52.8	0.69	0.25~1.94	0.48
Strong agree	6	40.0	9	60.0	0.92	0.24~3.59	0.91
Duration of having HTN							0.93
less than 1 year (ref)	12	48.0	13	52.0			
1~2 years	8	44.4	10	55.6	1.15	0.34~3.89	0.82
2~5 years	11	47.8	12	52.2	1.01	0.32~3.13	0.99
longer than 5 years	15	40.5	22	59.5	1.35	0.49~3.77	0.56
Duration of taking anti-HTN medicines							0.61
less than 1 year (ref)	14	48.3	15	51.7			
1~2 years	8	53.3	7	46.7	0.82	0.23~2.85	0.75
2~5 years	9	34.6	17	65.4	1.76	0.95~5.23	0.31
longer than 5 years	15	48.4	16	51.6	1.00	0.36~2.74	0.99
Blood Pressure Control							0.80
Controlled	16	45.7	19	54.3			
Stage 1	14	46.7	16	53.3	0.96	0.36~2.56	0.94
Stage 2	15	39.5	23	60.5	1.29	0.51~3.27	0.59
Comorbidities							0.116
No comorbidities (ref)	25	39.7	38	60.3			
Diabetes	7	36.8	12	63.2	1.13	0.39~3.26	0.82
Other diseases	14	63.6	8	36.4	0.78	0.14~1.03	0.056
Perceived family support level (PSS-Fa)							0.59
No/Weak Family Support (ref)	9	50.0	9	50.0			
Strong Family Support	37	43.0	49	57.0	1.32	0.48~3.66	0.59
Perceived family functioning level (APGAR)							0.93
Dysfunctional (ref)	10	43.5	13	56.5			
Functional	36	44.4	45	55.6	0.96	0.38~2.45	0.93

3.5.2 Bivariate Logistic Regression of Medication Adherence Using the Hill-Bone Scale

Table 13 shows the detailed results of the bivariate logistic regressions of medication adherence using the Hill-Bone Scale. Compared with patients who thought they had poor or fair knowledge of hypertension, patients who thought they had good HTN knowledge are significantly less likely to adhere (OR = 0.21, CI = 0.07~0.60, p = 0.004), which is similar to patients who perceived they had very good or excellent HTN knowledge (OR = 0.18, CI = 0.05~0.62, P = 0.007). Compared with patients who thought their family had poor or fair HTN knowledge, patients whose perceived family knowledge of HTN was good are significantly less likely to adhere (OR = 0.35, CI = 0.13~0.93, P = 0.036). Patients who experienced side effects from the medicines are less likely to adhere than those who with no side effects among the sampled patients, and the P value, although not significant, is very close to 0.05 (OR = 0.13, CI = 0.02~1.02, P = 0.052). No other variables included in the analysis showed significance or marginal significance.

As for family support, patients with strong family support are generally more adherent than patients with no or weak family support among the sampled patients, but the difference is not significant (OR = 1.35, CI = 0.41~4.53, P = 0.62). Patients with functional family status also have a higher level of adherence than those with

dysfunctional family status among the patients, but the difference is not significant either (OR = 2, CI = 0.62~6.50, P = 0.25).

Table 13: Bivariate Logistic Regression of Medication Adherence Using the Hill-Bone Scale

	Non-perfectly adherent		Perfectly adherent		OR	95% CI	P
	N	%	N	%			
Perceived Health Status							0.58
Very good/excellent health (ref)	4	66.7	2	33.3			
Good	33	75.0	11	25.0	0.67	0.11~4.15	0.66
Fair	31	68.9	14	31.1	0.90	0.15~5.52	0.91
Poor	8	88.9	1	11.1	0.25	0.02~3.66	0.31
Number of kinds of medicines							0.92
One kind (ref)	43	72.9	16	27.1			
More than one kind	17	73.9	6	26.1	0.95	0.32~2.83	0.93
Medicine kinds (missing=40)							0.42
HCTZ (ref)	24	77.4	7	22.6			
Antenol	8	61.5	5	38.5	2.14	0.53~8.68	0.29
HCTZ & Antenol	7	70.0	3	30.0	1.47	0.30~7.23	0.64
Others	9	90.0	1	10.0	0.38	0.04~3.55	0.40
Number of pills of medicines daily							0.35
One (ref)	32	68.1	15	31.9			
Two	33	80.5	8	19.5	0.52	0.19~1.39	0.190
More than two	9	81.8	2	18.2	0.47	0.25~2.47	0.38
Perceived importance of medication adherence							0.48
Very important (ref)	64	71.1	26	28.9			
Moderately important	6	85.7	1	14.3	0.41	0.05~3.58	0.42
Not that important	6	85.7	1	14.3	0.41	0.05~3.58	0.42
Side effects							0.011
Don't have side effects (ref)	59	68.6	27	31.4			
Have side effects	17	94.4	1	5.6	0.13	0.02~1.02	0.052
BP measurement frequency							0.91
At least weekly (ref)	9	69.2	4	30.8			

Monthly	54	73.0	20	27.0	0.83	0.23~3.01	0.78
Less than monthly	13	76.5	4	23.5	0.69	0.14~3.52	0.66
Perceived HTN knowledge							0.0043
Poor/Fair (ref)	11	45.8	13	54.2			
Good	41	80.4	10	19.6	0.21	0.07~0.60	0.004
Very Good or Excellent	24	82.8	5	17.2	0.18	0.05~0.62	0.007
Perceived Family's HTN knowledge							0.065
Poor or Fair (ref)	35	63.6	20	36.4			
Good	35	83.3	7	16.7	0.35	0.13~0.93	0.036
Very Good or Excellent	6	85.7	1	14.3	0.29	0.03~2.60	0.27
The extent to which the patient agrees that HTN influenced his/her quality of life							0.84
(Strongly) disagree (ref)	16	76.2	5	23.8			
Neutral	10	66.7	5	33.3	1.6	0.37~6.96	0.53
Agree	38	71.7	15	28.3	1.26	0.39~4.06	0.70
Strong agree	12	80.0	3	20.0	0.8	0.16~4.02	0.79
Duration of having HTN							0.68
less than 1 year (ref)	17	68.0	8	32.0			
1~2 years	12	66.7	6	33.3	1.06	0.29~3.86	0.93
2~5 years	18	78.3	5	21.7	0.59	0.16~2.16	0.43
longer than 5 years	29	78.4	8	21.6	0.59	0.19~1.85	0.36
Duration of taking anti-HTN medicines							0.55
less than 1 year (ref)	19	65.5	10	34.5			
1~2 years	12	80.0	3	20.0	0.48	0.11~2.08	0.32
2~5 years	20	76.9	6	23.1	0.57	0.17~1.88	0.36
longer than 5 years	25	80.7	6	19.4	0.46	0.14~1.48	0.19
Blood Pressure Control							0.97
Controlled	25	71.4	10	28.6			
Stage 1	22	73.3	8	26.7	0.91	0.31~2.71	0.86
Stage 2	28	73.7	10	26.3	0.89	0.32~2.50	0.83
Comorbidities							0.84
No comorbidities (ref)	47	74.6	16	25.4			
Diabetes	14	73.7	5	26.3	1.05	0.33~3.37	0.94
Other diseases	15	68.2	7	31.8	1.37	0.47~3.96	0.56

Perceived family support level (PSS-Fa)							0.62
No/Weak Family Support (ref)	14	77.8	4	22.2			
Strong Family Support	62	72.1	24	27.9	1.35	0.41~4.53	0.62
Perceived family functioning level (APGAR)							0.23
Dysfunctional (ref)	19	82.6	4	17.4			
Functional	57	70.4	24	29.6	2	0.62~6.50	0.25

3.6 Multiple Logistic Regression of Medication Adherence

This section presents the results of the four models of multiple logistic regressions for medication adherence.

3.6.1 Overview of Four Regression Models

The outcome variable was medication adherence. The major independent variables of interest were patients' family support and family function levels. Additionally, based on the results of the demographic subgroup comparisons and bivariate logistic regressions, the multiple logistic regression models also included the following independent variables: age, gender, residency, number of pills prescribed per day, side effects, patients' perceived HTN knowledge, patients perceived families' HTN knowledge, and comorbidities.

To account for the triangulation principle, four multiple logistic regression models were built independently based on the two measurements for the outcome variable: medication adherence and the two primary independent variables, family support and family function. Model one used the Morisky Green Scale for medication

adherence and the PSS-Fa Scale for family support, model two used the Morisky Green Scale and the Family Function APGAR Scale, model three used the Hill-Bone Scale and the PSS-Fa Scale, and model four used the Hill-Bone Scale and the Family Functioning APGAR Scale.

3.6.2 Results of the Four Regression Models

Table 14 presents the overview of the properties of the four multiple logistic regression models, Table 15 shows the detailed information about regression models 1 and 2, and Table 16 shows the detailed information about regression models 3 and 4.

As shown in Table 14, all the four logistic regression models had non-significant results for the overall model as well as the primary independent variable—family support / family functioning levels, indicating the low power of the models to explain the variations of medication adherence, and the weak association between family support level / family functioning status and medication adherence.

