Hypertension and HIV in Northern Tanzania

by

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Thesis submitted in partial fulfillment of
the requirements for the degree of
Master of Science in the Duke Global Health Institute
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ABSTRACT

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Abstract

Background: Hypertension, a leading risk for cardiovascular mortality, is an important co-morbidity among people living with HIV (PLWH). Understanding the epidemiologic patterns of hypertension and barriers to hypertension care is a critical first step in developing interventions to improve cardiovascular outcomes among PLWH in sub-Saharan Africa (SSA). Methods: Semi-structured in-depth interviews were conducted with 13 hypertensive patients engaged in HIV care in northern Tanzania. Patients attending a single HIV clinic in Moshi, Tanzania were screened consecutively for hypertension. Hypertension was defined as having at least one of the following: 1) a self-reported diagnosis of hypertension, 2) a single blood pressure measurement $\geq$ 160 mmHg systolic or $\geq$ 100 mmHg diastolic, or 3) two measurements at separate visits, obtained at least one week apart of $\geq$ 140 mmHg systolic or $\geq$ 90 mmHg diastolic. All screened participants completed a short demographic survey. Participants who met criteria for hypertension were invited to complete a knowledge, attitudes and practices survey that included questions about previous hypertension history. Results: The data revealed a range of themes including poor understanding of hypertension causes, limited hypertension knowledge, perceived overlap and comparisons between hypertension and HIV, delays in hypertension diagnosis and linkage to care, shortcomings of provider communication and counseling, reluctance to use antihypertensive medication, lack of integration of hypertension and HIV care, and

multiple barriers to hypertension care. Over an 8-week period, 555 patients were screened for hypertension. Hypertension prevalence was 19.6% (20.3% among women and 16.8% among men). The median age of patients with hypertension was 50 (IQR 43 – 57 years), compared to 42 (IQR 35 – 49 years) years for normotensive patients. Older age (OR 1.07, 95% CI 1.04 – 1.09, p<0.001) and higher BMI (OR 1.13, 95% CI 1.09 – 1.18, p<0.001) were independently associated with hypertension. Among the 91 patients with hypertension who completed additional questions about their hypertension history, 44 (48%) reported having a prior blood pressure check, 32 (35%) were previously aware of their hypertension diagnosis, and only 21 (23%) reported ever taking antihypertensive drugs. Of the 10 patients (11%) reporting current antihypertensive use, none had a controlled blood pressure. Conclusions: Participants described multiple, intersecting challenges related to hypertension management. Hypertension prevalence among patients engaged in HIV care was high. Despite a high burden of disease, the rates of screening, awareness, treatment and control were unacceptably low. Multifaceted strategies that address barriers to care along the hypertension care continuum and that are integrated within HIV care are urgently needed to improve cardiovascular outcomes among PLWH in SSA.

Contents

List of Tables

List of Figures

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Introduction

Hypertension, a leading risk for cardiovascular mortality, is an important co-morbidity among people living with HIV (PLWH). Understanding the epidemiologic patterns of hypertension among PLWH in sub-Saharan Africa (SSA) and the barriers to effective blood pressure control are critical first steps for developing strategies to improve delivery of hypertension care among this population. In this thesis we report the perspectives and experiences of hypertension care among patients with both HIV and hypertension in the Kilimanjaro region of Tanzania. We also report the prevalence of hypertension among a cohort of patients engaged in HIV care in the Kilimanjaro region of Tanzania, and describe patterns of hypertension awareness, treatment and control.

1. Chapter 1

"It's because I think too much": Perspectives, experiences and opportunities for improvement among adults with hypertension engaged in HIV care in northern Tanzania

1.1. Introduction

With scale-up of antiretroviral therapy (ART), global HIV-related mortality has declined rapidly in the last decade, including in sub-Saharan Africa (SSA) (1). Adults with HIV are now living longer and are faced with a double burden of disease: HIV infection and chronic non-communicable diseases (NCDs), including cardiovascular disease (CVD) (2,3). CVD is the most common cause of death globally (4,5), and in people living with HIV (PLWH) it occurs earlier and more frequently. In comparison to adults without HIV infection, PLWH have up to a 50% increased risk for myocardial infarction and stroke and a 4-fold higher risk of sudden cardiac death (3,6–10). Hypertension is a major risk factor for CVD and is the leading risk for death world-wide (11), and compared to the general population hypertension in PLWH may portend poorer cardiovascular outcomes (12–14).

Sub-Saharan Africa has the highest prevalence of hypertension in the world (15). It is estimated that up to a third of adults living with HIV meet criteria for hypertension (16). Despite this increased burden of disease, most patients with hypertension in SSA are not on treatment. A recent meta-analysis revealed that 27% of hypertensive adults in SSA were aware of their diagnosis, 18% of those with a known diagnosis were on treatment, and only 7% of those on treatment achieved blood pressure control (17,18). These concerning trends are also present among persons with HIV (PWH): most

hypertensive adults living with HIV are unaware of their diagnosis, not on antihypertensive treatment, and have an uncontrolled blood pressure (19–21).

Several observational and qualitative studies have identified barriers to high quality hypertension care among the general patient population in SSA. Impediments to care include lack of access to blood pressure equipment and drugs, absence of guidelines for hypertension management, shortages in clinical staff, poor patient-provider communication, gaps in provider and patient knowledge, patient financial constraints, and patient mistrust in the health care system. (22–32). Whether PLWH face unique barriers to hypertension care remains unclear. However, the challenges faced by hypertensive adults with HIV may be different compared to the general population. PLWH have more non-traditional risk factors for CVD compared to their HIV-negative counterparts. Even without major CVD risk factors, HIV-infected adults have a 2-fold increased risk of myocardial infarction (3,8,33). In addition, persons with HIV may be unlikely to seek care outside of the HIV clinical setting and must often navigate perceptions of disease-related stigma (34–36).

In order to design interventions that address challenges unique to this patient population, it is crucial to understand the perspectives and experiences of PLWH who have navigated hypertension treatment. However, other than a few studies (37,38), the barriers to hypertension awareness, treatment and control among HIV-infected adults in SSA remain largely unexplored. To better understand barriers to hypertension

management among PLWH, we conducted a qualitative study exploring the perspectives and experiences of patients with both HIV and hypertension.

1.2. Methods

1.2.1 Setting

This study was situated in the Moshi urban district of northern Tanzania. In northern Tanzania, the approximate community prevalence of hypertension among adults is 28% (39). The study was conducted at two HIV clinics located in two government health facilities in Moshi that combined see approximately 2300 adults (1700 women and 600 men) with HIV per year.

1.2.2 Study population

Semi-structured in-depth interviews were conducted with 13 patients with HIV with a history of hypertension. Participants were eligible if they were active patients in one of the two HIV clinic study sites and had a self-reported diagnosis of hypertension. Participants were recruited until thematic saturation was reached.

1.2.3 Procedures

Eligible participants with known HIV and hypertension were recruited by the HIV clinic and research staff between September 1st and November 14th, 2018. During their routine HIV appointments patients were asked by the clinic or study nurse if they: 1) had a known diagnosis of hypertension, 2) were ever told by a health provider they had high blood pressure, and 3) had ever used medications to control blood pressure. If a patient met any of these criteria and also reported using ART for a minimum of 12 months, then a research assistant invited the patient to participate in the study.

The in-depth interview guide was developed by an interdisciplinary team of physicians, nurses and social scientists from Tanzania and the United States with expertise in hypertension or HIV. The guide included opening questions on key domains of interest (medical history, hypertension diagnosis, feelings and attitudes about hypertension, knowledge of hypertension, hypertension care and treatment, HIV and hypertension care, barriers to improved care, and desired services and facilitators to improved care), with each question followed by a list of possible follow-up probes to guide the conversation (Appendix A). The guide was reviewed by Tanzanian collaborators to ensure appropriate language, terminology and cultural saliency. All interviews were conducted in a private room at the study site by a physician from the US (PM). The interviews were conducted in English and were simultaneously translated in Swahili by a Tanzanian research assistant (LM) who had received training in qualitative methodology. Interviews lasted approximately 90 to 120 minutes, were audio recorded with participant consent, and were transcribed in English. A 3rd member of the research team (JTH) listened to 15% of all audio recordings to confirm and clarify the on-site translation. All participants were compensated approximately $2.20 USD (5000 Tanzanian shillings) as reimbursement for their time.

