

The Relationship Between Multidimensional Social Support and Medication Adherence

Among Hypertensive Patients in Kenya

by

Shujun Fan

Graduate Program in Global Health
Duke Kunshan University and Duke University

Date: _____

Approved:

Lijing Yan, Supervisor

Truls Ostbye

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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ABSTRACT

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Abstract

Background: Medication adherence is regarded as important to improve hypertension control. Therefore, research about how to improve hypertensive patients' adherence to their regimens becomes a hot topic. Multidimensional social support is defined as support that one could obtain from family, friends and significant others. It has been show that multidimensional social support might be useful to increase medication adherence, and thus we examined the relationship between multidimensional social support and medication adherence both quantitatively and qualitatively. Methods: The research setting is Kenya because of poor hypertension control. Convenience sampling was used to recruit hypertensive patients with the help from physicians in three clinics. After finishing a digital questionnaire, a follow-up interview was delivered to participants as long as they were willing to join. The independent variable, Multidimensional social support, was assessed by Multidimensional Scale of Perceived Social Support (MSPSS). Two different scales are used to measure one outcome variable: Medication Adherence Questionnaire (MAQ) and Hill-Bone Compliance Scale (HBCS). After identifying several potential confounders, ordered logistic regression and logistic regression were used to determine the relationship between independent and dependent variables. Results: Multidimensional social support is not correlated with medication adherence using both

measurements of medication adherence. However, follow-up interviews provide sufficient information about how multidimensional social support could affect medication adherence and hypertension control. Conclusions: Although there is no correlation between multidimensional social support and medication adherence among hypertensive patients in our study, further research is still needed to improve hypertension control from the perspective of social support or medication adherence.

Dedication

I would like to dedicate this paper to my mother.

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1. Introduction

1.1 *Hypertension is an increasing threat*

Hypertension, generally defined as higher than 140/90 mmHg, accounts for a huge disease burden all over the world. From 1990 to 2015, loss of disability-adjusted life-years (DALYs) associated with high blood pressure (140/90mmHg) increased from 95.9 million (95% CI, 87.0-104.9 million) to 143.0 million (95% CI, 130.2-157.0 million), indicating global disease burden of hypertension has been increasing for decades (Forouzanfar et al., 2017).

The disease burden of hypertension in in Sub-Saharan Africa (SSA) is particularly high. The prevalence increased by 67% from 1990 to 2010 (Murray et al., 2012). A systematic review and meta-analysis, conducted in 2015, found the pooled prevalence of hypertension was 30% among four different age groups in this area, while only 18% of these 110,000 participants received medication and even less people controlled their blood pressure effectively (Ataklte et al., 2015).

As a country in SSA, the situation regarding hypertension in Kenya attracts people's attention. In the 2017 Economic Survey conducted by the Kenya National Bureau of Statistics, almost 26,000 registered deaths can be attributed to Cardiovascular diseases (CVD) from 2012 to 2016. Nevertheless, it did not report the relative number of deaths caused by CVDs. Kenya STEPwise survey for non-communicable diseases (NCD) risk factors 2015 report reported "autopsy studies suggest more than 13% of cause-

specific deaths among adults could be due to CVDs” (MOH, 2016). As one of the known factors of CVDs, occurrences of hypertension have soared. According to a population-based household survey in slum areas in Nairobi, the capital city of Kenya, which collected data in 2010, the age-standardized prevalence of hypertension reached 22.8% (Joshi et al., 2014). Moreover, the prevalence of hypertension varies among different communities (MOH, 2016). For example, a community-based study found excessively high prevalence (55.3%) in Kasigau, a city in the south of Kenya (Williams, 2012), which is much higher than the prevalence in Nairobi.

Though hypertension is mostly asymptomatic, the consequences of high blood pressure are far from invisible and silent. Ischemic heart disease and stroke, two diseases related with elevated blood pressure, are now the leading causes of death all over the world (Forouzanfar et al., 2017). Considering the increasing disease burden in Kenya, systematic and effective control of hypertension should be emphasized and prioritized.

1.2 Medication adherence is a promising direction

When considering the effective way to better hypertension control, we need to first specify various barriers to it. Among barriers to control blood pressure, including those related to the patient, provider, and medical environment, patients’ adherence to medication regimens is one of the most significant modifiable patient-related barrier (Borzecki, Oliveria, & Berlowitz, 2005). However, even in the surroundings with

effective therapy and evidence-based treatment guidelines like the United States, less than half of hypertensive patients has high adherence to prescriptions (M. A. Krousel-Wood, Muntner, Islam, Morisky, & Webber, 2009). As for places where health care systems are not that well developed like Kenya, hypertension control is alarming from the perspective of medication adherence.

In order to enhance adherence to regimens among hypertensive patients, barriers to satisfying adherence were examined and categorized into three domains in accord with barriers to control hypertension. They are patient-specific (e.g. forgetfulness), medication-specific (e.g. difficulty to swallow), logistic- (e.g. frequency of clinic) and disease-specific (e.g. absence of symptoms) barriers (Ogedegbe, Harrison, Robbins, Mancuso, & Allegrante, 2004). These domains provide researchers with directions to ensure stricter adherence to antihypertensive regimens, leading to better control of hypertension.

1.3 Social support is linked with medication adherence

One potential solution to mitigate those barriers in medication adherence is to strengthen hypertensive patients' social support because low social support resides in the domain of patient-specific barriers. Social support is defined as the perception that one has an available confidant (Cohen & Wills, 1985), or feels loved, valued, and cared for by a particular source (Walen & Lachman, 2000). Social support is found beneficial for people's health in many ways, like reducing the impact of stressors on patients with

myocardial infarction and cancer (Schwarzer & Knoll, 2007). A meta-analysis of 122 studies from 1948 to 2001 revealed a significant correlation between practical, emotional, and unidimensional social support with patients' adherence to medical regimen (DiMatteo, 2004). However, this meta-analysis admitted several limitations may hamper the effectiveness of social support, such as limited number of papers that meet the inclusion criteria, considerable variation in the conceptualization, and different measurements of social support (DiMatteo, 2004). When trying to come up with effective interventions to improve patients' adherence to their antihypertensive regimens, we need to follow the instructions of previous studies. The first thing, therefore, is to determine the relationship between social support and medication adherence. With this aim of research, an appropriate measurement of social support need to be addressed.

Multidimensional social support, meaning various kinds of assistance that people can obtain from their family, friends and significant others, could be used to measure hypertensive patients' social support. Significant others refer to those who are important to a certain patient while they are not recognized as friends or family members, such as a pastor or one's colleagues. One way to assess multidimensional social support was by Multidimensional Scale of Perceived Social Support (MSPSS) (Zimet, Dahlem, Zimet, & Farley, 1988). MSPSS is a tool that has a great internal reliability across subject groups, as well as high functional validity among three

subscales (Stewart, Umar, Tomenson, & Creed, 2014). With this scale, it becomes possible to measure hypertensive patients' perceived social support.