Table 14: Overview of the Four Multiple Logistic Regression Models

Model	Primary outcome variable	Primary independent variable	Number of Observations	P Value	Pseudo R2*	Goodness of fit test
1	Morisky	PSS-Fa	96	0.19	0.1306	Non-significant
2	Morisky	APGAR	96	0.21	0.1259	Non-significant
3	Hill-Bone	PSS-Fa	96	0.096	0.1815	Non-significant
4	Hill-Bone	APGAR	96	0.089	0.1839	Non-significant

Table 15: Multiple Logistic Regression for Medication Adherence by Morisky Green Scale (Model 1 and 2)

	Model 1		Model 2	
	OR (95% CI)	**P**	**OR (95% CI)**	**P**
Age (missing=3)				
	1.04 (0.99~1.08)	0.086	1.04 (0.997~1.09)	0.067
Gender				
Male (ref)				
Female	1.09 (0.39~3.06)	0.86	1.07 (0.38~2.98)	0.90
Residency				
Rural (ref)				
Urban	1.00 (0.19~5.25)	1.00	0.96 (0.18~5.10)	0.97
Number of pills of medicines daily (missing=5)				
One (ref)				
Two	0.57 (0.21~1.53)	0.26	0.57 (0.21~1.54)	0.27
More than two	0.22 (0.04~1.22)	0.083	0.25 (0.05~1.32)	0.101
Side Effects				
Don't have side effects (ref)				
Have side effects	1.43 (0.39~5.20)	0.59	1.23 (0.35~4.37)	0.75
Perceived HTN knowledge				
Poor or Fair (ref)				
Good	0.32 (0.08~1.22)	0.095	0.33 (0.09~1.23)	0.098
Very good/Excellent	0.77 (0.15~3.94)	0.75	0.76 (0.15~3.77)	0.74
Perceived Family's HTN knowledge				
Poor or Fair (ref)				
Good	0.99 (0.37~2.69)	0.99	1.03 (0.38~2.77)	0.96
Very good/Excellent	0.58 (0.06~5.31)	0.63	0.76 (0.09~6.79)	0.81
Comorbidities				
No comorbidities (ref)				
Diabetes	0.79 (0.22~2.80)	0.72	0.73 (0.21~2.56)	0.62
Other diseases	0.23 (0.06~0.87)	0.031	0.26 (0.07~0.97)	0.045
Perceived Family Support/Family Functioning Level				
No/weak Family Support (Dysfunctional) (ref)				
Strong Family Support (Functional)	1.77 (0.52~5.99)	0.36	0.77 (0.25~2.33)	0.64

Table 16: Multiple Logistic Regression for Medication Adherence by Hill-Bone Scale (Model 3 and 4)

	Model 3		Model 4	
	OR (95% CI)	**P**	**OR (95% CI)**	**P**
Age (missing=3)				
	1.01 (0.95~1.06)	0.83	1.00 (0.95~1.06)	0.88
Gender				
Male (ref)				
Female	2.54 (0.71~9.10)	0.153	2.54 (0.71~9.10)	0.151
Residency				
Rural (ref)				
Urban	0.24 (0.04~1.37)	0.108	0.25 (0.04~1.38)	0.111
Number of pills of medicines daily (missing=5)				
One (ref)				
Two	0.60 (0.19~1.91)	0.39	0.64 (0.20~2.05)	0.46
More than two	0.43 (0.05~3.84)	0.45	0.46 (0.05~4.06)	0.48
Side Effects				
Don't have side effects (ref)				
Have side effects	0.19 (0.02~1.68)	0.135	0.19 (0.02~1.72)	0.140
Perceived HTN knowledge				
Poor or Fair (ref)				
Good	0.39 (0.10~1.53)	0.179	0.44 (0.11~1.74)	0.24
Very good/Excellent	0.65 (0.12~3.61)	0.62	0.68 (0.12~3.82)	0.66
Perceived Family's HTN knowledge				
Poor or Fair (ref)				
Good	0.40 (0.12~1.29)	0.125	0.41 (0.13~1.34)	0.141
Very good/Excellent	0.21 (0.01~4.23)	0.31	0.22 (0.01~4.16)	0.31
Comorbidities				
No comorbidities (ref)				
Diabetes	0.99 (0.22~4.40)	0.99	1.03 (0.23~4.58)	0.97
Other diseases	1.12 (0.27~4.65)	0.88	1.17 (0.28~4.82)	0.83
Perceived Family Support/Family Functioning Level				
No/weak Family Support (Dysfunctional) (ref)				
Strong Family Support (Functional)	1.93 (0.39~9.62)	0.42	2.09 (0.45~9.69)	0.35

4. Qualitative Results

This chapter presents the qualitative analysis results of the 21 in-depth interviews. Participants of the in-depth interviews were asked open-ended questions in a semi-structured manner in order to further explore the patients' perceptions about hypertension condition and medication use, their family relationship and situation, and most importantly, the role of their families in their hypertension management, with a focus on their medication adherence.

Grounded theory was applied to identify major themes during the thematic analysis. Table 17 shows the overview of major themes that were identified from the interviews and the key points that were frequently referred to in each of the sub-themes.

Table 17: Main Themes Identified in the In-depth Interviews

Major Themes	Key Points
1. Family Relationship and Situation	
1.1 Positive	Supportiveness, care
1.2 Negative	Poverty, lack of education
2. Patients Perceptions about HTN and Medication	
2.1 Patients' HTN Knowledge	Insufficiency, unawareness, risk factors, lack of symptoms
2.2 Patients' Perceived Importance of Adherence	Acknowledged importance, consequences of nonadherence
2.3 Barriers to Medication Adherence	Forgetfulness, intentional stops, unavailability, unaffordability
3. Patients' Family and Hypertension Management	
3.1 Family's Awareness of Patients' HTN Condition	Awareness of the conditions, familiarity with the treatment
3.2 Family's Hypertension Knowledge	Overarching insufficiency, health knowledge exchange
3.3 Reminders	Medicines reminders, appointment reminders
3.4 Lifestyle Modifications	Salt intake, physical exercise, adjustment of their own lifestyles
3.5 Increased Motivations	Emotional support, sense of responsibility
3.6 Expectations for Family	More health knowledge, better technical skills, constant emotional support

4.1 Family Relationship and Situation

When asked about their family relationships, most of the interviewees reported that they have a very comfortable family that is supportive and caring, although some did mention the presence of some tolerable problems in their family relationships:

"I feel good to live with them (my family). They comfort me. They make life enjoyable."

——Patient B4

"We do help each other, even though my family is not wealthy, we appreciate what God has given us and shared with others."

——Patient C7

"I feel good (to live with my family) despite of some problems that we go through."

——Patient L4

"I feel good (to live with my family), but problems are many at times it makes us suffer.

——Patient L5

However, there were also two participants who disclosed high level of difficulty in the family situation, both of whom attributed the difficulty to the low family income:

"It (my family situation) is critical because the income is very little. Life is so difficult, I always think if one of my children…I got one that finished form four (secondary school). She did a great job indeed. But I had no ways of helping her to get a job or aid her to go to a college. There are times when we don't get breakfast, and times where we don't even get lunch, and we just get supper, so you find people…not so healthy."

——Patient B1

"I feel it's hard (to live with my family) because that amount of money l get isn't enough to sustain us all……"

——Patient L8

4.2 Patients' Perceptions about Hypertension and Medication

4.2.1 Patients' Hypertension Knowledge

When asked about their knowledge of hypertension, most patients answered that they do not know much about hypertension, except for some consultations and/or instructions from the doctors. Some patients mentioned that they hope to receive more health education from the hospitals.

"I don't know much, what I know is things I should avoid. Like alcohol……Apart from the doctor, I have never received information from another person."

——Patient C4

"(Apart from the doctors) there's no other way l get information about hypertension."

——Patient L1

"I also hope the hospital to give me more education, about my health, what to do, what not to do."

——Patient B3

Several patients, though, were confidant about their knowledge of hypertension, mainly because they had had the disease for many years:

"(I) have had pressure for many years, so I know almost everything about it."

——Patient C3

The patients were then asked about the risk factors they know that may contribute to hypertension. Many of them mentioned lifestyle factors such as excessive salt intake and lack of exercise.

"……Also, one should avoid too much intake of salt, sugar and fatty foods, a lot of meat, but should (have) a lot of vegetables. Oh, and someone with hypertension should exercise more often."

——Patient L3

One patients mentioned that he thought people's awareness of hypertension was low because of its characteristic of lack of symptoms:

"Naturally there is not a lot of symptoms (for hypertension), you can live with it. The only way I was diagnosed was when I was in hospital. I did not know that I had high blood pressure (before that). So I was living with it without knowing for a long time. I did not have many symptoms, only the headache, and some dizziness sometimes……People are not aware of it because they have no symptoms. When they get some headache, they just use some painkillers."

——Patient B2

4.2.2 Perceived Importance of Adherence

The participants were asked how important they think it is to adhere to doctors' prescriptions on hypertension. In accordance with the quantitative results, most of them think it is very important to adhere to the prescriptions:

"I believe if someone takes the medication well as prescribed by the doctor, nothing will go wrong."

——Patient L8

Some patients said that they realized the importance of adherence from their own experience of bad consequences caused by non-adherence:

"After taking medicines for one year since diagnose, I stopped taking the medicines. And then my conditions went very bad, I started to have dizziness and headache. So I went here (hospital), and the doctors told me never to stop taking medicines again."

——Patient B4

"If l stay 4 days without taking my medication, my pressure would shoot up to 170. I can say that it's very important to take medication so that you may continue living for longer and taking care of your life."

——Patient L3

However, one patient in particular said that he/she did not think medication adherence is important.

"Medication is important, but l don't take any medication since I am able to control my pressure. That's why l don't see any importance on my side to take any medication."

——Patient L5

4.2.3 Barriers to Medication Adherence

Many patients in the interview talked about the barriers that they think decrease their level of medication adherence and hypertension control. The most frequently mentioned barriers are forgetfulness, intentionally stopping medication when feeling

good, unavailability of medicines and services, and unaffordability of medicines and services.

Forgetfulness was mentioned by many patients as an unintentional event, while some other patients also said that they would intentionally stop the medication when their blood pressure was controlled.

"When you're well and you're not feeling anything bad, you will forget to take the medicines"

——Patient B2

"There was a time (when) I stopped taking medicine because I thought I am okay, and (I) even stopped going to clinic. Afterwards, I went to the hospital and doctor told me that I should go for check-ups like every month, and that I should not stop taking the drugs not unless I want to die."