1.2.4 Data analysis

Data analysis was conducted using applied thematic analysis (40). As a first step, transcripts were reviewed, and memos (5-19 pages each) were written for each transcript

to summarize the content emerging across the domains of interest (41). After reviewing all memos, a codebook was developed that consisted of 10 themes and 11 subthemes. The transcripts were independently coded in NVivo by a physician from the US (PM) to label the transcript content with the respective themes. A Tanzanian member of the research team (LW) double-coded 20% of the transcripts, and the two team members met to discuss coding protocol, reach consensus on the application of codes, and make appropriate modifications to the code book. Coding queries were used to review text coded to themes and synthesize data. Representative quotes were reviewed throughout the analysis procedure and were selected to best capture the data.

1.2.5 Ethics

Ethical approval for this study was obtained from the Duke Health Institutional Review Board, the Kilimanjaro Christian Medical Centre Research Ethics Committee, and the Tanzania National Institute for Medical Research Ethics Coordinating Committee. All participants provided written informed consent prior to enrollment.

1.3. Results

1.3.1 Characteristics of participants

The characteristics of study participants are summarized in Table 1. Participants ranged in age from 28 to 78, with a median age of 54 years (IQR 41- 65 years). The sample included 11 women and 2 men. Most participants had no more than a primary school education. The median duration of HIV disease and ART use was 4 years (IQR 3.0 – 10.0 years) and 3 years (IQR 2.5 - 6.5 years), respectively. The majority of participants (n=10) had been diagnosed with hypertension after their diagnosis of HIV. In addition to hypertension and HIV, 10 participants also reported having another chronic medical condition (including diabetes, dyslipidemia, stroke, and chronic ocular, genitourinary, gastrointestinal and cardiopulmonary issues). Of the 13 participants, 8 stated they had used antihypertensive medication at some point in their course of care. At the time of the interview, only one participant described current use of antihypertensive therapy, but reported being noncompliant to the therapy.

Table 1. Characteristics of in-depth interview participants, Kilimanjaro Region, 2018 (n=13)

Characteristic	**n**
Sex	
Female	11
Male	2
Age	
18 – 35	1
36 – 50	5

51 – 70	5
71+	2
Marital status	
Single	1
Married	2
Separated/Divorced	3
Widowed	7
Education	
None	3
Primary (grade 0 – 8)	9
Secondary or higher (grade 9 or higher)	1
Median HIV duration years (IQR)	4 (3.0 – 10.0)
Median ART* duration years (IQR)	3 (2.5 - 6.5)
Median hypertension duration years (IQR)	1 (0.0 – 3.0)
Ever used antihypertensives	
Yes	8
No	5
Currently using antihypertensives	
Yes	1
No	12
Other chronic illnesses	
Yes	10
No	3

*ART: antiretroviral therapy

The data revealed a range of themes across the domains of perspectives and experiences of hypertension care (Table 2).

Table 2: Dominant themes of hypertension care among patients with HIV and hypertension, Kilimanjaro region, 2018 (n=13)

Domain	Themes
Perspectives	**Poor understanding of the causes of hypertension**
	Thinking too much
	HIV
	Lifestyle factors
	Limited knowledge of hypertension
	Poor understanding of definition, course of illness, symptoms, complications, and treatment
	Source of knowledge from lay-beliefs from the community
	Perceived overlap and comparisons between hypertension and HIV
	Double burden of disease
	HIV is chronic and controllable v. hypertension is temporary and fatal
	HIV requires a daily life-long medication v. hypertension is curable
Experiences	**Delays in hypertension diagnosis and linkage to care**
	Diagnosis in setting of symptoms only
	Delay in linkage to care following diagnosis
	Shortcomings of provider communication and counseling
	Limited counseling
	Misconceptions
	Reluctance towards antihypertension medication
	Preference for stress reduction, traditional treatment and lifestyle modification
	Lack of integration for hypertension and HIV care
	Separation of care
	HIV clinic as entry point
	Multiple barriers to hypertension care
	Cost
	Drug side effects
	Lack of access to medications
	Limited provider counseling and communication
	Limited awareness
	Separation of HIV and hypertension care
	Staff shortages and long wait times
	HIV associated stigma and social isolation

1.3.2 Perspectives of hypertension

Poor understanding of the causes of hypertension

All participants perceived their cause for hypertension to be due to 'thinking too much' and many believed this was the sole cause of hypertension. Thinking too much included 'being angry', 'annoyed or upset about something', 'receiving shocking news', 'having a lot of worries', or 'being stressed'.

> "When you hear about shocking news like death of someone who is very close to you that can lead to high blood pressure or if your family have problems, if they are annoying you, or disturbing you, or giving you problems all that may cause high blood pressure." (Female, 45 years)
>
> "Primarily stress (causes hypertension). If you think a lot you will get that problem." (Female, 28 years)

Many participants believed worrying about their HIV status or being stigmatized from HIV could lead to hypertension. A few respondents vocalized concern that their ART may be the cause of their hypertension due to adverse side effects.

> "If you accept your HIV results and you are at peace with them, then you won't have high blood pressure. But if you don't accept your results, then your blood pressure can be high." (Female, 54 years)
>
> "I once asked the (HIV) doctor about the medication. Like see, 'I have pressure. Do you think the medication (ART) I am using is the one causing it?'…I was worried. Because before I started using the HIV medication I didn't have high blood pressure." (Female, 40 years)

Few participants identified lifestyle factors such as high salt, fat and oil intake as a cause for their hypertension. Chemicals and pesticides used in farming were also believed to be potential causes of hypertension.

Limited knowledge of hypertension

Participants demonstrated poor levels of knowledge regarding hypertension. Participants referred to hypertension or high blood pressure as 'presha'. No respondent was able to correctly define hypertension. When asked, most participants defined high blood pressure as what they perceived as the cause: 'thinking a lot', 'being stressed' or 'receiving shocking news'. A few participants also described high blood pressure as what they perceived as the symptoms: 'heart beating too fast', the heart becoming 'tired' or 'weak', or 'blood flow' abnormalities.

Participants were unaware of the range of hypertensive values and the chronicity of hypertension; instead, they believed that hypertension was more of a 'temporary problem'. While participants often self-identified as being asymptomatic, most assumed it was unusual to have hypertension and be asymptomatic. Commonly described hypertension symptoms included headache, dizziness, shortness of breath and palpitations. Patients felt that being aware of their symptoms was sufficient enough to tell if their blood pressure was high. Perceived complications from hypertension included instantaneous death, falling down suddenly, rupture of blood vessels leading to instantaneous death, and stroke.

"You might just fall anywhere (from hypertension). You may fall in the middle of the road while you are by yourself." (Female, 63 years)

"It (hypertension) will kill you instantly." (Female, 55 years)

Many participants believed that hypertension could be cured by reducing one's worries, taking antihypertensive medication for a short duration of time, using herbal or traditional treatment or through prayer. Reducing stress was believed to be the most effective way to treat hypertension. One participant who trained as a nursing assistant, received additional training in pharmaceuticals and owned her own pharmacy, reported that she was taught in nursing school that stress is the most common cause of hypertension and believed that stress reduction could cure hypertension. Participants appeared hesitant about using medication to control blood pressure and expressed a preference for alternatives to pharmacologic treatment. Participants were unaware that antihypertensive medication use was generally life-long. Most respondents were able to identify some elements of lifestyle modification that could improve blood pressure including reduction of salt, fat and oil. Participants were largely unaware that weight loss and alcohol and smoking cessation could reduce blood pressure.