1.4 Conceptual framework

In brief summary, multidimensional social support may help overcome different types of barriers to adherence to antihypertensive regimens and thus exert a positive effect on hypertension control in Kenya. Therefore, the conceptual framework of this study can be constructed as follows:

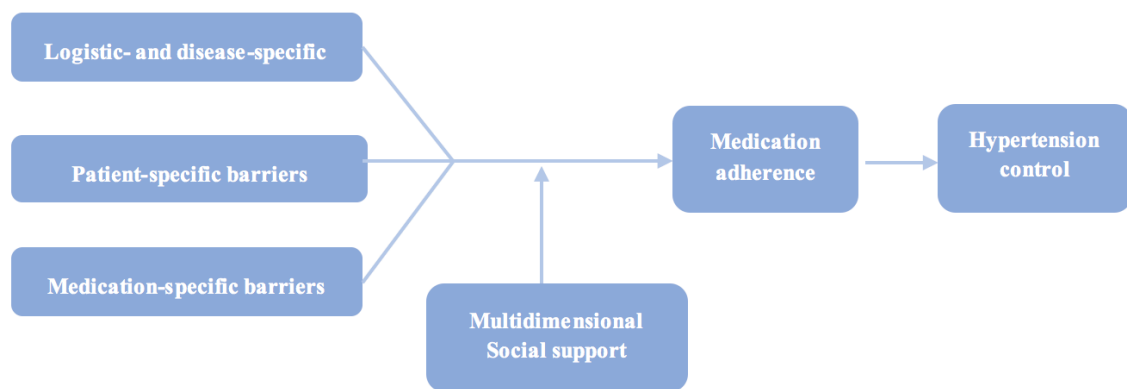


Figure 1. Conceptual framework

Conceptual framework shows the potential role of multidimensional social support. Three domains of barriers to satisfying medication adherence are demonstrated by the left three rectangles. These three domains provide implications for qualitatively exploring the relationship between multidimensional social support and medication adherence. Though building up a model explaining this pathway by this small-scale study may be too demanding, the researcher still hope to collect more information for others to finalize this task and better hypertension control.

1.5 Hypertension control in Kenya

Not only high prevalence, but also low control of hypertension in Kenya draw attention from the public. It is reported that rural Kenya has the lowest control of hypertension in one cross-sectional study conducted in four countries in SSA (Hendriks et al., 2012). Poor control of hypertension can be found in other research in Mombasa, a coastal city, and slum areas in Kenya (Jenson, Omar, Omar, Rishad, & Khoshnood, 2011; van de Vijver, Oti, Agyemang, Gomez, & Kyobutungi, 2013). Increasing disease burden of hypertension in this country calls for urgent attention on how to improve patients' adherence to prescription and then serve for hypertension control.

On the other hand, a master thesis from Kenyatta University disclosed the social support system of the elderly (aged 65 and above) in Nairobi, Kenya. The elderly obtained support mainly from their children (67%) and community (47%); there is a significant association between support from the community and functional ability of the respondents (Waweru, Lucy Mumbi, 2012). In other words, social support plays an important role in old citizens' life. Furthermore, the role of social support in health-related areas among citizens of Kenya has also been examined by several studies. A quasi-experimental study revealed the importance of social support in terms of infant feeding practices (Mukuria, Martin, Egondi, Bingham, & Thuita, 2016). More research supported its significance to improve HIV control as a buffer against the negative impact of HIV infection (Kingori, Haile, & Ngatia, 2015) and by improving adherence to HIV

medication (Kamau, Olsen, Zipp, & Clark, 2012). Inspired by these studies, the relationship between social support and medication adherence among hypertensive patients may indicate an effective strategy in this setting, with the attempt to reply on society's problems of hypertension.

1.6 Main goals and objectives

The central idea of this study is to determine the relationship between multidimensional social support and medication adherence among hypertensive patients in Kenya. This study hypothesizes there is a positive association between multidimensional social support and adherence to antihypertensive regimens, pointing out a promising direction for hypertension control. Furthermore, this study also tries to investigate possible routes from multidimensional social support to medication adherence.

Specific objectives of this study are as follows:

1. To measure participants' support obtained from their family, friends and other significant people.
2. To measure the level of medication adherence among participants.
3. To examine the hypothesis that there is a positive association between multidimensional social support and adherence to antihypertensive regimens.

4. To qualitatively investigate the mechanism by which social support can influence patients' medication taking behaviors.
5. To answer what are the potential effects of multidimensional social support toward other aspects of hypertension control except medication adherence.
6. To simply explore the perceived barriers of controlling blood pressure among patients and their suggestions for bettering hypertension control.

2. Methods

This project is a mixed-method study using a questionnaire and in-depth interviews to collect necessary information about multidimensional social support and medication adherence both quantitatively and qualitatively. The questionnaire is used to determine patients' demographic characteristics, health conditions, adherence to antihypertensive prescriptions, and the level of social support they obtained from friends, family and significant others. Further exploration of how those support could benefit patients in terms of taking medicine correctly is achieved by in-depth interviews.

2.1 Setting

Kenya is the targeted country due to its high prevalence and poor control of hypertension. The Republic of Kenya has a population of 48 million people in January 2017 (<http://countrysimeters.info/en/Kenya>). Swahili is their native language. Fortunately, the majority of inhabitants are fluent in English as well. In case participants can merely communicate in Swahili, this study still made all efforts to translate all instruments and recruited Swahili speakers as research assistants. The study was conducted in Nairobi, the capital of Kenya. Nairobi was selected because the non-governmental organization (NGO) African Population Health Research Center (APHRC) locates there. APHRC offered the most support for this study. Through the connections between APHRC and different levels of health organizations, we were then able to conduct data collection in two hospitals and one health center in Nairobi, Kenya.

Both private and public hospitals were accessed in order to collect data. The private hospital, Uhai Neema Hospital locates in the north outskirts of Nairobi. Due to its nature, the owners of this hospital required a presentation explaining this study. A collaboration letter issued by APHRC and an approval letter provided by Ethics and Scientific Review Committee of African Medical and Research Foundation (AMREF - ESRC) enabled us to communicate with hypertensive patients there. Lunga Lunga Hospital, the public hospital, is affiliated with Nairobi County, sitting closely to a slum and providing free clinic services regarding noncommunicable disease for the public every Thursday. These free clinic days were supposed to help researchers reach enough numerous hypertensive patients. However, this plan was disrupted because the election of president of Kenya and subsequent a prolonged strike. Under the pressure of limited time and participants, we start approaching the third clinic called Korogocho Health Center, which locates in the area of a slum. This public hospital has no free clinic days. However, a local mobilizer helped the research team to approach hypertensive patients living near it. To summarize, these three hospitals mostly serve patients with low socioeconomic status. Therefore, this study sample was limited to this population.