——Patient C2

Many respondents complained about the occasional unavailability of medicines and services and how it compromised their medication adherence and hypertension control.

"Like now I am not taking (medicines) because they are not available in the hospital."

——Patient C8

"The hospitals, I think they should increase the number of doctors to serve the people. People complain about the scarce (scarcity) of doctors. So that people can visit the hospitals more frequently. Because you know like know, we can only come here once in a week on Thursdays. So, I think we should increase the number of doctors and facilities, so it wouldn't be so crowded. People can just pop in when they need."

——Patient B2

Unaffordability of medicines and services was another frequently cited barrier to medication adherence among the interviewed patients.

"……Where l used to go for clinic, the medicine wasn't given free, I pray that the government can give out this medicine freely without being charged."

——Patient L1

"The drugs should be given to patients without charge, because it's very expensive to buy those medicines and some people can't afford."

——Patient L7

"……The prices are high, and since not everyone can afford that, the government should provide this drugs to patients with no charge"

——Patient L8

"Because some hospitals have high admission fee. It is the lack of money that makes one wait before going to the hospital. And sometimes it will be late."

——Patient B1

Notably, according to the responses, unavailability and unaffordability usually happen at the same time, because when drugs are not available at the clinics, patients will have to buy them at pharmacies where medicines are more expensive.

"(I stop taking the medicines) maybe when I run out of pills, especially this time when doctors are not working*, so we are really suffering. We are forced to purchase medicines from pharmacies which is very expensive."

(*There was an ongoing small-scale strike in the hospitals at the time of the interview.)

——Patient C3

"It's good that we don't buy medicine here (at this clinic), but if l run out of the medication before my next clinic (day), l (have to) go and buy, because l can't just stay without taking my medication."

——Patient L4

4.3 Patients' Family and Hypertension Management

This set of themes derived from questions about patients' families' role in their daily hypertension management. Patients were asked to reflect on how their family members may have contributed to the patients' hypertension management, and five major themes were identified from the interviews: family members' awareness of the patients' disease and treatment condition, family members' health knowledge,

reminders for medicines and appointments, emotional motivations, and lifestyle modifications.

4.3.1 Family's Awareness of Patients' HTN Condition

Almost all the patients reported that their family members knew that he/she has hypertension and are familiar with their treatment to a certain extent.

"They have always been aware of my conditions because it's about thirteen years. They are always worried about my condition, and they are quite supportive about it."

——Patient B1

However, there was also one patient who said that except her daughter, most of her family members did not know about her condition because she did not want them to know:

"I don't stress my family. Its only my daughter who knows I have pressure……I don't like to tell my children when I am sick, because I feel like I am disturbing them."

——Patient C2

4.3.2 Family's Hypertension Knowledge

The patients were asked to subjectively estimate their family's level of general health knowledge and hypertension related knowledge. Most of the patients used

languages such as “not much”, “a little”, or “not at all”, indicating an overall low level of health and hypertension knowledge among their families:

“No, my families are not aware of the condition. Even my sons, they have no knowledge about hypertension, they don’t know the symptoms of hypertension.”

——Patient B2

“They don’t know much, maybe just some obvious things like the food they are supposed to cook for me.”

——Patient C7

Health knowledge exchange does exist within some of the families. Some patients mentioned in the interview that their family members would share health knowledge with each other:

“They know that you should not take a lot of salt and sugar. We also share the knowledge”

——Patient C5

“I know a lot about hypertension and its risks, l even educate my family on how to manage pressure and how to eat well.”

——Patient L8

4.3.3 Reminders

Many of the patients interviewed mentioned that their family members were helpful in reminding them to take medicines as prescribed, and in some cases, their family members would even bring the pills and water to them to make sure they take medicines on time.

"They believe that after taking the medicine, I perhaps will get better.....They (my children) keep advising me not to skip. When I forgot, they come and tell me that 'father, it is time to take the medicine'. At times they even take the medicines to me……They think that if I skip the medicine, it will cause harm later."

——Patient B1

"Every day they have to make sure that I take the medication. Every morning and every evening. They would ask me to take the medicine, even bring me the medicines and water."

——Patient B4

Besides reminders of taking medicines, some interviewees emphasized that their family members also reminded them to keep the medical appointments and to get the prescription refills from the clinics:

"My daughter does remind me to go to hospital. Like today, my last born, she has told me 'mom wake up, go for clinic'. And also, when I seem to forget drugs, she reminds (me)."

——Patient C1

"My wife knows mostly. She does remind me to take medicines. She has mastered the time I am supposed to take medicines well since she accompanies me to the doctor."

——Patient C4

"He (my husband) is the one who takes me to clinic. He makes sure I book the next appointment with the doctor."

——Patient C6

4.3.4 Lifestyle Modifications

Most of the respondents talked about how their family members influenced their lifestyles for hypertension control. The most frequently mentioned lifestyle-related themes are salt intake reduction and physical exercise; other lifestyle-related themes were mentioned too, such as food choices and smoking cessation:

"At times, my wife reminds me not to take a lot of salt in my vegetables. They always ask me to take less salt."

——Patient B1

"When I forgot to do exercise, they say it's time for some exercise. My wife and sons would remind me to do the exercise. Because I know it is compulsory to do, they remind me."

——Patient B2

"My son, my third one, the one who is 17 years, he used to help me with this skipping rope. He even used to tell me: mama, let's skip so I kept skipping a lot. But things were like I am tired today, I felt like I was bringing him down, he was not happy. 'Mom, just try a small one.'"

——Patient S1

"They want to cook at home and don't want me to eat out. They tell you we have to eat meat maybe only two times or three times a week. They care about my feeling, they care about my lifestyle."

——Patient B4

"They really care (about my lifestyle). Like my wife, there was a time I used to like smoking cigarettes, she told me to stop."

——Patient C4

Moreover, some of the patients mentioned that their family members changed their own lifestyle for them, mainly by reducing their salt and sugar intake too.

"They care a lot (about my lifestyle), like even the food we eat, when they cook they put just a little salt. And also, the cooking oil (that they) used is very small. I can say they have adjusted well with my lifestyle."

——Patient L5

"They are also caring in the sense that they have adjusted to the lifestyle l am living. Some people can find it hard to even reduce the amount of salt put in the food or to reduce the amount of sugar put in the tea, but my family is used to it, and since they care about me, they are okay."

——Patient L6

4.3.5 Motivations

Another frequently mentioned theme was the motivations that family members gave to the patients. Some of the patients, especially among the male participants, said that they were the only or one of the few breadwinners in the family, and they wanted to have their blood pressure well controlled in order to better support their family:

"I'm the bread maker, so when I am not working, they (my family) won't feel good. I want to be healthy to support them."

——Patient B3

"Sometimes when your blood pressure goes higher, you feel dizziness, headache. Then you can't work. So they (my family members) have to make sure (that I am well).

They care, they talk to me, and they want me to change, 'don't go to these places', 'don't drink alcohol'…… They care about my feeling……"

——Patient B4

4.3.6 Expectations for Family

At the end of each interview, the patients were asked what they hope their family members can do to improve their hypertension conditions. Many participants gave answers from different perspectives, and the most frequent answers included more health knowledge, technical skills such as blood pressure measurement, and constant emotional support.

"I hope they can help me more in the diet. They have to cope with the diet, which is important to be taken care (of). They should know about salt (reduction) and be aware of it."

——Patient B2

"Right now, the blood pressure equipment is not available for us (at home). Because I only visit the hospital once in a month, I think it's important for my family to know how to measure blood pressure, so that I can measure my blood pressure more often, and so I can minimize it when something happens."

——Patient B2

"My family can always support me, by making me comfortable, not making me angry, because they will retrigger my high blood pressure. and take care of the food I eat."

——Patient B4

"Most people get pressure because of stress so I think my family should try not to stress me."

——Patient C6

"I pray that they my family is comfortable and get a job so as to help themselves and others, and this will stop me from worrying too."

——Patient L4

"Just show me love."

——Patient B3

5. Discussion

This mixed method cross-sectional study investigated the situation of blood pressure control with a focus on patients' medication adherence and assessed its association with family support among hypertensive patients in three health facilities in Nairobi, Kenya. The study revealed the suboptimal HTN control status and high prevalence of medication non-adherence among the HTN patients, despite the large percentage of reportedly strong family support and family function. The study further qualitatively explored the role of family members in patients' control of high blood pressure, which shed light on recommendations for more family-engaging hypertension management in the future.

5.1 Hypertension Control in Kenya

In the present study, we found that the overall control rate of HTN among the patients is low. Only 34.0% of the patients had their blood pressure under control, while 29.1% of them are at stage one and 36.9% are at stage two. The low control rate is consistent with other studies conducted in Kenya. One cross-sectional study conducted at Nyeri Provincial General Hospital in 2014 reported that the control rate of HTN was 33.4%, also with a substantial proportion of patients with uncontrolled BP at stage two (Mutua et al., 2014). One study conducted in Mombasa reported a control rate of 25% (Jenson, Omar, Omar, Rishad, & Khoshnood, 2011), and another study performed at

Kenya's national referral hospital (Kenyatta National Hospital) in 2009 reported a BP control rate of 26%, which is even lower than the present study. The slightly higher control rate found in the present study relative to these previous findings cannot be safely seen as progress, given the regional differences and sampling bias. In summary, hypertension control in Kenya is still very challenging.