"To drop pressure, maybe someone should avoid noise and try to reduce stress in their lives and conflicts…When there is a problem you know you can't solve, you should just try to not think about it. Like for example me, I want to build a house, but I can't buy bricks, I can't buy the cement. I can't buy the sand needed.

So, I don't want to constantly think about it. I just ask God, please help me with this because in the mean time I can't handle this." (Female, 45 years)

Participants reported learning about hypertension from other members of the community including hypertensive family members, friends, neighbors or coworkers. Information about hypertension was typically acquired through hearsay or from personal experiences. Only a few participants cited learning about hypertension from a medical provider. Almost all participants vocalized that they would like more information about hypertension.

Perceived overlap and comparisons between hypertension and HIV

Patients expressed concern about having both HIV and hypertension and described having two illnesses as "overwhelming". They alluded to pill burden and felt that taking two medications for two diseases was tiresome' and 'too much'.

"It's tiresome. It's really tiresome because I have to take ARVs every day, every single day, and adding another medication it's tiresome." (Female, 55 years)

A few participants reported that they would be willing and even "happy" to use antihypertensive medications every day because they were used to taking ART. While HIV was universally perceived as a chronic disease that was controllable, most participants believed that hypertension was temporary but almost always fatal. Hypertension was believed to be more dangerous than HIV because it could lead to

instantaneous death, whereas HIV could be controlled with medication and one could still live a long and healthy life.

> "I think it's better to have HIV than pressure…You know with HIV you can just take medication and you will be fine. You can just continue with your life. But with pressure it can just go up suddenly and you can die instantly…I saw that with my aunt. It started in the night and in the morning they were dressing her to take her to the hospital and she died in the morning. That's why I'm scared." (Female, 44 years)

While no patient described adherence with hypertension care, almost all reported adherence with their HIV care. Participants believed that there were alternative options to antihypertensive drugs for blood pressure control, whereas they believed the only way to control HIV was through ART and were therefore more committed to their HIV treatment.

> "I've never thought about stopping using my HIV medications because I know I have to use it for the rest of my life. They explained it clearly at the clinic there's no day that you're going to be cured (from HIV). So, we're just giving this medication for you to live as long as possible, so you should not stop it because once you do you will be at risk for opportunistic diseases like TB and other things like that so I've never thought about stopping the medication. But for high

blood pressure? I guess maybe there will be a cure or an alternative." (Female, 55 years)

1.3.3 Experiences of hypertension care

Delays in hypertension diagnosis and linkage to care

Blood pressure was usually only checked in the setting of symptoms; typically, a headache, dizziness, fatigue or insomnia. Almost all patients reported receiving their hypertension diagnoses when they presented with perceived symptoms.

"Yea, I checked pressure once in a while because sometimes I may receive some scary news and things that may worry me. And when things like that happen my heart starts beating fast and I get short of breath and when I feel like that I go to the dispensary and check my pressure." (Female, 45 years)

Several participants noted a delay in linkage to care following their initial hypertension diagnosis or were not linked to care at all. One patient stated he first heard his blood pressure was high several decades ago when his blood pressure was checked in the pre-operative setting. At the time, he was told his surgery was canceled due to his high blood pressure, but he received no counseling, linkage to care or management for his hypertension. He reported only becoming aware that he had hypertension within the past year when he presented to his HIV clinic with a headache and was referred to the outpatient department (OPD) for a blood pressure check.

> "They wanted to do the operation on the eye, I went to the hospital. When I was waiting for the operation they checked my blood pressure and they said, 'No, this blood pressure is so high. We can't operate you when your blood pressure is so high'…They didn't tell me anything (about my high blood pressure). They just say that they couldn't do the operation…I was never told again (about blood pressure)." (Male, 67 years)

Shortcomings of provider communication and counseling

Patients reported receiving minimal counseling from their healthcare providers regarding the causes, symptoms, complications and treatment of hypertension. When medications were prescribed, patients noted they did not receive counseling regarding side effects, potential drug-drug interactions, treatment duration or medication adherence. Most patients did cite receiving lifestyle modification counseling including salt reduction, eating a healthy diet, exercise and stress reduction. Participants reported that blood pressure monitoring and follow-up plans were often not discussed.

In addition, participants described hypertension misconceptions communicated by their medical providers. Patients conveyed that healthcare providers told them that thinking too much was the cause of their hypertension. Some patients said that their providers told them to stop worrying about their HIV, and often asked them what they were thinking about when their blood pressure was high. One woman who had evidence of pre-eclampsia and suffered a subsequent miscarriage described being told

by her provider that her hypertension was due to her grief. Another woman described how the nurse implied that her hypertension was due to conflicts with her husband.

> "He (the doctor) didn't discuss much about the cause but he told me that it may be because of thinking too much and being stressed out and the nurse even asked me, 'Do you have problems with your husband?'. And I said 'Yes Nurse, I've had an argument again', and she said 'Okay you should not think too much about these things'." (Female, 39 years)

Some participants referred to situations where a provider advised them either not to initiate antihypertensive medications or advised to stop and "take a rest" from their medication because their blood pressure was now in a normal range or because they were asymptomatic.

> "I was feeling fine. So when I went back even the doctor was very happy, and he was like, 'Wow, you are doing great. And I am happy that you are doing great. So let's see if you can stay without medication for 2 weeks. I just want you to be without medication for 2 weeks and see.'" (Female, 40 years)

> "For this hypertension medication, they told us that if you're feeling better you can stop the medication. The nurses have told me." (Male, 67 years)

Reluctance towards antihypertension medication

While over half of participants reported receiving a prescription for antihypertensive drugs at some point in their lives, most participants admitted

reluctance towards pharmacologic therapy and preferred non-pharmacologic approaches to blood pressure control. All participants who reported having received a prescription stated that they were given a prescription for only 5 to 7 days at a time, and typically only used their antihypertensives when feeling symptomatic or until their prescription ran out. Reasons for discontinuing medication included high costs, lack of availability at the local pharmacy, drug side effects, pill burden from taking too many medications, and lack of awareness about the silent and chronic nature of disease.

> "But you know as a human sometimes when I feel like I'm okay I don't take medication. Yeah but when I get sick that's when I say okay now I know I have to take the medication…So, since 2002 up to today, I know the doctor have told me I should always take (antihypertensive) medication but I can't afford that. So I usually take medication when I feel I'm sick…So when I don't have money to buy medication and I'm not feeling good I drink a lot of water because they told me it will help and eat a lot of cucumbers." (Female, 63 years)

At the time of this study, only one participant was still using antihypertensive drugs. All other patients were either not using any methods for blood pressure control or were using stress reduction, herbal or traditional treatment or lifestyle modification with the intention to 'cure' their hypertension. All respondents reported that they tried to reduce their thinking in order to control their blood pressure. A few participants had tried herbal, natural and traditional treatment including drinking lots of water, eating

cucumbers, using herbal plants, using ginger and garlic supplements, and also visiting a traditional healer. Participants who used traditional and herbal treatment typically stopped using their antihypertensive drugs and did not discuss the use of their herbal treatment with their clinical providers.

> "I'm using some herbal medication. This is the person I have seen (a traditional medicine man). He was able to cure people with cancer and with goiter…he told me that I have to use the (traditional) medication for a while. The medication is only a teaspoon three times a day…I'm not sure what is in there but it seems like it is several things combined because it is in a powder form. These medications I can't use it together with hospital medication so I had to stop the hospital medication (antihypertensives)." (Female, 40 years)

> "I just thought it would be too much for me. I already have this medication (for HIV), now starting using this medication (for hypertension) for a long time, I didn't want to get used to it, and I decided I would stick with more natural methods and even felt better sometimes when I had a chance to go and check. After using garlic sometimes I would go and check and find that my pressure is a bit lower." (Female, 55 years)

Lifestyle modification that patients had attempted included reducing salt, fats, oils, eating more fruits and vegetables and exercising. Most participants stated they had no plans to follow up with a medical provider for their hypertension care.