2.2 Participants

Hypertensive patients attending these health organizations were asked by their physicians to participate in the study at the conclusion of their appointment. The fundamental inclusion criteria for participating in this study is no more than

hypertensive adults. However, due to the requirement of measuring patients' adherence to antihypertensive regimens before determining the wanted relationship, we required patients to first confirm that they are on prescription. To explain further, some patients are diagnosed with hypertension while they are not recommended for taking antihypertensive medications immediately. Instead, they are asked to change their lifestyle to decrease blood pressure. This kind of patients were not included in this study since we cannot get information about medication adherence. In addition, a strike of doctors and nurses prevent some participants from refilling antihypertensive medications. However, the limitation of research time did not allow us to drop these participants. More importantly, there were patients who were prescribed the medicine but could not afford to buy them therefore they were without access to medicine for us to assess medication adherence. The questionnaire did not specify this kind of reasons of medication nonadherence but we did explore it in interviews.

With the help from health professionals in three health organizations, eligible hypertensive patients were identified and then recruited into the study after providing written informed consent. After answering the questionnaire, every participant was inquired whether he or she was willing to take a follow-up interview for the qualitative part of the study. All other participants who agreed to take the interviews were included into qualitative research.

2.3 Procedures

After a brief introduction, participants were also provided with printed informed consent form for further comprehending the whole study. They had time to read this material until they have no doubts about potential risks and our preventive measures for their benefits, and then decided to join in this study or not.

The research team included four people: two graduate students from Duke Kunshan University and two local research assistants recruited from APHRC. Shangzhi Xiong and Shujun Fan, two graduates of Duke Kunshan University, have our own research topics and questions but are also related to some extent. To explain further, the independent variable of my study is multidimensional social support, talking about the total amount of support that people can obtain from their friends, family and significant others. All kinds of support are supposed to be included. In other words, I obtained general information about family support as one kind of social support. It is Shangzhi Xiong who designed comprehensive methods to investigate family support as his research topic. Therefore, there is some overlap between our research projects. However, I did not quantitatively explore each subscale (family, friends, significant others) further. In addition, when family support was identified in the interviews, it was discussed in the context of social support.

Before we integrated our instruments, a special process of translation of MSPSS was conducted. In order to produce a translated version in Kenya language with

semantic conceptual and operational equivalence to the original English version, we conducted localization of the MSPSS in agreement with the internationally accepted guidelines stipulated by the Mapi Research Institute's methodology (Acquadro, Conway, GirouDET, & Mear, 2004). Through this strict translation process, measurement error can be minimized. The specific process of linguistic and culture localization has three steps (Figure 2): first, MSPSS questionnaire was translated into Swahili by two translators who are native Swahili speakers and are proficient in English. These two translators worked independently to avoid interaction. One of them was told the general idea of study aims and process while the other one did not have any previous knowledge about the study's objectives. After completing independent work, two translation results will be compared and compiled to Version 1 by two translators and investigators. Second step is back translation means that the third translator will translate Version 1 from Swahili into English. The comparison between translation result and original MSPSS questionnaire was conducted and we then got Version 2 through further reconciliation and rectification. The last step was pilot testing. The aim of this step is to ensure the translation result is understandable and acceptable to participants. Finally, with the attempt to avoid typographical, spelling and grammatical errors, the final version of MSPSS questionnaire in Swahili will be obtained and then disseminated to participants.

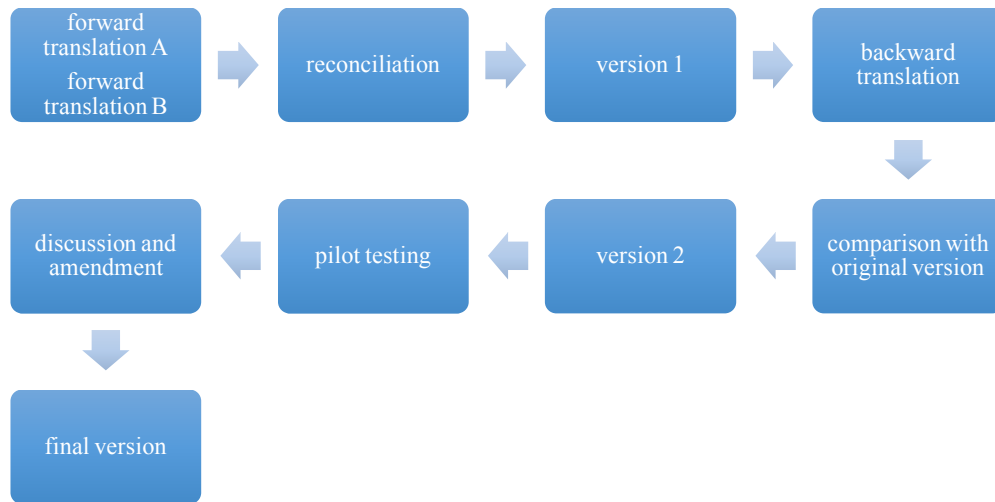


Figure 2. Flowchart of linguistic localization

Another particular practice is the digitization of the questionnaire. With the attempt to avoid mistakes occurred during data entry, the questionnaire, both in English and Swahili, was digitized and presented by tablets with the help from IT researchers in APHRC. Another great advantage of using digital questionnaire is that Survey CTO system would remind participants if they omit certain questions. In this way, respondents have to go back to that omitted question and thus make sure they finish all questions before submitting the whole questionnaire.

All participants got a pen as compensation. Any participants who took the follow-up interviews received other compensations, including soaps or shopping bags.

Ethical Approvals for this study were given by 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-

ESRC). To conduct this research in Lungu Lungu hospital, we also obtained the approval letter from Nairobi County.

2.4 Measures

Selected demographic characteristics included age, education level, employment status, marital status and religions. The independent variable of this study is the level of multidimensional social support, represented by the score of MSPSS. As introduced above, MSPSS is a 12-item scale measuring interpersonal support usually sought for and provided by family, friends and significant others. The dependent variable is patients' medication adherence that determined by two different scales, referring to the extent to which patients adhere to antihypertension regimens prescribed by the physicians.

2.4.1 Measurement of Multidimensional Social Support

The Multidimensional Scale of Perceived Social Support (MSPSS) is a 12-item scale with 7 choices attached to each statement. Like one statement: "I can count on my friends when things go wrong", and participants can choose 1 to 7 respectively represent "very strongly disagree", "strongly disagree", "mildly disagree", "neutral", "mildly agree", "strongly agree", and "very strongly agree". Participants thereby got 12 to 84 points according to their answers. The higher that a person scored, the more social support he or she perceived from friends, family or other important people. Given skew distribution of mean scale scores of MSPSS, the second score option provided by the inventor was used to divide participants into three groups: any mean score ranging from

1 to 2.9 was labeled as “low support”, any mean score from 3 to 5 was considered “moderate support” and the score from 5.1 to 7 was labeled “high support”.