The challenging situation of HTN control in Kenya is enhanced by the low rate of medication adherence. In the present study, we found that only 55.8% of the patients determined by the Morisky Green Scale and 26.9% of the patients determined by the Hill-Bone Scale had good adherence to medication, which is either in accordance with or even lower than the overall 50% adherence rate estimated by a previous systematic review of HTN medication adherence in general populations (Brown & Bussell, 2011). There has been a daunting insufficiency of research that prioritizes the evaluation of medication adherence among HTN patients in Kenya. One previous study conducted in the Korogocho slum area in Nairobi, which is also the one of our three study sites, echoed the critically low level of medication adherence, although without quantifiable adherence measurements (Hulzebosch et al., 2015). Therefore, tackling patients' medication adherence should be further prioritized in Kenya's future hypertension control strategies.

The sharply higher participation rate of women in the present study is informative. We found that 68.3% of the participants were female, and only 31.7% of them were male. Even though the sampling strategy of this study was convenient sampling, we meant to approach all the HTN patients who attended the clinics/healthcare centers on our research days. Thus, the gender proportion in the study may roughly reflect the gender distribution of people's attendance for HTN care. The substantially higher number of women seeking HTN care was repeatedly found in previous studies in sub-Saharan African countries. Ojo et al. attributed women's higher participation rate in their study in Nigeria to women's higher likelihood to seek HTN care instead of higher prevalence of HTN among women (Ojo et al., 2016), and Jenson et al. found in their study in Kenya that women had significantly higher rates of detection, treatment, and control of HTN (Jenson et al., 2011). Two explanations can be offered to this phenomenon. Firstly, in traditional African society, males are the major breadwinners of the family, and are thus less likely to have clinic visits unless urgent (Jenson et al., 2011; Ojo et al., 2016). Secondly, females' hypertension are more likely to be detected from their contacts with healthcare facilities during their reproductive years (Jenson et al., 2011; Ojo et al., 2016). The gender disparity of HTN care seeking behavior thus provides insight into the serious issue of low awareness and detection rates of HTN in Kenya, especially among its male population.

5.2 Medication Adherence

5.2.1 Adherence Measurements

The three different adherence measurements generated different results in our study. We found that the adherence rate determined by the 80% cut-off point scale was higher than 70 percent in any groups of patients divided by the adherence level determined by the Morisky Green Scale and the Hill-Bone Scale (Tables 8 and 9), and it showed no significant associations with the other two measurements. This reflects the fact that the self-report-based pill-counting method was not sufficiently capable of detecting medication non-adherence in our study setting. On the other hand, although the Morisky Green Scale and the Hill-Bone scale showed significant association with each other, a large proportion of patients (40.8%) who were identified as non-perfectly adherent by the Hill-Bone Scale were identified to be highly adherent by the Morisky Green Scale (Table 7), indicating that the Morisky Green Scale is more "tolerant" with non-adherent behaviors than its counterpart in our research setting. Such different results from different adherence measurements suggest the need for a localized and validated adherence measurement in the context of Kenya. Moreover, given the lack of ideal medication adherence measurements, previous reviews also recommended the mixed use of multiple adherence measurements to mitigate the measurement bias and to

investigate different components of non-adherence (Lam & Fresco, 2015; Nielsen, Shrestha, Neupane, & Kallestrup, 2017).

5.2.2 Barriers to Medication Adherence

Some risks factors of medication non-adherence were identified from the quantitative analysis. Although there is inconsistency between the results from the two different adherence scales, the bivariate logistic regressions found that being prescribed to take more than two pills per day and having better perceived knowledge of the patient or his/her family are significant predictors of lower adherence. Additionally, having comorbidities other than diabetes and having side effects from the medicines are marginally significant predictors of lower adherence. Among these factors, being prescribed to take multiple pills per day, comorbidities, and side effects were previously identified as risk factors for non-adherence by other studies (Calderon-Larranaga et al., 2016; Tedla & Bautista, 2016; Veronesi et al., 2007). However, no previous study has mentioned the counter-intuitive result of the negative association between the level of perceived HTN knowledge and medication adherence. This finding suggests a gap between patients' "perceived HTN knowledge" and their "actual HTN knowledge." Further studies are thus needed to comprehensively evaluate the level of HTN and health knowledge among the study population, and actions must be taken to avoid misleading information that may influence patients' BP control behaviors.

Another important barrier to medication adherence was identified through the qualitative analysis, which is the unavailability of medicines. To ensure the medicine supply and accessibility of its HTN population, Kenya's Ministry of Health included eight kinds of antihypertensive medicines in the national essential medicine list in 2016 (MOH, 2016). We found that the listed drugs were commonly prescribed and used among our sampled patients, especially HCTZ (Table 3). However, in some of the interviews, the patients complained about the occasional unavailability of antihypertensive medicines at local clinics: "Like now I am not taking (medicines) because they are not available in the hospital." Moreover, there was a five-month large-scale strike among nurses in Kenya due to disagreements in allowances (Kennedy Kimanthi, 2017), which resulted in large vacancies in healthcare provisions.

Our results also showed that unaffordability of the medicines is usually combined with the unavailability of antihypertensive medicines. Some of the participants mentioned that the unavailability of these medicines at the clinics forced them to purchase medicines at pharmacies, which is costly and unaffordable for them. The unaffordability of medicines being a barrier to antihypertensive medication adherence was also identified in the study by Hulzebosch et al. conducted in the Korogocho slum area in Nairobi, where they found that 51.0% of the patients did not adhere to the treatments because they could not afford the medication (Hulzebosch et

al., 2015). As was suggested by one of our interviewees: "I pray that the government can give out this medicine freely without being charged." Further governmental enforcement for the essential medicine policy is needed to ensure patients' accessibility to antihypertensive medications in Kenya.

5.3 Family Support and Blood Pressure Control

Our study found that the level of perceived social support from family and the perceived level of family function are high among the participants: 82.7% of the patients in our study reported strong family support, and 77.9% reported high satisfaction with family function. Although there are few existing studies in Kenya that have investigated family support and family function, this finding is in accordance with studies conducted in other sub-Saharan countries. Ojo et al. in Nigeria found that 79.4% of the hypertensive patients in their study reported having strong family support, which they attributed to the family-centered nature of many African societies (Ojo et al., 2016; Okumagba, 2011). The high family support level was further confirmed by our qualitative results. When asked about their feelings about their families, most of the patient responses were positive: "I feel good to live with them (my family). They comfort me. They make life enjoyable." Although some of the patients did mention some hardships within the family, the overall family environment of the patients was very supportive.

Further qualitative analysis in our study confirmed the positive influence from family members on patients' HTN management. The patients interviewed mentioned three major ways in which their family members helped with their HTN control. First, many patients said that their family members would remind them to take the medicines regularly and to keep their clinical appointments. Second, some of the patients reported that their family members would supervise them in keeping healthy lifestyles, and they may even adjust their own lifestyles for the HTN patients. Third, families give the patients emotional support to overcome the long-term battle against the disease. These pathways from family support to HTN control were corroborated by studies on family support and general chronic disease management (Rosland, 2009). The finding suggests great potential for patients' families to contribute to HTN control in Kenya.

However, our overarching finding is that, in the quantitative analysis, we failed to establish a significant association between family support, family function, and medication adherence. Both the bivariate logistic regressions and the multiple logistic regression models generated non-significant results between the variables. Besides the shortcomings in the study design and data collection which might have influenced the statistical results, an important explanation to this negative finding is that patients' strong perceived family support and function could not be successfully translated into enabling factors to patients' medication adherence.

There are three possible explanations for the failure of this translation. The first one is the low level of awareness and health literacy in the population. The United Nations Educational, Scientific and Cultural Organization (UNESCO) mentioned in their 2017 literacy report there is still a large population in the world with low health literacy, with 27% of them living in sub-Saharan Africa (UNESCO, 2017). There is no recent data available about Kenya's health literacy level. However, based on our data, patients' perceptions about the level of their family's HTN knowledge was very low, with only 6.7% of them reporting that their family had very good knowledge about hypertension (Table 2). In the interviews, many participants also suggested that although their family cared about their health, they did not know much health and HTN knowledge. Therefore, the strong family support may have led to the family's willingness and intentions to help, but it cannot be transformed into meaningful improvements in HTN patients' medication adherence.

The second possible explanation is the limited involvement of family members in patients' disease management due to facility limitations. As a critical example, our study found that more than 80% of the patients had their blood pressure measurement no more than once a month, and 92.3% of the patients only had their BP measurements done by doctors or nurses at the clinics on their clinical days, while only 1.9% of them had measurements from their family (Table 2). The limited access to BP control facilities

such as home-based BP measurement may thus be another obstacle for family support to contribute to patients' medication adherence improvement.

Thirdly, other substantial barriers to medication adherence such as the unavailability and unaffordability to medicines may have compromised the positive effects from family support. In other words, HTN patients cannot adhere to the treatments when they have limited access to the medicines, even with their families' strong support and intentions to help.

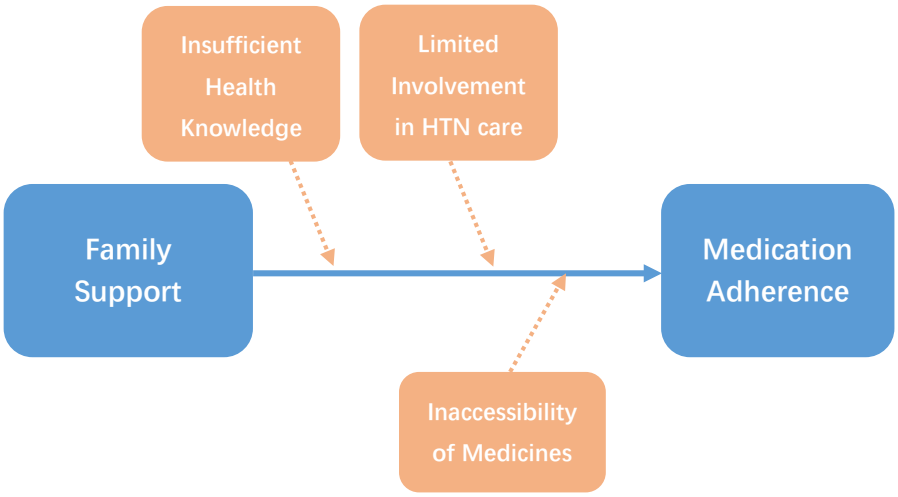

Figure 3: The Weakened Association between Family Support and Medication Adherence

Figure 3 provides a graphic summary for the discussion above that explains why family support is not a significant contributor to medication adherence among the HTN patients. Family members' insufficient knowledge and limited involvement in HTN care may have reduced their capacity to enhance patients' medication adherence, and the

"residual" positive effects from patients' family on medication adherence was further compromised by the unavailability and unaffordability of antihypertensive medicines.