Lack of integration for hypertension and HIV care

HIV and hypertension care were managed in discrete silos. Participants revealed that their HIV providers did not know they were hypertensive and that their hypertension providers also did not know they had HIV. Patients did not discuss their HIV with their hypertension provider, did not discuss their hypertension with their HIV provider, and reported that their providers did not ask them if they had other medical issues or were taking other medications. The majority noted that their blood pressure was never checked in the HIV clinic. However, the HIV clinic was often the entry point into hypertension care. Patients presented with symptoms to the HIV clinic, often during their regularly scheduled appointment, and were subsequently referred to the OPD for a blood pressure check.

> "When I went to pick up my medication (ART) they asked me how I was feeling. So I told them that I have these terrible headaches and I also feel dizzy. So they give me this piece of paper and they told me to go to the doctor and check my blood pressure at the OPD." (Female, 42 years)

Although hypertension and HIV care was separate, patients conveyed a preference for integrated care due to convenience and efficiency.

> "I think it will save a lot of time because I would get my (HIV) medication and then see the doctor right there (for hypertension). It will be very

nice and I think would help me to improve my health and help me to feel a lot better without these headaches and dizziness." (Female, 55 years)

Multiple barriers to hypertension care

Multiple barriers to hypertension care were described by participants. Financial barriers were the most common; participants described the high costs of medication, health insurance, provider visits, transport to the healthcare facility, and even the expense of a healthy lifestyle as making it difficult for them to manage their hypertension.

"I'm not using (blood pressure medications)…it's hard to raise the money now. You need money for food. You need money for this medication. If you suddenly get fever you need money again, so how are you going to manage it?" (Female, 78 years)

Side effects due to antihypertensive drugs were also cited as a common reason for medication discontinuation. Participants who had never used blood pressure medication also expressed concern for potential side effects, toxicity to the body, and a fear of dependence on the medication as reasons why they would not want to initiate antihypertensive therapy.

"I heard people also saying when you keep taking this (blood pressure) medication and your body get used to them, it's not a very good thing." (Female, 63 years)

"When I use them (antihypertensive agents) I feel sleepy, so how can I use them every day? Who's going to take care of me? That's why I use them and when I feel better, I stop." (Female, 78 years)

System-level barriers were also noted. Participants described lack of medication access either due to pharmacy outages or the short length of prescriptions as reasons for drug non-adherence.

"One of the biggest challenges with this hospital is that you may go and see the doctor, he may prescribe the medication, and you may be in this long que, but when you get to the pharmacy they don't have the medication. So then you have to go to a private pharmacy outside and they are business people so you may have to pay 15,000 or 20,000 (Tanzanian shillings)." (Female, 55 years)

In addition, participants often conveyed receiving minimal counseling from providers about hypertension, which may have led to low levels of knowledge about the disease. This limited awareness of the silent, chronic nature of hypertension and effective hypertension treatment contributed to disengagement and loss to follow up.

The separation of HIV and hypertension care was another barrier to care. Participants reported there were often no medical doctors present in the HIV clinic, and stated that when they brought up their blood pressure issues in the HIV clinic their hypertension was not addressed or they were told to seek hypertension care elsewhere.

"No, I've never checked my blood pressure at the HIV clinic. Even there is no doctor at the HIV clinic. I've just seen nurses providing the HIV medication…If you tell them that you're sick they tell you go down there (pointing to OPD)." (Female, 39 years)

Some participants expressed frustration with the long wait times at health facilities which may have resulted from staff shortages.

"Maybe the only thing (challenge) is the delays in the clinic, because I have a lot of work that I need to do and sometimes there is a lot of people and so the line is quite long." (Male, 73 years)

HIV stigma was an over-arching experience of participants. Many patients reported feeling stigmatized from their HIV by their family and community and described a feeling of social isolation.

"My brothers at home they stigmatize me a lot. Sometimes when I want to go to bed at night, they insult me the whole night. Or sometimes they may take stones and throw them on the roof and I feel like I am shocked and fall down. So sometimes I don't even stay at my home." (Female, 44 years)

Stigmatization may have played a role in lower health seeking behaviors and led to HIV and hypertension nondisclosure to medical providers and subsequent disengagement in hypertension care.

1.4. Discussion

1.4.1 General implications

This study explored hypertension perspectives and experiences among hypertensive adults engaged in HIV care in northern Tanzania. Participants revealed multiple, intersecting challenges related to hypertension management including poor hypertension knowledge, insufficient hypertension counseling, financial constraints, lack of access to antihypertensive medications, staff shortages, HIV-related stigma, and lack of integration between hypertension and HIV care. Of note, while participants in our study were disengaged in hypertension care and nonadherent with antihypertensive therapy, they remained engaged in HIV care and adherent with ART. These findings suggest that the barriers depicted are unique to hypertension care and that the HIV clinic may provide a robust model of chronic disease management that can support retention in care. High quality, culturally salient, evidence-based interventions that are integrated within the HIV clinic are urgently needed to address the double burden of disease in PWH.

Poor and inaccurate hypertension knowledge among patients was identified as the predominant barrier to hypertension awareness, treatment and control in our study. These findings are consistent with data on HIV-uninfected hypertensive patients from other studies in SSA (37,42,43). In contrast to hypertension knowledge, participants had good knowledge about HIV disease and treatment. The high levels of HIV care

engagement seen among our participants may be due to concentrated efforts at patient-directed HIV education and highlights the importance of health education initiatives. Several studies in SSA have shown an improvement in hypertension outcomes following educational interventions. A patient education tool in Côte d'Ivoire reduced antihypertensive non-adherence from 60% to 5% one year after implementation (44), and in Ghana, receiving health education was found to be protective against uncontrolled hypertension (45). Similar efforts to improve hypertension education should be implemented within the HIV clinical setting in order to improve cardiovascular outcomes among PLWH in SSA.

Our findings suggest that hypertension management was limited by inadequate provider counseling and communication. Similar studies in SSA have found that lack of counseling and gaps in knowledge and practice among healthcare providers are impediments to hypertension outcomes in the general population (29,32,43). Provider counseling regarding all aspects of hypertension, including course of illness, causes, complications, treatment, monitoring and follow up, was lacking in our study. While providers did prescribe antihypertensive agents, the medication counseling was insufficient and, at times, erroneous. Duration of treatment, side effects, and potential drug-drug interactions with ART were often not discussed, potentially leading to reluctance towards pharmacologic therapy and poor adherence to antihypertensive medications. In contrast, participants described their HIV medical providers as a source

of education and support. This underscores the importance of patient-provider communication and the potential impact of improved provider counseling on health outcomes (46,47). Health system interventions in HIV that have targeted providers have made considerable strides in improving HIV clinical outcomes in SSA (48–50). Similar interventions in hypertension training are essential to address the rising burden of CVD among PLWH.

Unaffordable healthcare costs were identified by patients as a driving factor towards hypertension disengagement and antihypertensive nonadherence. A study examining affordability and accessibility of antihypertensive drugs globally found that in SSA drugs were neither affordable nor accessible and that the cost of one tablet was often more than a day's wages (51). Unlike hypertension care, all aspects of HIV care are free in Tanzania, which likely plays a major role in ART uptake and long-term HIV care engagement. Universal health coverage (UHC) is needed to support access to NCD care, but coverage must be affordable. Many participants in our study cited that they wanted health insurance but were unable to afford the high annual premiums. While the government has made major strides in improving health coverage, most Tanzanians remain uninsured (52). As PLWH are living longer and are at higher risk for cardiovascular disease and other chronic diseases, enhanced coverage of NCDs in SSA must be addressed (2,53).

Our participants described the lack of integration of HIV and hypertension management as an impediment to their care. The separation of HIV and hypertension care represents a missed opportunity to improve cardiovascular outcomes among a high-risk population. Primary care and NCD models in SSA are either non-existent or are fragmented and weak. HIV is the first large chronic care program in SSA, and has received significant investments. HIV clinics serve as models for robust service delivery and may provide a good opportunity to integrate NCD management. In 2011 the UN declared that HIV programs from low and middle-income countries (LMICs) should be leveraged for effective integration of NCDs (54,55). However, in order to achieve successful integration of the routine assessment, prevention and management of NCDS, including hypertension, it will be critical to address the need for adequately trained staff, equipment, medications and protocols for NCD care within the HIV clinical setting.