2.4.2 Measurement of Medication Adherence

The measurement of outcome variable is based on two independent scales: Medication Adherence Questionnaire (MAQ) by Morisky (D. E. Morisky, Levine, Green, & Smith, 1982) and Hill-Bone Compliance Scale (HBCS) (Kim, Hill, Bone, & Levine, 2000). While MAQ is concluded as the most frequently used measurement tools, the latter one is proved to have better internal consistency (standardized Cronbach’s alpha was 0.74-0.84) (Culig & Leppee, 2014).

The mean of scoring MAQ is provided by the inventor simultaneously as follows: A patient who gave negative answers to all four questions was regarded as highly adherent to his regimen; anyone gave one to two “yes” to certain questions was labeled as “medium adherent” to prescriptions; the left people who offered more than three positive responses to these four items were considered to have low adherence.

Meanwhile, one’s score of HBCS was simply summed up according to authors’ original article. The scale has 14 items with four response options: (4) all of the time, (3) most of time, (2) some of time, and (1) none of the time. Therefore, the total scores of HBCS range from 14 to 56. Higher score of HBCS indicates lower levels of adherence to antihypertensive treatment. Among 14 questions of this scale, however, three are asking about dietary intake and two are related with appointment keeping. There are 9

questions truly categorized into the subscale of medication adherence. We thus merely calculated the mean score of questions 1, 2, and 8 to 14. The distribution of scores of these nine questions is heavily skewed, and 27% of participants reported perfect medication adherence. Thus, suggested by another study, the results of the subscale of medication compliance were separated into two groups: anyone achieved more than 9 points was labeled as “imperfect adherence” and others who got 9 points were labeled as “perfect adherence” (M. Krousel-Wood, Muntner, Jannu, Desalvo, & Re, 2005).

2.5 Analysis

2.5.1 Quantitative analysis

Thanks to digitization of the questionnaire, all data were directly uploaded to the platform Survey CTO, which is confirmed safe by senior researchers in APHRC. And then it was download to researcher’s encrypted device for storage. In this way, it is innocuous to claim that we avoid potential mistakes caused by data entry. However, when using tablets on the first day of data collection, research assistants typed participants’ blood pressure incorrectly. And one participant entered his birth year and month in the wrong place, leading to wrong calculated age. These obvious mistakes were corrected before data analysis and then the whole dataset was imported into Stata 15.0.

There are few missing data except participants’ income. The information about patients’ income was first considered as a potential confounder. However, education

level is closely related with income level and thus can be used as an alternative confounding variable. In this way, it is unnecessary to drop all missing data stemmed from income level. Meanwhile, without assistants from research assistants, three participants entered their age wrongly, resulting in three outliers. Age is an important variable may affect the association between multidimensional social support and medication adherence, so these three outliers were dropped at the beginning.

After dealing with missing data and outliers, demographic characteristics were summarized. Then, stepwise estimation was used to identify related variables via backward selection. Backward selection started with all candidate variables, examining their correlation with the outcome variable using a suitable model, deletes insignificant variables one by one until no further variables can be deleted.

Because of two different scales used to measure dependent variable, stepwise estimation was used twice and based on different model and thus located different confounding variables. Specifically, the outcome variable, assessed by MAQ, is ordered while the difference between various adherence is not consistent. Therefore, when using MAQ to describe outcome variable, stepwise estimation used ordinal logistic regression model to automatically identify related variables. Ordered logistic regression is widely used in ordinal variables. In this way, participants' age was found to be a confounder. On the other hand, logistic regression model was used in stepwise with another measurement of outcome variable (HBCS). As a result, residence place and marriage

would probably affect the association between multidimensional social support and medication adherence among hypertensive patients. In conclusion, these two backward elimination procedures identified age, residence place, and marital status as confounding variables, probably influencing the association between multidimensional social support and medication adherence. Then unadjusted odds ratios and 95% confidence intervals was calculated with ordered logistic regression and logistic regression respectively in line with different measurements of outcome variable. In the end of data analysis, multivariate ordered and logistic regression were used to examine the relationship between multidimensional social support and medication adherence. A P-value of <0.05 was considered as statistically significant.

2.5.2 Qualitative analysis

As mentioned above, participants were asked whether they are willing to provide more information through a follow-up interview. In this way, 21 participants were interviewed with the attempt to answer research questions. The main question to be answered by qualitative research is how multidimensional social support influence medication-taking behaviors among hypertensive patients. Apart from affecting medication-taking behaviors, what is the potential association between multidimensional social support and hypertension control? To answer these two questions, a guideline of a semi-structured interview was developed. During the training of research assistants, this guideline was revised and thus became more smooth

and orderly. However, several transcriptions with insufficient information showed the fact that semi-structured interviews were difficult for research assistants to utilize.

Under this circumstance, the guideline was finally revised into a list of questions for structured interviews.

Transcriptions were required to be finished by interviewers immediately after interviews in order to reproduce as many details of interview processes as possible. Not only each word, but also moods, tones, and non-verbal expressions of interviewees are important to understand people's answers. The tool of qualitative exploration is Nvivo 11 for Mac. The main steps of analysis are reading materials, identifying codes and categorizing them into different theme nodes, and lastly identifying representative quotes. Therefore, after accumulating transcriptions of interviews from fields, reading transcriptions was prioritized. The main purpose of reading is to modify wrong typing because we cannot make changes to transcriptions after importing them into Nvivo. The following step is to import materials and read them closely in order to generate a whole picture of answers to two research questions. Having this whole idea, I started coding these sources and gather materials about two main questions and store them in different containers called nodes. The last step is to summarize the answers toward research questions based on these nodes. Suitable quotes were marked during summarizing meanwhile in order to exemplify the answers.

3. Results

3.1 Quantitative results

3.1.1 Description of the sample

After deleting three observations, there are 101 observations remained in dataset. Their demographic characteristics were summarized in Table 1. As shown in this table, the age of participants ranged from 29 to 82. After quartering this range of age, we got four age groups and found the large percentage of hypertensive patients joined in this study are middle-aged and elderly. More than two thirds of participants are female. Nearly 90 percent of people attended at least primary school and most of them speak English very fluently. Due to the locations of three clinics, the majority of participants live in urban area (N=92) although some participants actually live in slum areas. As for marital status, most of participants got married (N=91) while some of them has been divorced (N=9) or widowed (N=15). As we known, Kenya population believe in various religions. The majority of participants followed Christianity (N=93). Half of participants are employed while another half do not have jobs and financially rely on others.

Table 2 demonstrates that two different measurements of medication adherence brought different results. 55% participants reported high adherence to their regimens with MAQ while the proportion of perfect adherence is much lower (28%) with HBCS.