5.4 Strengths and Limitations

The present study has its strengths in the following aspects: First, this is the first study conducted in Kenya that focused on the association between patients' family support and medication adherence. Given the current limited access to healthcare in low-income settings in Kenya, investigations about family-based HTN management may provide insights to cost-effective interventions for Kenya's HTN control. Second, the mixed-method design applying both quantitative and qualitative research methods gives a multi-level overview of the issue of medication non-adherence in Kenya. Third, the measurement triangulation for the primary constructs of the study—patients' family support and medication adherence—provides multiple perspectives to the research question. Finally, the use of bilingual instruments and local researchers helped to achieve better researcher-participant communication and more reliable data collection.

There are also several limitations of our study. First, we did not have rigorous sample size calculation given the lack of previous studies in the specific field. The 104 patients we included in the study, although meeting the law of large numbers, may be underpowered to cover sufficient variation of variables and to detect the significance of the association. Second, the convenience sampling strategy might have limited the

representativeness of our study sample, since we were only able to approach patients that attended the health facilities on our research days. The third limitation for the study is the possible measurement bias. Although the measurements of family support, family function, and medication adherence used in this study have been widely adopted by researchers in other settings, the validity of the measurements has never been verified in the context of Kenya. Moreover, the dichotomization of the outcome variables, although technically justified, may cause loss of information and thus reduce the power of analysis. Finally, during the process of data collection, there were emergent disruptions that resulted from Kenya's 2017 presidential election that might have influenced the quality of our data collection.

6. Conclusions

Our study found that the current hypertension control status in Kenya is still challenging, with highly-prevalent suboptimal medication adherence among the hypertensive patients. We found that the role of family members in hypertensive patients' blood pressure control in Kenya is promising, but we did not find a significant association between family support and medication adherence. Lack of health knowledge, limited involvement in home-based hypertension care, and unavailability and unaffordability to medicines, are important obstacles that compromise the effects of family support in hypertension control in Kenya.

Our study provided implications for future policy making and research projects in three major aspects: health education, home-based hypertension care, and healthcare provision.

6.1 Health Education

Better health education is urgently needed among the population in Kenya. In order to do so, first of all, studies are needed to comprehensively evaluate the health literacy and health knowledge level of the population. Based on the evaluation findings, health education interventions should be tailored to the needs of not only the hypertensive patients, but also their family members.

Importantly, the channel of health education in Kenya should be expanded. One finding from our qualitative analysis suggested that hospitals were currently the only source of health information for the HTN patients. Existing studies have provided experience for the paradigm shift in the health education model from hospital-centered to other kinds, such as community-based approaches (Hennessey Lavery et al., 2005), peer-support interventions (E. B. Fisher et al., 2017), and mobile health technologies (Feinberg et al., 2017). Better coverage and quality of health education in the Kenyan population is highly needed to improve the detection and treatment rate of hypertension and to reduce the health disparities among the population.

6.2 Home-based Hypertension Care

The second implication of our study is for home-based hypertension care. Our finding about the high level of family support and function among the patients implies there is solid ground for a home-based hypertension care model in Kenya. However, due to the lack of awareness, facilities, and training, the current level of family's engagement in patients' HTN care is very low. Future studies and programs should assess the feasibility of better engagement of hypertensive patients' families in hypertension control. Interventions such as home-based blood pressure monitoring may be introduced in reasonable settings in Kenya to increase families' engagement in patients' BP control (Agarwal, Bills, Hecht, & Light, 2011).

6.3 Healthcare Provision

Our third implication is for Kenya's healthcare system. As was suggested in our qualitative analysis and other literatures, the unavailability and unaffordability of medicines and services as a result of the unstable healthcare system are causing difficulties in patients' hypertension management. The Kenyan government needs to enhance its healthcare system from the perspective of medicine supply, service delivery, workforce, and financing in order to achieve a more accountable healthcare provision environment.

Appendix 1: English Questionnaire

Track Number:

Researcher's name:

Date of Research:

Part 1: General Information

Notes: The following questions are about general information of you and your family members, including demographic information and health information. Please circle the answers where options are provided, and please write your answer on the "____" where there is no option.

1. What is your year of birth? _____
2. What is your gender? ☐ Male ☐ Female
3. What is your highest level of education?

   ☐ No formal schooling ☐⩽Primary school

   ☐ Primary school complete ☐⩾Secondary school
4. Are you rural or urban resident? ☐ Urban ☐ Rural
5. What is your marriage status?

   ☐ Unmarried ☐ Married ☐ Divorced ☐ Widowed
6. How many family members do you live with? _____

   What are their relationships with you? (mother, father, spouse, son, daughter, cousin, etc.) _____
7. Are you religious?

   ☐ Yes, my religion is _____ ☐ No, I'm not religious
8. Are you currently employed?

   ☐ Yes, my job is_____ ☐ No, I am currently not employed
9. What is your monthly/annual family income? _____KES/month (OR ___KES/year)

Part 2: Health and Medical Conditions

Notes: The following part is for us to know about your health conditions, e.g. your hypertension history, other conditions, and medications. Please answer each question according to your perception of your own situation.

1. How do you think about your overall health status?

   ☐ Excellent ☐ Very good ☐ Good ☐ Fair ☐ Poor

2. How long has it been since you first got diagnosed with hypertension? _____

3. How long have you been taking hypertension medications? _____

4. Where did you firstly receive your diagnosis of hypertension?

   ☐ Primary Health Center ☐ Hospital ☐ traditional healer ☐ Others: _____

5. What are the anti-hypertension drugs you are currently prescribed?

   _____

6. How many pills for each anti-hypertension drugs are you prescribed to take per day?

   _____

   How many pills of anti-hypertension drugs did you take in total in the last week?

   _____

7. Do you think it is important to take the medicine exactly as prescribed?

   ☐ Very important ☐ Moderately important ☐ Somewhat important

   ☐ A little important ☐ Not important

8. Have you experienced any side effects from the anti-hypertension medicines? ☐ Yes

   ☐ No

   If yes, how severe is the side effects?

   ☐ Very severe ☐ Moderately severe ☐ Somewhat severe ☐ Just a little

9. How often do you measure your blood pressure?

☐ Every day ☐ Every 3~4 days ☐ Every week ☐ Every month ☐ Others_____

10. Who mostly help you with the measurement of blood pressure? _____

    ☐ Myself ☐ My husband/wife ☐ My parents ☐ My children ☐ Others

11. How do you think about your knowledge about hypertension?

    ☐ Excellent ☐ Very good ☐ Good ☐ Fair ☐ Poor

12. How do you think about your family's knowledge about hypertension?

    ☐ Excellent ☐ Very good ☐ Good ☐ Fair ☐ Poor

13. How much do you agree that hypertension has influenced your quality of life?

    ☐ Strongly disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly agree

14. Do you have health insurance? ☐ Yes ☐ No ☐ Don't know

15. Apart from hypertension, do you have any other health conditions? (e.g. diabetes, heart diseases, infectious diseases, etc.)

    _____

    _____

16. For how many years have you had each of the conditions you mentioned above?

    _____

    _____

Part 3: Medication Adherence

Notes: The following part is to assess your medication adherence. For the first 7 questions, there are two possible answers: "Yes" or "No"; for the next 14 questions, there are four possible answers: none of the time, some of the time, most of the time, and all of the time. Please circle the answer you choose for each item. For the last 2 questions, the answers should be given in numbers.

1. Do you ever forget to take your medicine?

   ☐ Yes ☐ No

2. Are you careless at times about taking your medicine?

   ☐ Yes ☐ No

3. When you feel better do you sometimes stop taking your medicine?

   ☐ Yes ☐ No

4. Sometimes you feel worse, when you take the medicine, do you stop taking it?

   ☐ Yes ☐ No

5. How often do you forget to take your HBP medicine?

   ☐ None of the time ☐ Some of the time ☐ Most of the time ☐ All of the time

6. How often do you decide not to take your HBP medicine?

   ☐ None of the time ☐ Some of the time ☐ Most of the time ☐ All of the time

7. How often do you eat salty food?

   ☐ None of the time ☐ Some of the time ☐ Most of the time ☐ All of the time

8. How often do you shake salt on your food before you eat it?

   ☐ None of the time ☐ Some of the time ☐ Most of the time ☐ All of the time

9. How often do you eat fast food?

   ☐ None of the time ☐ Some of the time ☐ Most of the time ☐ All of the time

10. How often do you make the next appointment before you leave the doctor's office?

    ☐ None of the time ☐ Some of the time ☐ Most of the time ☐ All of the time

11. How often do you miss scheduled appointments?

☐ None of the time ☐ Some of the time ☐ Most of the time ☐ All of the time

12. How often do you forget to get prescriptions filled?

☐ None of the time ☐ Some of the time ☐ Most of the time ☐ All of the time

13. How often do you run out of HBP pills?

☐ None of the time ☐ Some of the time ☐ Most of the time ☐ All of the time

14. How often do you skip your HBP medicine before you go to the doctor?

☐ None of the time ☐ Some of the time ☐ Most of the time ☐ All of the time

15. How often do you miss taking your HBP pills when you feel better?

☐ None of the time ☐ Some of the time ☐ Most of the time ☐ All of the time

16. How often do you miss taking your HBP pills when you feel sick?

☐ None of the time ☐ Some of the time ☐ Most of the time ☐ All of the time

17. How often do you take someone else’s HBP pills?

☐ None of the time ☐ Some of the time ☐ Most of the time ☐ All of the time

18. How often do you miss taking your HBP pills when you are careless?

☐ None of the time ☐ Some of the time ☐ Most of the time ☐ All of the time

Part 4: Family Support Measurements

Notes: The following statements refer to your feelings and experiences between you and your family members. For each statement, there are three possible answers: Yes, No, or Don't know. Please circle the answer you choose for each item.