1.4.2 Limitations

This study must be interpreted in light of its limitations. Firstly, inclusion criteria for hypertension was based on a self-reported diagnosis instead of a clinical diagnosis. Therefore, it is possible that some participants were not truly hypertensive, and thus fittingly did not engage in hypertension care. Second, social desirability bias when speaking with a non-Tanzanian physician may have influenced participants' responses. Participants may have been less willing to disclose their true beliefs, concerns and

challenges. Thirdly, our recruitment strategy excluded patients who had dropped out of HIV care. Therefore, we may have lost some additional insight into the perspectives and experiences of an HIV-disengaged population. Lastly, only 2 men participated in this study and therefore findings may be biased towards a female perspective. The challenge of recruiting men is not unique to our study. Men may be less likely to seek healthcare and are less likely to remain engaged in medical care in SSA (56,57). Additional research may be needed to explore male perspectives and experiences of hypertension care.

1.5. Conclusion

In conclusion, hypertensive adults engaged in HIV care in northern Tanzania described multiple, intersecting challenges to hypertension management. Multifaceted strategies that improve hypertension education and counseling, and that are affordable, accessible and integrated within HIV care are urgently needed to improve cardiovascular outcomes among PLWH. As more individuals with HIV initiate ART and continue to age, the prevalence of hypertension and its associated cardiovascular morbidity and mortality among PLWH will almost certainly continue to rise. Thus, it is imperative to develop and implement effective strategies for integrating cardiovascular care in the HIV clinical setting.

2. Chapter 2

Prevalence, awareness, treatment and control of hypertension among adults engaged in HIV care in northern Tanzania

2.1. Introduction

Hypertension is the primary risk factor for death world-wide (11) and is a leading contributor to cardiovascular related morbidity and mortality (58,59), including in persons living with HIV (PLWH). Compared to the general population, PLWH have a 50% increased risk of atherosclerotic cardiovascular disease (ASCVD) (3,10) and people with treated HIV have a higher risk of hypertension (16).

Sub-Saharan Africa (SSA) has the highest prevalence of hypertension (15) and HIV (60) in the world. The scale up of antiretroviral therapy (ART) in SSA has led to a rapid decline in HIV-related deaths (1) and a growing aged population at risk for non-communicable diseases (NCDs), including hypertension (2). Only a limited number of studies in SSA have assessed epidemiologic patterns of hypertension among HIV-infected adults; most of these studies define hypertension with a single blood pressure measurement or multiple blood pressure measurements obtained in a single evaluation (16). Furthermore, blood pressure is often not routinely measured in SSA leading to an absence of clinical data on hypertension. Most people in SSA with hypertension, including those with HIV, are unaware of their diagnosis and not on treatment (18,19). The lack of blood pressure data and under-recognition and undertreatment of hypertension in SSA greatly limits the ability to adequately control this disease, and significantly increases the risk of ASCVD-related morbidity and mortality in this high-risk population.

Understanding the epidemiologic patterns of hypertension among PLWH in SSA and the barriers to effective blood pressure control are critical first steps for developing strategies to improve delivery of hypertension care among this population. The primary goal of this study was to determine the prevalence of hypertension among a cohort of patients engaged in HIV care in the Kilimanjaro region of Tanzania, and to describe patterns of hypertension awareness, treatment and control. A secondary goal was to determine potential predictors of hypertension among adults with HIV.

2.2. Methods

2.2.1 Setting

This study was conducted in the Moshi urban district of northern Tanzania. In northern Tanzania, the approximate prevalence of hypertension among all adults is 28% (39). The study was conducted at one HIV clinic located in a government health facility in urban Moshi that sees approximately 1200 adults (900 women and 300 men) with HIV per year.

2.2.2 Study population and sampling

The study was conducted between October 16 and December 10, 2018. Individuals were eligible to participate if they were over the age of 18 years, not pregnant, and seeking HIV care at the study site. Recruitment took place during all HIV clinic sessions. During routine HIV appointments patients were introduced to the study nurse by a member of the clinical staff and invited to have their blood pressure measured. If a patient expressed interest, the study nurse was notified and approached the patient to invite them to participate in the study.

2.2.3 Procedures

Hypertension and obesity screening was conducted by the study nurse in a private room within the HIV clinic. All screened participants completed a short demographic survey administered by the study nurse in Swahili. Participants who met

criteria for hypertension were invited to complete a knowledge, attitudes and practices survey that also included questions about previous hypertension history.

2.2.4 Measures

Hypertension

Hypertension was defined as meeting any of the following criteria: 1) a self-reported diagnosis of hypertension, 2) a single blood pressure measurement that was ≥ 160 mmHg systolic or ≥ 100 mmHg diastolic, or 3) two measurements at separate visits obtained at least one week apart that were ≥ 140 mmHg systolic or ≥ 90 mmHg diastolic.

Blood pressure was measured with an FDA approved automatic blood pressure monitor (Omron Healthcare, Bannockburn, Illinois, USA) with an adult sized adjustable arm cuff. The blood pressure monitor was calibrated monthly. Blood pressure was measured after patients were seated with their backs supported and with their legs resting on the ground and uncrossed for at least 5 minutes. The patient's arm used for measurement was at the same level as the heart with the arm resting comfortably on a table. Blood pressure was measured twice in the right arm with at least a five-minute interval between the two measures. If a measurement was elevated (i.e. ≥ 140 mmHg systolic or ≥ 90 mmHg diastolic), the patient was referred to their clinic provider for further management as per routine standard of care. If at least one of two measurements was ≥ 140 mmHg systolic or ≥ 90 mmHg diastolic, then the participant was invited to return to the clinic within two weeks for repeat blood pressure measurements.

Hypertension treatment cascade

All participants were asked if they ever had their blood pressure measured previously. If the participant answered yes to the previous question, they were asked how many times it was measured and where it was measured. Participants who met criteria for hypertension and completed the knowledge, attitudes and practices survey were asked questions about their hypertension awareness and treatment history. Awareness of hypertension diagnosis was defined as a positive response to the question 'Prior to today, have you ever been told you have high blood pressure?'. Self-reported antihypertensive drug use was defined as a positive response to the question 'Have you been prescribed medication for high blood pressure?'. Self-reported current antihypertensive drug use was identified if the participant reported still using medication for high blood pressure at the time of survey. Hypertension control was identified if all blood pressure measurements obtained by the study nurse were < 140 mmHg systolic and < 90 mmHg diastolic.

Body mass index

Weight was measured using a digital scale (seca) and recorded in kilograms to the nearest 0.01 kg. The scale was calibrated monthly. Height was measured with a stadiometer and recorded in centimeters to the nearest 0.1 cm. All participants were asked to remove their shoes when measuring height and weight. Body mass index (BMI) was calculated by dividing weight in kilograms by height in meters squared (kg/m^2) for

all screened participants using their weight and height measurements. Overweight was defined as a body mass index (BMI) greater than 25 kg/m^2 and obesity was defined as a BMI greater than 30 kg/m^2.

Demographics

All participants were asked questions about education, income, and marital status.

2.2.5 Data storage and analysis

Data were collected on paper forms and entered into a REDCap database by a member of the research team. Approximately 20% of all data were verified after electronic data entry by an independent reviewer to ensure accuracy. Data were analyzed using STATAv.16 (STATA Corp., College Station, TX).

To examine hypertension prevalence, the proportion of all screened participants who met study criteria for hypertension was determined. For descriptive purposes, blood pressure was also categorized and described using the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure VII (JNC-VII) guidelines based on the average of the two blood pressure measurements obtained at the initial visit for all screened participants. Normotension was defined as a systolic measurement < 120 mmHg and a diastolic measurement < 80 mmHg, prehypertension was defined as a systolic blood pressure measurement between 120 to 139 mmHg or a diastolic measurement between 80 to 89 mmHg, stage 1 hypertension was defined as a

systolic value between 140 to 159 mmHg or a diastolic value between 90 to 99 mmHg, and stage 2 hypertension was defined as either a systolic measurement $\geq$ 160 mmHg or a diastolic measurement $\geq$ 100 mmHg (61).