Table 1. Descriptive characteristics for respondents

Characteristics	Total(N=101)	Percentage
Age		
29-42	12	0.12
43-55	34	0.34
56-68	33	0.33
69-82	22	0.22
Gender		
male	32	0.32
female	69	0.68
Education		
no formal schooling	13	0.13
primary school	41	0.41
primary school complete	16	0.16
secondary school	31	0.31
Residence		
rural	9	0.09
urban	92	0.91
Marital status		
unmarried	10	0.10
married	67	0.66
divorced	9	0.09
widowed	15	0.15
Religions		
Islamism	3	0.03
Catholicism	3	0.03
Protestantism	1	0.01
Christianism	93	0.92
Hinduism	1	0.01
Employment status		
employed	50	0.50
unemployed	51	0.50

Table 2. Measurement of medication adherence with two scales

Measurements	Frequency (N=101)	Percentage
MAQ		
Low	5	0.05
Medium	40	0.40
High	56	0.55
HBCS		
Perfect adherence	28	0.28
Imperfect adherence	73	0.72

3.1.2 Using Morisky Adherence Questionnaire (MAQ)

With the Morisky Adherence Questionnaire, we assessed patients' adherence to their antihypertensive regimens: 56 patients reported high adherence, 40 claimed medium adherence, and merely 5 people admitted low adherence to their regimens (Table 2).

Ordered logistic regression did not give positive results with regard to the association between independent and dependent variable in both univariable and multivariable model (Table 3). Meanwhile, age was identified as a confounding variable. Different age groups of patients behave distinctively in terms of taking antihypertensive medications in both univariable model and multivariable model. After controlling other variables, the odds of people whose age are from 43 to 55 is around four times higher than people who are younger than 42 years old (OR=4.25; 95% CI: 1.11 to 16.31). People older than 55 have a higher possibility to be high adherent to their

regimens. Residence and Marital Status were both irrelevant to medication adherence using MAQ.

Table 3. Relationship between multidimensional social support and medication adherence using Morisky Adherence Questionnaire (MAQ)

Variables	Unadjusted OR (95% CI)	P	Adjusted OR (95% CI)	P
MSPSS				
low	1 (Referent category)		1 (Referent category)	
medium	0.32 (0.06 to 1.80)	0.20	0.36 (0.56 to 2.27)	0.27
high	0.62 (0.11 to 3.44)	0.58	0.82 (0.13 to 5.15)	0.84
Age				
29-42	1 (Referent category)		1 (Referent category)	
43-55	4.51 (1.23 to 17.33)	0.02*	4.25 (1.11 to 16.31)	0.04*
56-68	5.19 (1.37 to 19.64)	0.02*	5.06 (1.29 to 19.76)	0.02*
69-82	5.73 (1.37 to 23.96)	0.02*	5.10 (1.12 to 23.22)	0.04*
Residence				
rural	1 (Referent category)		1 (Referent category)	
urban	0.91 (0.24 to 3.45)	0.89	0.69 (0.15 to 3.21)	0.64
Marriage				
unmarried	1 (Referent category)		1 (Referent category)	
married	0.47 (0.11 to 1.96)	0.3	0.51 (0.17 to 2.28)	0.38
divorced	0.56 (0.09 to 3.55)	0.54	0.49 (0.07 to 3.48)	0.48
widowed	0.46 (0.09 to 2.45)	0.36	0.34 (0.06 to 2.02)	0.24

* significantly different (p<0.05)

3.1.3 Using Hill-Bone Compliance Scale (HBCS)

Negative result of relationship between multidimensional social support and medication adherence was also found using Hill-Bone Compliance Scale (HBCS). With this instrument, 28 participants reported perfect adherence to their regimens while other 73 people got more than 9 points at the end of this scale (Table 2). As we can see from

Table 3, place of residence is significantly related with medication-taking behaviors in multivariate logistic regression model. People living in urban areas are much more likely to have better adherence to their regimens than rural dwellers do (OR=8.52; 95% CI: 1.34 to 54.32). Association among patients' age, marital status, and medication adherence was not found as well.

Table 4. Relationship between multidimensional social support and medication adherence using Hill-Bone Compliance Scale (HBCS)

Variables	Unadjusted OR (95% CI)	P	Adjusted OR (95% CI)	P
MSPSS				
low	1 (Referent category)		1 (Referent category)	
medium	2.91 (0.56 to 15.12)	0.20	3.95 (0.51 to 30.92)	0.19
high	1.13 (0.24 to 5.29)	0.87	1.04 (0.15 to 7.13)	0.97
Age				
29-42	1 (Referent category)		1 (Referent category)	
43-55	0.37 (0.69 to 1.95)	0.24	0.32 (0.05 to 1.94)	0.22
56-68	0.63 (0.11 to 3.47)	0.59	0.55 (0.10 to 4.18)	0.66
69-82	0.53 (0.09 to 3.18)	0.49	1.07 (0.13 to 8.55)	0.95
Residence				
rural	1 (Referent category)		1 (Referent category)	
urban	3.75 (0.93 to 15.16)	0.06	8.52 (1.34 to 54.32)	0.02*
Marriage				
unmarried	1 (Referent category)		1 (Referent category)	
married	2.31 (0.58 to 9.27)	0.24	2.97 (0.58 to 15.07)	0.19
divorced	5.33 (0.47 to 60.80)	0.18	7.08 (0.51 to 97.60)	0.14
widowed	0.58 (0.12 to 2.95)	0.51	0.79 (0.12 to 5.21)	0.81

* significantly different (p<0.05)

3.2 Qualitative results

3.2.1. Effects to medication adherence

The fourth specific objective of this study is to qualitatively display underlying impact of multidimensional social support on patients' adherence to antihypertensive treatment. Participants interacted with interviewers lively and provided valuable information about this question. The answer can be summarized into two headings: others' reminders and information sharing.

3.2.1.1 Others' reminders

Among 21 interviewees, 15 mentioned that they were reminded by others to take medications on time. Most participants reported that their family members help them maintain and even improve their adherence to antihypertensive medication. Some of them further specified that it is their children or spouse that remind them of taking medication. For example, one respondent remarked, *"They 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."* Meanwhile, 3 respondents also mentioned reminders from their friends. However, these kinds of reminders from friends seems to be weak. For instance, one respondent said, *"Some of my friends concerned, they do ask 'do you take your medicine today?'"* This kind of reminders are different from the kind said by family members. The reason for the difference is because patients' families tend to know more about their regimens and the time that respondents are supposed to take medications.

For example, one participant shared her story about her family help her with taking medication correctly. She suffered from both hypertension and diabetes and thus became forgetful, so sometimes she took more pills than prescribed. Taking more medication is as dangerous as skipping medication for a hypertensive patient. Her family ameliorated this situation by using a calendar: *“they decided to put a calendar somewhere. So they talk to me, Mom, after taking drugs, tick, showing today you took the drug, for you not taking them again and again.”* This may serve as an example for future interventions with patients who suffer from comorbidities. In a short summary, others’ reminders, especially from family members, could help reduce the possibility of forgetting to take medications.