4.1 Perceived Social Support from Family Scale (PSS-Fa)

1. My family gives me the moral support I need.

   ☐ Yes ☐ No ☐ Don't know

2. I get good ideas about how to do things or make things from my family.

   ☐ Yes ☐ No ☐ Don't know

3. Most other people are closer to their family than I am.

   ☐ Yes ☐ No ☐ Don't know

4. When I confide in the members of my family who are closest to me, I get the idea that it makes them uncomfortable.

   ☐ Yes ☐ No ☐ Don't know

5. My family enjoys hearing about what I think.

   ☐ Yes ☐ No ☐ Don't know

6. Members of my family share many of my interests.

   ☐ Yes ☐ No ☐ Don't know

7. Certain members of my family come to me when they have problems or need advice.

   ☐ Yes ☐ No ☐ Don't know

8. I rely on my family for emotional support.

   ☐ Yes ☐ No ☐ Don't know

9. There is a member of my family I could go to if I were just feeling down, without feeling funny about it later.

   ☐ Yes ☐ No ☐ Don't know

10. My family and I are very open about what we think about things.

☐ Yes ☐ No ☐ Don't know

11. My family is sensitive to my personal needs.

☐ Yes ☐ No ☐ Don't know

12. Members of my family come to me for emotional support.

☐ Yes ☐ No ☐ Don't know

13. Members of my family are good at helping me solve problems.

☐ Yes ☐ No ☐ Don't know

14. I have a deep sharing relationship with a number of members of mu family

☐ Yes ☐ No ☐ Don't know

15. My family members get good ideas about how to do things or make things from me.

☐ Yes ☐ No ☐ Don't know

16. When I confide in members of my family, it makes me uncomfortable.

☐ Yes ☐ No ☐ Don't know

17. Members of my family seek me out for companionship.

☐ Yes ☐ No ☐ Don't know

18. I think that my family feels that I am good at helping them solve problems.

☐ Yes ☐ No ☐ Don't know

19. I don't have a relationship with a member of my family that is as close as other people's relationships with family members.

☐ Yes ☐ No ☐ Don't know

20. I wish my family were much different.

☐ Yes ☐ No ☐ Don't know

4.2 Family Functioning APGAR scale

Notes: The following part is to assess your perception of family functioning by examining your satisfaction with family relationships. For each statement, there are three possible answers: Almost Always, Some of the Time, Hardly Ever. Please circle the answer you choose for each item.

1. I am satisfied that I can turn to my family for help when something is troubling me.

   ☐ Almost Always ☐ Some of the Time ☐ Hardly Ever

2. I am satisfied with the way my family talks over things with me and shares problems with me.

   ☐ Almost Always ☐ Some of the Time ☐ Hardly Ever

3. I am satisfied that my family accepts and supports my wishes to take on new activities or directions.

   ☐ Almost Always ☐ Some of the Time ☐ Hardly Ever

4. I am satisfied with the way my family expresses affection and responds to my emotions, such as anger, sorrow, and love.

   ☐ Almost Always ☐ Some of the Time ☐ Hardly Ever

5. I am satisfied with the way my family and I share time together.

   ☐ Almost Always ☐ Some of the Time ☐ Hardly Ever

Final Question: *Are you willing to participate in a follow-up in-depth interview?*

(Please refer to the informed consent form for the interview for your information.)

☐ Yes ☐ No

Part 5: Blood Pressure Measurement:

This part will be filled by the researchers. The researchers will help you measure your blood pressure twice, and then write down the results below:

First time:

Systolic Pressure_____ mmHg

Diastolic pressure _____mmHg

Second time:

Systolic Pressure_____ mmHg

Diastolic pressure _____mmHg

This is the end of the questionnaire. Thank you so much for your participation!

Appendix 2: Swahili Questionnaire

Nambari ya dodoso:

Jina la mtafiti:

Tarehe ya utafiti:

Sehemu 1: Taarifa ya Ujumla

Maswali yafuatayo yanahusu maelezo kwa ujumla kukuhusu wewe na familia yako ikiwemo demografia na taarifa za afya. Tafadhali pigia mduara majibu ambapo umepewa kuchagua na ambapo hamna majibu ya kuchagua tafadhali andika jibu lako.

1. Mwka wako wa kuzaliwa ni upi?
2. Wewe ni jinsia ipi? ☐ Kiume ☐ Kike
3. Kiwango chako cha elimu ni kipi?

   ☐ Sina Kisomo ☐ < Shule ya msingi ☐ Nimemaliza shule ya msingi ☐ ≥ Zaidi ya sekondari
4. Wewe ni mkazi wa kijinini/mashambani au mjini? ☐ Mjini ☐ Kijijini/mashambani
5. Hali yako ya ndoa ni ipi?

   ☐ Sijaoa/kuolewa ☐ Nimeolewa ☐ Talakiwa/talaka ☐ Mjane
6. Unaishi na watu wangapi wa familia? _____

   Una uhusiano gani nao? (mama, baba, mwana, binti, na kadharika.)
7. Wewe ni wa kidini?

   ☐ Ndio, dini yangu ni _____ ☐ Apana, si wa kidini
8. Umeajiriwa kwa sasa?

   ☐ Ndio, kazi yangu ni_____ ☐ Apana, sijaajiriwa kwa sasa
9. Mapato ya kila mwezi/mwaka ya familia yako ni hela ngapi? mapato? KSh/mwezi au _____KSh/mwaka

Sehemu ya 2: Afya na hali ya matibabu

Vidokezo: sehemu ifuatayo ni kwa ajili yetu kujua afya yako, kwa mfano historia yako ya shinikizo la damu, hali nyinginezo na dawa. Tafadhali jibu kila swali kwa mujibu wa mtazamo wako wa hali yako mwenyewe.

1. Unafikiri je huhusu hali yako ya afya kwa ujumla?

   ☐ Mufti ☐ Nzuri sana ☐ Nzuri ☐ Si mbaya ☐ Mbaya

2. Ni muda gani umepita tangu ulipopatikana na ugonjwa wa shinikizo la damu? _____

3. Umekua ukiyatumia madwa ya Shinikizo la damu kwa muda gani? _____

4. Ulitambuliwa wapi mara ya kwanza kuwa unashinikizo la damu?

   ☐ Kituo cha afya ya msingi ☐ Hospitali ☐ muuguzi wa kitamaduni ☐ Mengineo: _____

5. Ni madawa gani ya kudhibiti shinikizo la damu umeagizwa na daktari kutumia kwa sasa?

   _____

6. Ni tembe ngapi za kila aina ya dawa za shinikizo la damu umeagizwa kunywa kila siku?

   _____

   Ni tembe ngapi za madawa ya shinikizo la damu ulizotumia kwa jumla juma lililopita? _____

7. Unafikiri ni muhimu kunywa madawa hasa kama ulivyoagizwa?

   ☐ Muhimu sana ☐ Muhimu ☐ Muhimu kiasi fulani

   ☐ Muhimu kidogo ☐ sio muhimu

8. Umeyapata madhara yeyote kutokana na madawa ya shinikizo la damu?

   ☐ Ndio ☐ La

9. Kama ndio, madhara yako na ukali gani?

☐Makali sana ☐ Makali kwa kiasi ☐ Makali kinamna ☐ makali machache sana

10. Ni mara ngapi huwa unajima presha yako?

    ☐ Kila siku ☐ Kila baada ya siku 3-4 ☐ Kila juma ☐ Kila mwezi ☐ Mengine_____

11. Ni nani kwa mara nyingi hukusaidia kupima presha yako ya damu?

    ☐ Mimi mwenyewe ☐ Mke/Mme yangu ☐ Mzazi ☐ Mtoto wangu ☐ Mengine_____

12. Unafikirije kuhusu kuelewa kwako kuhusu shinikizo la damu?

    ☐ Mufti ☐ Vizuri sana ☐ Vizuri ☐ Kiasi ☐ Mbaya/Sina habari yeyote

13. Unafikitije kuhusu kuelewa kwa familia yako kuhusu shinikizo la damu?

    ☐ Mufti ☐ Vizuri sana ☐ Vizuri ☐ Kiasi ☐ Mbaya/Sina habari yeyote

14. Kwa kiasi gani unakubaliana kwamba shinikizo la damu limebadili ubora wa Maisha yako?

    ☐ Nakataa kabisa ☐ Nakataa ☐ Yawezakana au Haiwezekani ☐ Nakubali ☐ Nakubali kabisa

15. Unabima ya afya?

    ☐ Ndio ☐ Apana ☐ Sijui

16. Mbali na shinikizo la damu, una matatizo mengine ya kiaya? (kama vile kisukari, magonjwa ya moyo, magonjwa ya kuambukiza, na kadhalika)

    _____

    _____

17. Ni kwa miaka mingapi umekua na kila tatizo ulilolitaja awali?

    _____

Sehemu ya 3: Uzingatiaji wa matibabu

Vidokezo: Sehemu ifuatayo itatathmini uzingatiaji wako wa matibabu. Maswali ya kwanza tano (5), kuna majibu mawili yawezekanayo: "Ndio" au "Apana"; maswali fuatayo kumi na manne (14), kuna maibu manne yawezekanayo: "Hakuna wakati wowote", "Wakati mwingine", "Wakati mwingi", na "Kila wakati". Tafadhari pigia mduara jibu utakalochagua kwa kila swali.