To describe sample characteristics, the median or mean and inter-quartile ranges or standard deviations were reported for each continuous variable. The proportion of participants with hypertension and normotension were determined for all categorical variables.

To examine predictors of hypertension logistic regression was used to determine the unadjusted odds ratios and corresponding 95% confidence intervals for the association between predictor variables and hypertension. All p-values were two-sided and reported at a 0.05 significance level.

To examine patterns of hypertension awareness, treatment and control, the proportion of hypertensive participants who provided a positive response to questions about prior diagnosis and treatment and who met criteria for hypertension control was determined.

2.2.6 Ethics

Study procedures were approved by the Duke Health Institutional Review Board, the Kilimanjaro Christian Medical Centre Ethics Committee, and the Tanzania National Institute for Medical Research Ethics Coordinating Committee. All participants provided verbal informed consent prior to blood pressure screening and completion of

the short demographic survey. All participants who completed the knowledge, attitudes and practices survey provided written informed consent prior to the survey. Participants with an elevated blood pressure were instructed to follow up with an outpatient provider during the same day for further evaluation and management.

2.3. Results

2.3.1 Hypertension prevalence

Over an 8-week period a total of 806 patients attended the HIV clinic and 555 patients were screened for hypertension. Among the 555 participants screened, 74 met criteria for hypertension at the initial visit, 31 met criteria for hypertension at the second visit, with a total of 105 participants meeting criteria for hypertension (Figure 1). Hypertension prevalence was 19.6% (20.3% among women and 16.8% among men).

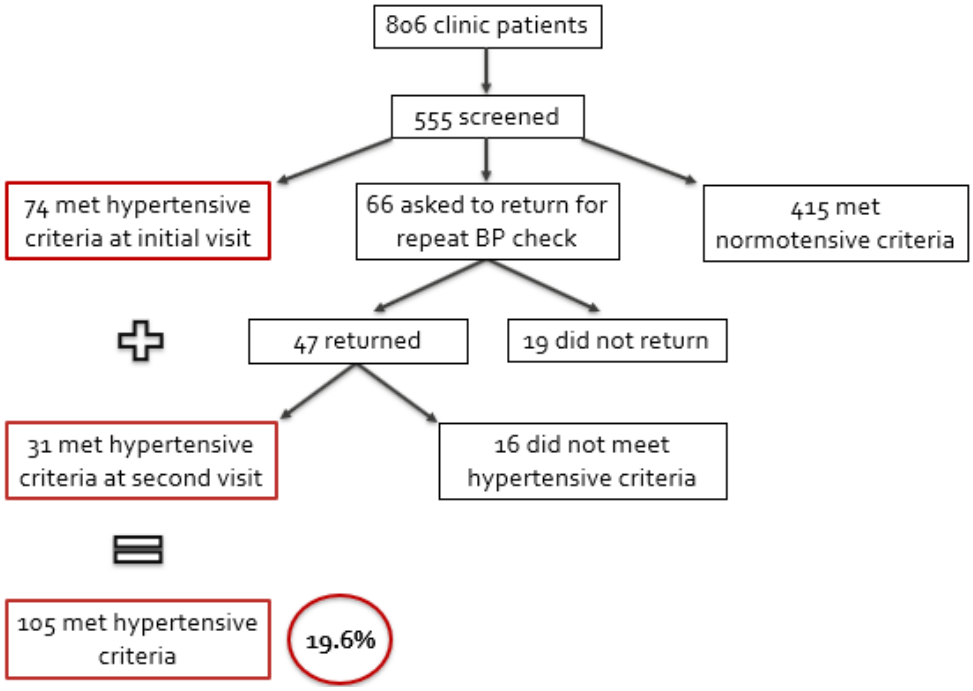

Figure 1: Flowchart describing hypertension screening and prevalence in an HIV treatment clinic in Northern Tanzania, 2018

Using JNC-VII categorization of hypertension, 70 participants (12.7%) had Stage I hypertension, while 42 (7.6%) had stage II hypertension. Another 167 (30.3%) of participants had prehypertension. (Figure 2).

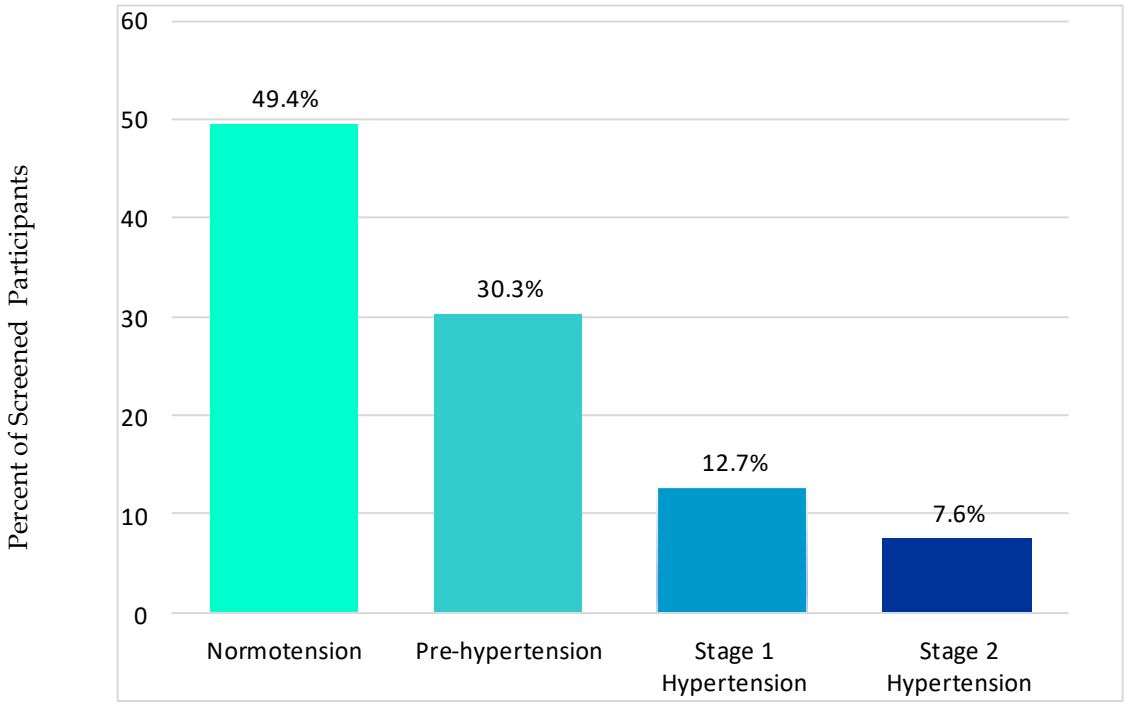

Figure 2: Prevalence of hypertension per JNC-VII categorization in an HIV treatment clinic in northern Tanzania, 2018 (n=551)

2.3.2 Characteristics of participants

Characteristics of patients with hypertension and with normotension are presented in Table 1. The majority of patients were women, and there was no association observed between sex and hypertension.

The median age of patients with hypertension was 50 years (IQR 43 – 57 years), compared to 42 years (IQR 35 – 49 years) for normotensive patients. Most participants were married and had no more than a primary school education. Median monthly household income was 40 USD (approximately 90,000 Tanzanian shillings) for both hypertensive and normotensive patients. The majority of hypertensive participants were overweight with a median BMI of 27 (IQR 24 – 30), while most normotensive participants had a normal weight with a median BMI of 23 (IQR 20 – 27). The mean SBP and DBP for hypertensive participants was 157 mmHg (SD 21.7 mmHg) and 95 mmHg (SD 11.7 mmHg), respectively, while the mean SBP and DBP for normotensive participants was 114 mmHg (SD 12.4 mmHg) and 74 mmHg (SD 8.1), respectively.