3.2.1.2 Information sharing

Information sharing is critical for hypertensive patients. Almost two thirds of respondents (13/21) mentioned that they share stories with others. Friends play the most important role with regard to sharing information, one participant claimed, *“we usually meet at times and exchange ideas on the various ways we should live healthy and educate each other more even on the importance of taking our medication without fail.”* People tend to share their health conditions with those who are under the same circumstance. Some said, *“I explained to some of my friends when I was diagnosed with hypertension, especially those I knew that they have hypertension. We do encourage each other.”*

There is a phenomenon emerging from interviews: some patients did not realize the importance of taking medicines as prescribed until they felt uncomfortable. At that time, their blood pressure probably had reached a terrible level. In response to this phenomenon, information sharing could prevent patients from overlooking the danger of stopping medicine arbitrarily. For instance, one patient said, *“I just hear other people saying they have hypertension, we share knowledge. Like a while ago I was talking to one there who has diabetes as well and she was telling me of someone who refused to take medication and is now paralyzed and ended up using a lot of money for treatment.”*

Hypertension is regarded as a silent killer. It is important to emphasize the necessity of taking medication as prescribed even if patients do not feel uncomfortable. Friends’ support, in the form of information sharing, is beneficial for hypertensive patients as a buffer against the ignorance of this necessity.

3.2.2. Effects to hypertension control

The last research question is what are the potential effects of multidimensional social support toward other aspects of hypertension control except medication adherence. To answer the question, we need to examine the knowledge level of hypertension among hypertensive patients because knowledge about hypertension is the foundation of controlling blood pressure at a satisfactory level. According to the interviews, knowledge regarding hypertension was varied among participants. Some people could hardly discuss about even risk factors of hypertension while some people

displayed their abundant knowledge. Some patients with greater knowledge surrounding hypertension could specifically explain risk factors of high blood pressure, one said, *“like when there’s something stressing me, I control myself. Because with hypertension, I am not supposed to worry much or receive shocking news, it will make the pressure to shoot. Also one should avoid too much intake of salt, sugar and fatty foods, a lot of meat, but should eat a lot of vegetables. Oh and also someone with hypertension should exercise more often.”*

Facing with discrepancy of knowledge surrounding hypertension, we have to examine sources of knowledge among hypertensive patients. Among 15 participants who were asked about information source, 10 of them claimed that health professionals are their mere source of knowledge regarding hypertension because of trustworthiness. Although as mentioned before, some interviewees share information with others in order to better control their blood pressure. For instance, a community volunteer worker shared her experience about managing blood pressure through sharing various kinds of information with her colleagues, such as the way of keeping fit and avoiding stress. Sharing information, a form of multidimensional social support, provides hypertensive patients with more opportunities to obtain knowledge about better control hypertension. In addition to information sharing, few interviewees also mentioned social media and health-related organization as their sources of knowledge. This is related with potential improvements below.

Apart from educating each other and taking medications as prescribed, there are three dimensions of multidimensional social support related with hypertension control: inquiries about health condition, lifestyle adjustments and appointment keeping, explained as following head titles.

3.2.2.1 Inquires about health condition

Almost half of participants reported they were asked by their family members about their health status. None of them specified whether their friends also act in the same manner with their families. However, it is reasonable to imagine that friends might start discussions with asking about each other's health conditions. In addition, one participant mentioned her pastor "*really much concerns and does ask like how I am faring on.*" This person is the vary respondent whose family members tried to help her improve medication adherence with the calendar. In other words, she had the access to support not only from the significant people, her pastor, but also from her family members. In this way, she believed hypertension did not hamper her quality of life. In general, patients got the feeling that they are cared for when they were asked about their health conditions. Patients were stimulated by this perceived support and thus became more active to control their blood pressure.

3.2.2.2 Lifestyle adjustment

This aspect of support could be only related with support from family members since none of participants live with their friends or other people. More than half of

interviewees reported their family members had adjusted lifestyles for them (N=11), like one said, *“They are also caring in the sense that they have adjusted to the lifestyle I (am) living. Some people can find it hard to even reduce the amount of salt put in the food or even 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.”* As this example shown, limiting salt intake is an important aspect of lifestyle adjustment. 14 of them indicate limiting salt intake is the major way of their family, friends or significant others showing their concerns. Although most people obtain lifestyle support from their family members, two people also mentioned friends’ support. They were provided with suitable meals with less salt by their friends during visits. However, there is one participant who reported the opposite effect as his friends always persuaded him to drink more beers. This behavior of friends cannot be regarded as support according to its definition.

A few participants reported another three means of multidimensional social support with regard to lifestyle adjustment. These means are relieving stress, improving physical activity, and controlling tobacco consumptions. Although some participants mentioned others suggested them *“avoid overthinking”*, none of them specified the approach of lowering their stress level. Meanwhile, two participant mentioned their family members and friends remind them or invite them to do some exercises and another mentioned his wife persuaded him to quit smoking. To sum up, lifestyle

adjustment, an aspect of social support, is an important factor of better hypertension control.

3.2.2.3 Appointment keeping

According to HBCS, appointment keeping is also an important component for hypertension control. Almost half of participants reported they were reminded by others to go to clinics (N=8). Family members try to help them make the appointments with doctors or directly send them to hospitals when necessary. In the example of community volunteer worker mentioned above, she said her friends, other volunteer workers, also remind her of regular checkup.

3.2.3 Barriers and improvements

At the end of the interview guide, researchers further explored barriers of controlling hypertension and any related improvements that interviewees expected. Among those who revealed barriers to take medicine as prescribed (n=6), the lack of free medication at public hospital seems to be the biggest obstacle for them to follow instructions from health professionals. What exacerbated this situation is that staffs at the hospital were on strike to protest unsatisfactory salaries during the time we did this research. Therefore, when participants were asked about situations that they will probably stop medications, some participants answered, "May be when I run out of pills, especially this time doctors are not working. So we are really suffering. We are

forced to purchase medicine from pharmacy or private hospitals, which is very expensive.”

What can be done to improve patients’ medication adherence is closely related with their perceived barriers. Around one third of participants reflected their expectations that the government could provide enough antihypertensive medications at public hospitals without charge or payment (N=6). Some also advised the government to tackle the current strike effectively and employ more health professionals. One said, *“The government should see what to do to bring nurses back so that they can give the drugs.”* and *“Government should employ more doctors to deal with hypertension.”*

Apart from expectations on government, participants pointed out some other potential ways to better their hypertension control. These other ways including solving family financial problems, obtaining support from others and optimizing public surroundings. Four respondents said the way of protecting them from stress is to address their family finance issues. These four participants believed that if they or their family members acquired steady jobs, they could manage their life better and thus control blood pressure more easily. One participant emphasized that obtaining support from his family could help him improve hypertension control. He said, *“May they try and cook for the food advised by the doctor and also when I forget to take drugs they remind me.”* This answer also reflects the positive effect of others’ reminders as hypothesized. Meanwhile, two respondents said they hope health professionals can provide more health education

to them as a form of support. Last but not least, one people pointed out the importance of smoking cessation in public areas.