1. Je, huwa unasahau kunywa dawa zako?

   ☐ Ndio ☐ Apana

2. Wewe kwa wakati mwingine hutojali kunywa dawa zako?

   ☐ Ndio ☐ Apana

3. Unapojihisi vyema, huwa wakati mwingine unaacha kuyanywa madawa yako?

   ☐ Ndio ☐ Apana

4. Wakati mwingine unapojihisi vibaya, baada ya kunywa madawa, huwa unaacha kunyanywa?

   ☐ Ndio ☐ Apana

5. Kwa kawaida gani huwa unasahau kunywa madawa yako ya shinikizo la damu?

   ☐ Hakuna wakati wowote ☐ Wakati Mwingine ☐ Wakati mwingi ☐ Kila wakati

6. Kwa kawaida gani wewe huamua kutokunywa madawa yako ya shinikizo la damu?

   ☐ Hakuna wakati wowote ☐ Wakati mwingine ☐ Wakati mwingi ☐ Kila wakati

7. Kwa kawaida gani huwa anala chakula chenye chumvi?

   ☐ Hakuna wakati wowote ☐ Wakati mwingine ☐ Wakati mwingi ☐ Kila wakati

8. Kwa kawaida gani wewe hutikisikia chumvi kwa chakula kabla ya kukila?

   ☐ Hakuna wakati wowote ☐ Wakati mwingine ☐ Wakati mwingi ☐ Kila wakati

9. Kwa kawaida gani huwa unala "fast food"?

   ☐ Hakuna wakati wowote ☐ Wakati mwingine ☐ Wakati mwingi ☐ Kila wakati

10. Kwa kawaida gani huwa unaomba kumwona daktarin mara ingine kabla hujatoka kwa

ofisi ya daktarin?

☐ Hakuna wakati wowote ☐ Wakati mwingine ☐ Wakati mwingi ☐ Kila wakati

11. Kwa kawaida gani huwa unakosa miadi iliyopangwa?

☐ Hakuna wakati wowote ☐ Wakati mwingin ☐ Wakati mwingi ☐ Kila wakati

12. Kwa kawaida gani wewe husahau kupata mjazo wa madawa uliyoagizwa?

☐ Hakuna wakati wowote ☐ Wakati mwingine ☐ Wakati mwingi ☐ Kila wakati

13. Kwa kawaida gani huwa unaishiwa na madawa yako ya presha?

☐ Hakuna wakati wowote ☐ Wakati mwingine ☐ Wakati mwingi ☐ Kila wakati

14. Kwa kawaida gani huwa unaruka kunywa madawa ya presha kabla ya kwenda kwa daktarin?

☐ Hakuna wakati wowote ☐ Wakati mwingine ☐ Wakati mwingi ☐ Kila wakati

15. Kwa kawaida gani huwa unakosa kunywa madawa yako ya presha unapojihisi vizuri?

☐ Hakuna wakati wowote ☐ Wakati mwingine ☐ Wakati mwingi ☐ Kila wakati

16. Kwa kawaida gani huwa unakosa kunywa madawa yako ya presha unapokuwa mgonjwa?

☐ Hakuna wakati wowote ☐ Wakati mwingine ☐ Wakati mwingi ☐ Kila wakati

17. Kwa kawaida gani huwa unanywa madawa ya mtu mwingine ya presha?

☐ Hukuna wakati wowote ☐ Wakati mwingine ☐ Wakati mwingi ☐ Kila wakati

18. Kwa kawaida gani huwa unakosa kunywa madawa yako ya presha kwa kutojali?

☐ Hakuna wakati wowote ☐ Wakati mwingine ☐ Wakati mwingi ☐ Kila wakati

Sehemu ya 4: Vipimo vya msaada wa familia

Vodokezo: kauli zifuatazo zinarejjelea hisia na uzoefu kati yako na watu wa familia yako. Kwa kila kauli, kuna majibu matatu yanayowezekana: Ndio, Apana, ama Sijui. Tafadhali pigia mduara jibu utakalolichagua kwa kila kauli.

4.1 Kipimo cha mwonekano wa msaada wa kifamilia (PSS-Fa)

1. Familia yangu hunipa msaada wa kimaadili naohitaji.

   ☐ Ndio ☐ Apana ☐ Sijui

2. Napata mawaidha mazuri kuhusu jinsi ya kufanya mambo au kuunda vitu kutoka kwa familia yangu

   ☐ Ndio ☐ Apana ☐ Sijui

3. Watu wengi wako karibu na familia zao kuliko nilivyo.

   ☐ Ndio ☐ Apana ☐ Sijui

4. Ninapo tumainia watu wa familia yanguwalio karibu nami, huwa nahisi kana kwamba hii huwakosesha starehe.

   ☐ Ndio ☐ Apana ☐ Sijui

5. Familia yangu hufurahia kuskia mawazo yangu.

   ☐ Ndio ☐ Apana ☐ Sijui

6. Watu wa familia yangu hupenda mengi nayoyapenda

   ☐ Ndio ☐ Apana ☐ Sijui

7. Watu wengine wa familia yangu hunijia wakiwa na matatizo au wakitaka mawaidha

   ☐ Ndio ☐ Apana ☐ Sjui

8. Nawategemea familia yangu kwa msaada wa kihisia

   ☐ Ndio ☐ Apana ☐ Sijui

9. Kuna mtu kwa familia yangu ambaye naweza enda kwake iwapo najihisi chini kihisia, bila kuhisi vibaya.

   ☐ Ndio ☐ Apana ☐ Sijui

10. Familia yangu nami huwa wazi sana kuhusu tunayofikiria kuhusu mambo

    ☐ Ndio ☐ Apana ☐ Sijui

11. Familia yangu kila wakati wanajua mahitaji yangu binafsi.

    ☐ Ndio ☐ Apana ☐ Sijui

12. Watu wa familia yangu hunijia kwa msaada wa kihisia.
    ☐ Ndio ☐ Apana ☐ Sijui

13. Watu wa familia yangu ni wazuri kwa kunisaidia kusuluhisha matatizo.

    ☐ Ndio ☐ Apana ☐ Sijui

14. Nina uhusiano wa kina wa kushirikiana na watu wengi wa familia yangu.

    ☐ Ndio ☐ Apana ☐ Sijui

15. Watu wa familia yangu hupata mawazo mazuri kuhusu utendaji wa mambo au uundaji wa vitu kutoka kwangu.

    ☐ Ndio ☐ Apana ☐ Sijui

16. Wakati ninaposema siri zangu kwa watu wa familia yangu, huwa inanifanya nikose starehe.

    ☐ Ndio ☐ Apana ☐ Sijui

17. Watu wa familia yangu hunitaka kukaa nao.

    ☐ Ndio ☐ Apana ☐ Sijui

18. Nafikiri kwambafamilia yangu huhisi kwamba mimi ni mzuri katika kuwasaidia kusuluhisha matatizo.

    ☐ Ndio ☐ Apana ☐ Sijui

19. Sina uhusiano na mtu yeyote wa familia yangu ambao ni wa karibu kama uhusiano wa watu wengine na familia zao.

    ☐ Ndio ☐ Apana ☐ Sijui

20. Natamani famalia yangu ingekua tofauti kabisa

    ☐ Ndio ☐ Apana ☐ Sijui

4.2 Kipimo cha utendakazi wa familia (APGAR scale)

Vidokezo: Sehemu ifuatayo inatathmini mtazamo wako wa utendakazi wa familia kwa kuchunguza kuridhika kwako na mahusiano ya familia. Kwa kila kauli, kuna majibu matatu yanayowezekana: Karibu kila wakati, Wakati mwingine, Nadra sana. Tafadhali pigia mduara jibu utakalochagua kwa kila kauli.

1. Nimetosheka kuwa naweza enda kwa familia yangu kwa usaidizi nkiwa na tatizo.

   ☐ Karibu kila wakati ☐ Wakati mwingine ☐ Nadra sana

2. Nimetosheka na jinsi familia yangu huongelea mambo na kushirikiana nami katika matatizo.

   ☐ Karibu kila wakati ☐ Wakati mwingine ☐ Nadra sana

3. Nimetosheka na kuwa familia yangu hukubali na kuniunga mkono katika matamanio yangu kutekeleza mambo mapya ama kuchukua mielekeo mipya

   ☐ Karibu kila wakati ☐ Wakati mwingine ☐ Nadra sana

4. Nimetosheka na jinsi familia yangu huonyesha upendo na kushughulikia hisia zangu kama vile hasira, majonzi na mapenzi.

   ☐ Karibu kila wakati ☐ Wakati mwingine ☐ Nadra sana

5. Nimetosheka na jinsi familia yangu na mimi hushuriki wakati pamoja.

   ☐ Karibu kila wakati ☐ Wakati mwingine ☐ Nadra sana

Swali la Mwisho: *Uko tayari kushiriki katika mahojiano ya kina ya kufuatilia?*

(Tafadhali rejelea fomu ya ridhaa kwa taarifa yako kuhusu mahojiano)

☐ Ndio ☐ Apana

Sehemu ya 5: Upimaji wa shinikizo la damu:

Sehemu hii itajazwa na watafiti. Ntafiti atakusaidia kupima presha yako ya dam umara mbili, kisha kuandika matokeo hapa:

Kipimo cha kwanza:

Systolic Pressure_____ mmHg

Diastolic pressure _____mmHg

Kipimo cha pili:

Systolic Pressure_____ mmHg

Diastolic pressure _____mmHg

Hapa ndio tamati ya mahojiano. Asante sana kwa kushiriki kwako!