Table 3: Characteristics of hypertensive and normotensive participants engaged in HIV care in an HIV treatment clinic in northern Tanzania, 2018 (n=555)

Characteristics	Hypertensive n = 105	Normotensive n = 450	Odds ratio (95% CI)	P-value
Sex (females), n (%)	86 (81.9)	350 (77.8)	1.29 (0.75 – 2.23)	0.750
Age (years), n=554, median (IQR)	50 (43 – 57)	42 (35 – 49)	1.07 (1.04 – 1.09)	<0.001
Marital status, n=554, n (%)				
Single	11 (10.5)	76 (16.9)	(reference)	(reference)
Married	33 (31.4)	179 (39.9)	1.27 (0.61 – 2.65)	0.518
Separated/Divorced	30 (28.6)	104 (23.2)	1.99 (0.94 – 4.23)	0.072
Widowed	31 (29.5)	90 (20.0)	2.38 (1.12 – 5.05)	0.024
Education, n=545, n (%)				
Primary or less	87 (83.7)	346 (78.5)	(reference)	(reference)
Secondary or higher	17 (16.4)	95 (21.5)	0.712 (0.40 – 1.25)	0.240
Monthly household income USD, n=528, median (IQR)	40 (18 – 67)	40 (22 – 67)	1.00 (1.00 – 1.00)	0.275
BMI, n=554, median (IQR)	27 (24 – 30)	23 (20 – 27)	1.13 (1.09 – 1.18)	<0.001

2.3.3 Hypertension treatment cascade

Of the 555 study participants, 226 (40.7%) reported having a prior blood pressure measurement. Among the participants who had a prior blood pressure measurement 68 (30.7%) reported having only one prior blood pressure measurement. The most frequent location for measuring blood pressure was the outpatient department (OPD) (n=123). Only 26 participants had ever had their blood pressure measured in the HIV clinic.

Of the 105 participants who met the study definition for hypertension, 91 completed additional questions about blood pressure history. Among these 91 hypertensive participants, 44 (48%) reported having a previous blood pressure measurement, 32 (35%) were previously aware of their hypertension diagnosis, and 21 (23%) reported current or prior use of antihypertensive drugs. Of the 10 patients (11%) reporting current antihypertensive use, none had a controlled blood pressure (Figure 3).

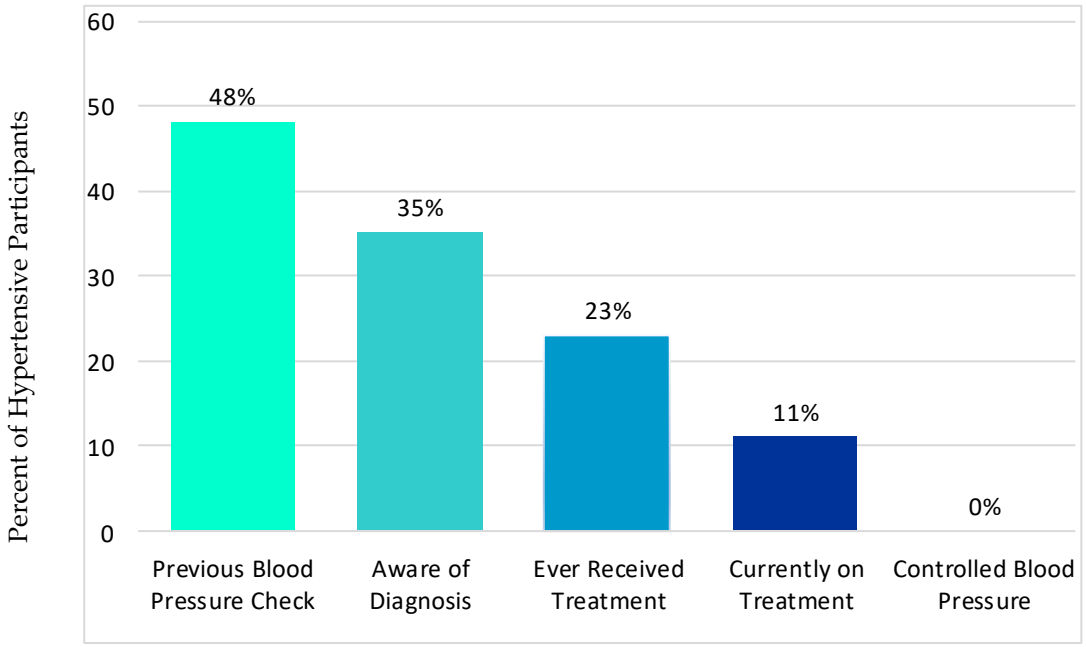

Figure 3. Hypertension treatment cascade among hypertensive participants engaged in HIV care in an HIV treatment clinic in northern Tanzania, 2018 (n=91)

2.3.4 Predictors of hypertension

We observed no difference in the prevalence of hypertension by sex, education or monthly income (Table 1). Increased age, OR 1.07 (95% CI 1.04 – 1.09, p <0.001), and increased BMI, OR 1.13 (1.09 – 1.18, p<0.001), were independently associated with higher risk for hypertension. Being widowed was also associated with a higher odds ratio for hypertension. However, after adjusting for age, this effect was no longer found to be statistically significant.

2.4. Discussion

2.4.1 General implications

This study examined the prevalence and predictors of hypertension, and examined patterns of hypertension awareness, treatment and control among a cohort of patients engaged in HIV care in northern Tanzania. The findings revealed that approximately one in five participants had hypertension, but that the majority had never had their blood pressure measured, were unaware of their diagnosis, and remained untreated. These findings suggest that challenges along the hypertension treatment cascade lead to a high burden of uncontrolled hypertension among PLWH. People who are engaged in HIV care in SSA routinely attend HIV clinic. Therefore, HIV clinics possess the critical ability to routinely screen, monitor, and treat patients for hypertension. HIV clinics in SSA should be leveraged to improve the engagement and delivery of hypertension care among PLWH.

We found that the prevalence of hypertension among adults engaged in HIV care in the Kilimanjaro region was high (20% using our study criteria). In addition, when blood pressure was categorized using the JNC-VII stages, more than half of all participants met criteria for either pre-hypertension or hypertension. Pre-hypertension, similar to hypertension, is a leading risk for ASCVD related morbidity and mortality, including in persons with HIV (13). In addition, the American Heart Association (AHA) and American College of Cardiology (ACC) recently revised their guidelines to reflect a

lower threshold for hypertension so that blood pressure values once considered to be pre-hypertensive now meet the definition for hypertensive disease (62). As 30% of our participants were categorized as pre-hypertensive and 20% hypertensive, this high burden of disease is concerning. Systems for preventative and chronic disease care outside of HIV in SSA are weak (63). Therefore, the existing healthcare infrastructure is unprepared to manage the growing epidemic of NCDs (22,38) and the high rates of pre-hypertension, hypertension, and its associated ASCVD related morbidity and mortality may be a formidable challenge if not promptly addressed.