4. Discussion

The gathered data did not support our hypothesis that there is a positive relationship between multidimensional social support and medication adherence among hypertensive patients. In addition, due to different scales of medication adherence, even identified confounding variables are different. However, the analysis of interviews still suggested potential influence of support from others on patients' adherence to their regimens. The forms of multidimensional social support could be others' reminders and information sharing, leading to good medication adherence reported by interviewees. Furthermore, interviews implied other potential mechanisms by which multidimensional social support could benefit hypertension control.

The negative quantitative results of this study might stem from three chosen scales. Multidimensional Scale of Perceived Social Support (MSPSS) though is confirmed as a useful tool with a great internal reliability (Stewart et al., 2014), 7-likert items may be too difficult for participants to choose the one corresponds to fact. Given that the large percentage of participants (69%) did not attend secondary school, it is reasonable to assume some of them cannot tell the difference among "very strongly", "strongly" and "mildly". In spite of sophisticated localization of MSPSS, it is still likely that this scale distorted the relationship between dependent and independent variables. Moreover, the two measurements of outcome variable could also result in the adverse impact on the result of this study, even though a great deal of research suggest these two

instruments are reliable for measuring medication adherence (Donald E Morisky, Green, & Levine, 1986; Song et al., 2011; Uchmanowicz, Jankowska-Polańska, Chudiak, Szymańska-Chabowska, & Mazur, 2016). Morisky Medication Adherence Questionnaire (MAQ), known as the shortest instrument with regard to self-report medication adherence, is very convenient to score. However, a study revealed MAQ lacks consistency when used in an elderly population aged from 45 to 64 (Beyhaghi, Reeve, Rodgers, & Stearns, 2016). Since the majority of participants in our study are older than 43 years old (88%), we probably could not avoid the problem of low consistency of this scale and thus got the neutral result in this study. This problem was also found in using Hill-Bone Compliance Scale (HBCS)(Culig & Leppee, 2014). In addition to low consistency, floor effects are also found when using these two measurements of medication adherence (Culig & Leppee, 2014). Floor effects in this paper referred to the tendency that people chose answers that show their adherence. This tendency is likely to be enlarged when participants were helped by research assistants.

Another possible reason of nonsignificant correlation between multidimensional social support and medication adherence is the limitation of sample size. Generally speaking, related research engaged more participants than we did. In our case, the time of waiting for ethical approval partially discourage us from approaching more patients given that we only have ten weeks in fields.

As for age and residence, identified as confounding variables in this study, we also failed to explain it based on sound literature. The reason of this failure is these two factors were seldom used as variables individually, which means little research explored age difference and residence difference regarding social support or medication adherence.

Results gathered from qualitative analysis specified a potential impact of multidimensional social support on medication adherence. Because no research was found to qualitatively explore this mechanism, it is unlikely to compare results of this study with what previous research found. As far as this study is concerned, family support, especially reminders from family members is the most important and straightforward way to enhance patients' adherence to their regimens. It is reasonable that family members could undertake the task of reminding patients better than others due to closer relationship among family members in general. However, most of participants reported that they did not have other family members who were meanwhile diagnosed with hypertension. This condition motivated patients to share stories with their friends and significant others. Although many people said they usually share information with their friends, the majority of people claimed that they obtained knowledge regarding hypertension only from health professionals. This phenomenon indicates the mechanism of friends' support might be seeking emotional resonance while the main source of knowledge was physicians. To explain further, patients tried to

improve their medication adherence via depending others as a mirror. These patients learned from sad stories shared by their friends and thereby avoid repeating harmful behaviors such as skipping medicine. Meanwhile, it is knowledge about hypertension that afforded patients strong motivation to stay persistent with their prescriptions. In short, social support from friends seems to be limited and support from health professionals was emphasized.

Multidimensional social support could probably exert a positive effect on patients' lifestyle and appointments keeping, supportive research was not found though. Nevertheless, the qualitative result might provide some ideas for future interventional programs in Kenya.

4.1 Implications for policy and practice

A direct indication of this study is that Kenyan citizens expect more free antihypertensive medications and sufficient health professionals at public hospitals. The Kenya Economic Survey 2017 showed that the number of clinical officers was 0.38 per 1,000 populations in 2016 (Kenya, 2017), while worldwide average number of physicians is 1.498 per 1,000 people in 2012 (World Bank, 2012). If patients are unable to meet with physicians regularly and purchase their antihypertensive medicine easily, any kinds of research will not help people fight with this silent killer.

What aggravated the situation of patients is that the majority of participants obtained knowledge about hypertension only from health professionals. In other words,

health education from other trustworthy people or organizations is urgently needed. There are many non-profit organizations trying to help local populations in Kenya. However, interviews showed that few patients received health education from these organizations. The coverage of healthcare assistance from non-profit organizations is insufficient. Thus, this study calls for more attention to hypertensive patients given that hypertension is an increasing health threat for Kenya.

4.2 Implications for further research

The study appeals to researchers to make a concerted effort to address the instruments of self-report medication adherence. Due to the limitation of research budget, we had to utilize four-item Morisky Adherence Questionnaire, which is free to use. The modified version, 8-item Morisky Medication Adherence Scale (MMAS) (Donald E Morisky, Ang, Krousel-Wood, & Ward, 2008) is recommended if only research budget allows. However, a review of MMAS and original four-item scale summarized some weaknesses of these two scales, such as the poor relationship between the MMAS and objective clinical measures (Tan, Patel, & Chang, 2014). In addition, HBCS obtained adverse comments with regard to low consistency and floor effects. And the number of research using this scale might not be enough to affirm its validity and reliability. In addition, because of the challenge of explaining different results caused by using two scales, we suggest further research should use one instrument to measure a

certain variable. More importantly, an improved scale of medication adherence needs more intensive research.

Another implication for future research is related with friends' support. Although support from friends seems to be limited in terms of improving medication adherence, it still shed light on the potential of peer support groups. Peer support groups, an advanced form of social support, could be used as an alternative in order to mitigate the shortage of health professionals. As mentioned in results, one participant said she talked with her colleagues, who are also hypertensive patients, about how they should live a healthy life. They exchanged knowledge about keeping fit and avoiding stress and reminded each other to take medications, providing her with life altering behavior modifications.

4.3 Study strengths and limitations

Special translation process of MSPSS is an advantage of this study. This complicated process of translation ensured that participants understood the question as precisely as possible. According to our experience, we did not predict so many differences between first two translators' work. After backward translation and discussion with each other, translators finally reached an agreement on the Swahili version of MSPSS.

When analyzing the reason that we did not achieve desired relationship between multidimensional social support and medication adherence, we have mentioned several

limitations of this study, including imperfect instruments and small sample size.