Appendix 3: English Interview Guide

Objectives: to qualitatively determine how family support and multidimensional social support influence hypertensive patients' adherence to treatment, and to explore what are the possible solutions to tackle the existing problems.

Participants' Autonomy: all the participants should be voluntarily involved in the interviews with their informed consent; participants have the right to withdraw from the interview at any moment.

Audio Record: upon the interviewee's informed consent, there will be audio recording, in order to transcribe the interview information completely.

Duration: the in-depth interview will take no more than 30 minutes for each patient.

Location: the interview should happen in a private room in the primary clinics, with the presence of only one researcher, one research assistant, and the interviewee.

Interview Procedure:

Step 1: disseminating the informed consent forms to the participants

Step 2: orally presenting the informed consent to the interviewees, and answer their questions

Step 2: collecting the participants' informed consent forms

Step 3: starting the conversation with casual chatting to create friendly and relaxing atmosphere

Step 4: starting to ask the following questions

Domains	Questions	Probes
Family Support	1. What do you think about your relationship with other family members? 2. Normally, what are the major kinds of problems that may cause unpleasant experience within your family? 3. How do your family think about your health condition? 4. How much do they know about the treatments you are receiving? 5. How much do your family care about your lifestyle? 6. Have you ever received information about hypertension, medication, and other health-related issues from other people?	1. What do you think about the relationships within your family, compared to other families? Do you think your family members are caring about each other/ about you? Who take care of you the most? 2. Do you have any stories to share about your family? How do you solve those problems? 3. How many of them know that you have hypertension? How much do they know about hypertension, risk factors such as sodium intake? Do any of them have hypertension too? Are you on the same treatments? Do they ask you about your recent health status? 4. How much do they know about the type of medication you are taking, the regimen, the frequency? Do they ask for updates of your medication (e.g. any new drugs prescribed, how much drugs left)? How often do they remind you to take the medicine? Do they encourage you to take the medicine? What are their reasons when they want you to take the medicine? How do feel when they remind/encourage you to take the medicine? Do you take the medicine in order to satisfy them? Will they praise you when you take the medicine? Will they blame you when you don't take the medicine? Do you intentionally not tell them when you didn't take the medicine?

		What do you think would happen if they don't remind/encourage you to take the medicine? 5. Do they care about your salt intake, physical exercise, smoke, or drink? Do your family change their lifestyles (e.g. reducing the salt intake for the meals, working out with you, stop smoking/drinking, etc.) for you? Do they persuade you to set up appointments with doctors? 6. what are the examples of such information? How much do you trust the information? How does that information influence your behaviors? Do you confirm those information with authority? What do you do when some of the information contradicts with each other/ with what you previously thought? Do you share your own knowledge with those people?
Medical Adherence	1. What do you think about your adherence to the hypertension medication? 2. How do you feel about the effectiveness of the hypertension medication you are taking? 3. What do you think are the most important reasons that stop you from taking the medication?	1. Have you changed your adherence over time? 2. How do you think your conditions are becoming, better, unchanged, or worse? Are there side effects from the medicine? Does it meet your expectation from the medication? Does this influence your medication taking? Do you want to change your medicine? 3. What do you think about the importance of adherence to treatment? Do you think the drugs are too expensive? Too complicated? Too hard to swallow?

Solutions	What do you think can be done to improve your hypertension condition/adherence?	What do you think your family can do to improve your condition/adherence? What do you think other people can do to improve your condition/adherence?

Step 5: End the conversation casually and show how much their contribution is appreciated. Give the interviewees the small gifts.

Appendix 4: Swahili Interview Guide

Malengo: kwa kimaelezo kuamua jinsi msaada wa familia na mielekeo mbalimbali ya usaidizi wa kijamii yanavyo shawishi wagonjwa wa shinikizo la damu kufuatilia matibabu na kutafuta majibu ya kukabiliana na matatizo yaliyopo.

Uhuru wa washiriki: washiriki wote watashirikishwa katika mahojiano kwa hiari kwa idhini yao. Washiriki wana uhuru wa kujitoa kwenye mahojiano wakati wowote.

Kurekodi sauti: Baada ya mhojiwa kutoa idhini, kutakuwa na kurekodi sauti ili kuwezesha kunukuu habari ya mahojiano kwa ufasaha.

Muda: Mahojiano ya kina yatachukua muda usiozidi dakika thelathini (30) kwa kila mgonjwa.

Eneo: mahojiano yanafaa kufanyika kwa chumba cha siri katika kliniki. Na kuwepo kwa mtafiti mmoa tu, msaidizi wa mtafiti na mhojiwa.

Utaratibu wa mahojiano:

Hatua 1: Kusambaza fomu za ridhaa kwa washiriki

Hatua 2: kuwasilisha kwa kusoma fomu za ridhaa kwa wahojiwa na kuibu maswali yao.

Hatua 3: Kukusanya fomu za ridhaa za washiriki

Step 4: kuanza mazungumzo kwa maongezi ya kawaida ili kujenga urafiki na hali nzuri.

Step 5: Kuanza kuuliza maswali yafuatayo

Nyanja	Maswali	Uchunguzi
Msaada wa familia	1. Una maoni gani kuhusu uhusiano wako na watu wengine katika familia? 2. Kwa kawaida, ni shida zipi kuu ambazo zinaweza sababisha matukio yasiyopendeza katika familia yako? 3. Familia yako hufikirije kuhusu haliyako ya afya? 4. Wanajua kiasi gani kuhusiana na matibabu unayoyapokea? 5. Familia yako wanajali kwa kiasi gani kuhusu mtindo wako wa kimaisha? 6. Ushawahi kupokea uumbe wowote kuhusu shinikizo la damu, matibabu, na masuala mengine yanayohusiana na afya kutoka kwa watu wengine?	1. Unafikirije kuhusu mahusiano katika familia yako ukilinganisha na familia zingine? Unafikiri watu wa familia yako wanawajali wenzao/wanakujali wewe? Nani hukutunza kw asana? 2. Una hadithi zozote ambazo unaweza hadithia kuhusu familia yako? Unasuluhishae matatizo hayo? 3. Ni wangapi wao wanaua huwa uko na shinikizo la damu? Wanajua kwa kiasi gani kuhusu shinikizo la damu? Kuna yeyote anayeugua shinikizo la damu pia? Mko katika matibabu sawa? Je, huwa wanakuuliza kuhusiana na hali yako ya kiafya ya hivi karibuni? 4. Je, wanajua ni kwa kiasi gani na aina ya matibabu, mkusanyiko au ni kwa mara ngapi unayopokea? Je, huwa wanauliza sasisha za matibabu yako (kwa mfano madawa mapya uliyoagizwa, kiasi cha dawa kilichobaki) Ni mara ngapi wao hukukumbusha kunywa madawa? Je, wao hukupa moyo kuyanywa madawa? Wao hukupa sababu zipi watakapo uyanywe madawa? Huwa unajihisi vipi wanapokukumbusha/kukupa moyo uyanywe madawa? Je, huwa unayanywa madawa ili kuwatosheleza? Je, wao hukusifu unapoyanywa madawa? Je, wao hukulaumu usipoyanywa madawa? Je, wewe kwa kusudi hukosa kuwafahamisha wakati unapokosa kuyanywa madawa? Unafikiri nini kitakachofanyika iwapo watakosa kukukumbusha/kukupa moyo uyanywe madawa? 5. Je, wanajali ulaji wako wa chumvi, kufanya

		mazoezi ya mwili, kuvuta sigara au unywaji wa pombe? Je, familia yako hubadili jinsi ya masiha (kwa mfano kupunguza ulaji wa chumvi, kufanya mazoezi pamoa nawe, kuacha kuvuta sigara/kunywa pombe na mengineyo) kwa ajili yako? Je, huwa wanakusihi kuweka miadi na madaktarin? 6. Mifano ya taarifa kama hizi ni ipi? Kwa kiasi gani unaamini hizi taarifa? Taarifa hizi zinashawishije tabia yako? Je, huwa unadhibitisha taarifa hizi? Unafanyae wakati taarifa zingine zinapinganazenyewe au na fikira zako za awali? Je, huwa unabadilishana maarifa yako na hao watu?
Ufuatiliaji wa matibabu	1. Unafikirije kuhusu ufuatiliaji wa madawa yako ya shinikizo la damu? 2. Unahisije kuhusu ufanisi wa madawa ya shinikizo la damu unayoyatumia. 3. Unafikiri ni sababu zipi muhimu sana ambazo zinaweza kukufanya uache kuyanywa madawa?	1. Je, umebadili ufuatiliaje wako wa madawa hivi karibuni? 2. Unafikiri hali yako inaendeleaje? Inaimarika, haibadiliki, au inazorota? Kuna madhara yeyote kutokana na madawa? Je, inalingana na matarajio yako kutoka kwa matibabu? Jee, hii inashawishi unywaji wako wa madawa? Je, unataka kubadili madawa yako? 3. Unafikirije kuhusu umuhimu wa kufuatilia matibabu? Je unafikiri madawa ni ghali sana? Yanachanganya sana? Ni ngumu sana kumeza?
Suluhisho	Unafikiri ni vipi hali yako ya shinikizo la damu au ufuatiliaji wa madawa unaweza imarishwa?	Unafikiri ni kitu gani familia yako yaweza fanya kuimarisha hali yako au ufuatiliaje wako? Unafikiri ni kitu gani watu wengine wanaeza fanya ili kuimarisha hali yako au ufuatiliaji wako?

Hatua 5: Tamatisha maongezi kikawaida na uonyeshe jinsi kuchangia kwao kunafurahiwa na kukubaliwa**.** Tunuku wahojiwa vizawadi**.**

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