Another three limitations are intraclass correlation, cross-sectional nature of the study and social desirability bias. Intraclass correlation might emerge from convenient sampling because we approach one group of participants at a time in a certain hospital. This method of sampling cannot avoid the potential similarity or mutual effect amongst this group of participants since they go to clinics together on a regular basis, like once a month. This contextual factor might bring problems through their similar answers to some certain questions. Nevertheless, we did not realize this problem until the end of data collection and thus did not collect sites information. Future research should tackle intraclass correlation, for example, including sites in the stepwise estimation and regressions.

On the other hand, it is unlikely to avoid some bias due to cross-sectional questionnaire. Although the inventor of HBCS claimed a good predictive validity, one-time questionnaire could be problematic to measure medication adherence. To explain further, research about persistence with treatment demonstrated that hypertensive patients' adherence to their regimens continued decreasing over time from the beginning of treatment to the fourth year (Caro, Salas, Speckman, Raggio, & Jackson, 1999). And fluctuations of medication adherence could also result from changes of in the patients' life. Therefore, if any further research attempts validate the potential effect of a

variable on medication adherence, it would be better to measure both baseline and follow up data.

The last limitation is social desirability bias probably introduced by digitization. To explain further, in some cases that participants were not aware of how to deal with tablets, research assistants had to hold the digital devices and read each question to participants and asked for their answers, which might result in over-reporting good medication adherence and under-reporting unpleasant experience with friends, family members or other significant people. When collecting data, our research assistants inquired whether participants need help to deal with digital questionnaire. In order to decrease the possibility of social desirability bias, participants are encouraged to finish all questions by themselves.

5. Conclusion

Although multidimensional social support was not significantly correlated with medication adherence in this study, the similar research topic is worthy of investigation. Hypertensive patients reported several important forms of multidimensional social support which are beneficial for increasing medication adherence and other aspects of hypertension control. According to verbal information from participants, it is still promising to determine the long-term impact of social support on medication adherence among more hypertensive patients.

Appendix A. Questionnaire

Research Title: The Relationship between Multidimensional Social Support and Medication Adherence among Hypertensive Patients in Kenya

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 age? _____ years old
2. What is your gender? Male Female
3. What is your education level?
 ≤ Junior school High school Some colleges ≥ Graduate school
4. Are you rural or urban resident? Urban Rural
5. What is your marriage status?
 Unmarried Married Divorced
6. How many sons/daughters do you have? _____
7. How many family members do you live with? _____

What are their relationships with you? (mother, father, son, daughter, etc.)

8. Are you religious?

Yes, my religion is _____ No, I'm not religious

9. Are you currently employed?

Yes, my job is _____ No, I am currently not employed

10. 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. Who did you first get diagnosis of hypertension from?

A licensed physician A nurse A community health worker Others:

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

5. 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?

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

Very important Moderately important Somewhat important A little important Not important

7. 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

8. How often do you measure your blood pressure?

Every day Every 3~4 days Every week Every month

Others_____

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

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

Excellent Very good Good Fair Poor

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

Excellent Very good Good Fair Poor

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

Strongly disagree Disagree Neutral Agree Strongly agree

13. Do you have a health insurance?

Yes No Don't know

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

15. 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 4 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 question, 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 leaving 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: Multidimensional Scale of Perceived Social Support

Notes: We are interested in how you feel about the following statements. Please read each statement carefully and indicate how you feel about each statement.

	Very strongly disagree	Strongly disagree	Mildly disagree	Neutral	Mildly agree	Strongly agree	Very strongly agree
1	1	2	3	4	5	6	7
	There is a special person who is around						

	when I am in need							
2	There is a special person with whom I can share joys and sorrows.	1	2	3	4	5	6	7
3	My family really tries to help me.	1	2	3	4	5	6	7
4	I get the emotional help & support I need from my family.	1	2	3	4	5	6	7
5	I have a special person who is a real source of comfort to me	1	2	3	4	5	6	7
6	My friends really try to help me.	1	2	3	4	5	6	7
7	I can count on my friends	1	2	3	4	5	6	7

	when things go wrong							
8	I can talk about my problems with my family	1	2	3	4	5	6	7
9	I have friends with whom I can share my joys and sorrows.	1	2	3	4	5	6	7
10	There is a special person in my life who cares about my feelings.	1	2	3	4	5	6	7
11	My family is willing to help me make decisions.	1	2	3	4	5	6	7
12	I can talk about my problems with my friends.	1	2	3	4	5	6	7

Appendix B. Interview guide

Start with personal background

1. place of residence, age, level of education, job, income (remember to chat with them, please don't ask questions by the list)
2. Okay, now let's talk a little bit about your family. How many family members do you live with? Who are they? Who are the bread-makers? What does it feel like to live with them?
3. Now, let's talk a little bit about your friends. How many friends do you think you have? What makes you think you are good friends? What do you think about the people in your community? How do you get along with them?
4. What do you think about your relationship with your family members?
 - Do you think your family members are caring about each other/ about you?
 - Who take care of you the most?
5. How do your family think about your health condition?
 - How many of them know that you have hypertension?
 - Do any of them have hypertension too? Are you on the same treatments?
 - Do they ask you about your recent health status?
 - How do they help you with your hypertension condition?

6. What about your friends or other people who are significant to you? How do they know about your health condition?
 - Do they also have hypertension? If so, are you on the same treatments?
7. How much do you know about hypertension?
 - The risk factors of hypertension?
 - How much do your family members know about hypertension?
 - Do you educate each other with the information?
8. How much do your family care about your lifestyle?
 - Probe about the risk factors such as salt intake, doing exercises, smoke, or drink
 - Do your family change their lifestyles for you? (e.g. reducing the salt intake for the meals, working out with you, stop smoking/drinking, etc.)
 - Do they persuade you to set up appointments with doctors?
9. How about your friends or other significant person? Do they care about your lifestyle?
 - Do they help you to lose weight? Do they help to stop smoking or limit alcohol consumption?
 - Do you educate each other with the health information?
10. How much do your family know about the treatments you are receiving?
 - 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)?
 - Do they care about your medication? Why do they care about your medication? Do they remind you to take the medicine?
11. How about your friends or other significant person? Do they care about your treatment?
- Do they do anything to encourage you to take medicine as prescription (like calling you at times to remind you to take medicine)?
12. Have you ever received information about hypertension, medication, and other health-related issues from other people?
- What are the examples of such information?
 - How does that information influence your behaviors?
 - Do you share your own knowledge with those people?
13. How do you feel about the effectiveness of the hypertension medication you are taking?
- Are there side effects from the medicine? Does this influence you?
14. What do you think about your adherence to the hypertension medication? (you may need to explain to the patients what adherence means)
- What do you think about the importance of adherence to treatment?
 - Why do you adhere/not adhere to the prescriptions?

- What do you think are the most important reasons that stop you from taking the medication? (maybe too expensive? Too complicated? Too hard to swallow? Side effects? Probe about those reasons)
 - What do you think can be done to improve your adherence?
15. 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?
 - Probe more about health education, pricing of medicines, dosage of medicines, etc., based on their answers to the questions above.

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