Having increased weight and increased age were predictors for hypertension in our study. Similar studies in SSA have found that both traditional factors and non-traditional HIV-related factors are associated with increased risk of hypertension in PLWH (64-66). Traditional risk factors associated with hypertension among PLWH in SSA include obesity, aging, family history, genetics, alcohol and tobacco use (67-69). HIV-related factors that have been implicated in hypertension include immune suppression, chronic inflammation, immune reconstitution with initiation of ART, ART toxicities, lipodystrophy, endothelial dysfunction, HIV-associated renal disease, and gut microbial translocation (14). However, most studies that assess the mechanisms of hypertension in PWLH have been conducted in high-income countries and therefore may not be generalizable to populations in SSA. The data regarding the association between HIV, ART and hypertension in SSA is still under debate. Most studies have

reported a higher prevalence of hypertension among ART-experienced HIV-infected patients, supporting the hypothesis that ART is associated with an increased risk of hypertension (19,70-71). Other studies have found no association between ART exposure and hypertension (72,73), and a few studies have reported a lower prevalence of hypertension among HIV-infected adults and people with untreated HIV (72,74). Untreated HIV has been associated with low blood pressure and hypotension possibly due to a massive systemic inflammatory response and increased vascular permeability (14). In addition, untreated HIV may mask undiagnosed hypertension, and as ART coverage continues to expand and as PLWH continue to age hypertension prevalence will likely increase accordingly. Hypertension in the context of ART use may be due to immune reconstitution and return of health as well as the direct side effects or toxicities of ART (14). Furthermore, integrase inhibitors have recently been associated with abnormalities in adiposity and clinically significant weight gain (75,76), a leading risk factor for hypertension. As there is current rapid and large-scale transition to integrase inhibitors as preferred first line therapy across SSA (77) this is potentially problematic and may implicate an impending crisis of obesity and its associated cardiovascular morbidity and mortality among PLWH. Future research that examines the pathophysiologic mechanisms of hypertension in patients with HIV who are ART naïve and ART exposed are needed to better understand the complexities of disease and the proposed mechanisms action.

The data from this study sheds light on the gaps in the hypertension treatment cascade and continuum of care. The proportion of individuals with hypertension who were aware of their diagnosis, treated and controlled was unacceptably low. Less than half of hypertensive participants had previously had their blood pressure measured, 35% were aware of their diagnosis, 23% were prescribed treatment, 11% were currently using antihypertensive medications, and no one had a controlled blood pressure. These findings are similar to other studies in SSA (17) and in Tanzania (19,39) and suggest a complexity of barriers within the existing healthcare infrastructure that lead to poor clinical outcomes in hypertension.

The lack of awareness and ineffective hypertension treatment may be due to fragmented and weak chronic disease health systems outside of HIV care. The response to the HIV epidemic prompted the first large chronic disease program in SSA. HIV clinics serve as robust models of care that represent an opportunity for integrated NCD care, including hypertension (78, 54-55). Only a few patients in our study reported having their blood pressure measured in the HIV clinic. In a previous study examining barriers faced by patients with HIV and hypertension in northern Tanzania, participants reported that they did not discuss blood pressure with their HIV medical providers, and that hypertension was often not addressed at all in the HIV clinic (Manavalan, P, et al., "It's because I think too much": Perspectives, experiences and opportunities for improvement among adults with hypertension engaged in HIV care in northern

Tanzania, submitted). However, the HIV clinic could be leveraged to fully integrate hypertension care into routine HIV appointments in order to improve hypertension screening, diagnosis, and treatment. HIV appointments could be further utilized for long-term monitoring and follow up of blood pressure to ensure that hypertensive patients have achieved blood pressure control (55). A multifaceted approach that improves the access to blood pressure equipment, drugs, and guidelines and targets provider training and patient education is needed for the successful integration of NCD management into existing HIV health systems in SSA (22,38).

2.4.2 Limitations

This study must be interpreted in light of its limitations. Firstly, our recruitment strategy only included patients who were engaged in HIV care. Prevalence of hypertension among persons with treated HIV has been shown to be higher compared to those with untreated HIV (16), our results likely underestimate the prevalence of hypertension among PLWH in the general community. Our sample likely included both ART-experienced and ART-naive patients, however these HIV-related measures were not collected on all participants. A second limitation in our study was the lack of an HIV-uninfected control group, which prevented any conclusions on the impact of HIV infection on hypertension. Thirdly, as this was a cross-sectional observational study, causal inferences could not be drawn. Therefore, the association between hypertension and increased weight and age may have been influenced by confounding variables.

However, there is strong evidence that reveals a positive correlation between obesity, aging and hypertension and therefore these variables likely represent true risk factors (79). Lastly, we were unable to examine HIV-related risk factors including type of ART, duration of HIV disease and ART exposure, and CD4 and viral load levels as predictors for hypertension. Additional research is needed to explore the effect of HIV-related risk factors on hypertension severity in northern Tanzania.

2.5. Conclusion

In conclusion, there is a high prevalence of hypertension among adults engaged in HIV care in northern Tanzania. Despite this high burden of disease the rates of screening, awareness, treatment and control are alarmingly low. Concentrated efforts must be made to address barriers to hypertension care along the hypertension care continuum and to develop high-quality, evidence based interventions that address capacity and infrastructure challenges in SSA. The HIV clinic in SSA represents a unique opportunity to engage patients in hypertension care, and should be leveraged to improve the delivery of hypertension and other NCD services among PLWH.

Conclusion

In this thesis we have shown that the prevalence of hypertension among adults engaged in HIV care in northern Tanzania is high. Despite this high burden of disease the rates of hypertension screening, awareness, treatment and control are alarming low. Hypertensive adults engaged in HIV care in northern Tanzania face multiple, intersecting challenges related to hypertension management including poor hypertension knowledge, insufficient hypertension counseling, financial constraints, lack of access to antihypertensive medications, staff shortages, HIV-related stigma, and lack of integration between hypertension and HIV care. Multifaceted strategies that address these barriers to care along the hypertension care continuum and that are integrated within HIV care are urgently needed to improve cardiovascular outcomes among PLWH in SSA.

Appendix A

IN-DEPTH INTERVIEW GUIDE FOR PATIENTS WITH HIV AND HYPERTENSION

READ ALOUD:

Hello, my name is Preeti. I'm a doctor and researcher from Kilimanjaro Christian Research Institute and partnering with Duke University on a research study. Hello, my name is Linda and I am also a researcher at KCRI and I will be translating this conversation. Thank you for agreeing to talk with me today. The purpose of this interview is to talk with you about your high blood pressure – how you feel about your high blood pressure, what types of care you have received, and ways to improve treatment in the future.

I encourage you to speak honestly and openly with me about these issues. What you say to me today will be kept confidential and will not be linked with your name. I will not share any information that you share with me with your healthcare providers.

You may choose to not answer questions and we can take a break or stop anytime. Our conversation will take about 90 minutes and will be audio recorded so that we can make sure we understand everything that you share with us today. Do you have any questions before we begin?

I. INTRODUCTION

I've introduced myself to you, and now I'd like to start by getting to know you a little better. Can you tell me a little about yourself?

[NOTE: Give him/her the opportunity to talk briefly about himself/herself. Let him/her know that you'll come back to some of these issues later in the interview.]

Do you have any children?
Do you work?
Are you married?
Where do you live?

II. MEDICAL/HIV HISTORY

Thank you for sharing that with me. I'd now like to ask you a few general questions about your health.

- How old are you?
- Tell me about your health. What medical issues do you have?
- Are you comfortable telling me about your HIV history?

When were you diagnosed?
How were you diagnosed?
Where were you diagnosed (i.e. at which health care facility)?
Are you on ART?
When did you start taking ART?
Where were you first prescribed ART (i.e. at which health care facility)?
Do you have any problems taking your ART? Why?
Do you ever forget to take your ART? Why do you forget?
Have you ever stopped your ART? Why?
When did you first start going to this CTC clinic?
How often do you come to the CTC clinic for appointments or to pick up medication?
Is there anyone that helps you to pick up your medication at the CTC?

- What other health problems do you have? [*Note: if patient starts talking about hypertension here, note to him/her that you'll come back to that later for more details.]*
- Have you ever been tested for diabetes?
- Have you ever been tested for kidney disease?
- Have you ever had your eyes checked by a doctor?
- Have you ever had a stroke?
- Have you ever had any problems with your heart?
- Do you smoke cigarettes?
- Do you drink alcohol?
- Other than ART, have you ever been prescribed other types of medication? If yes, what type(s) of medication did you use? What was the name? Why did you take this medication?
- Do you use any herbal or traditional medication? What do you use? Why? How long?
- Where do you receive care for the medical issues that you have other than HIV?

III. HYPERTENSION DIAGNOSIS

Let's start talking more about your high blood pressure now. Tell me about the first time you learned that you had high blood pressure.

- When were you first told you had high blood pressure?
- Who told you that you had high blood pressure?
- What did they tell you?
- Did they tell you what your blood pressure measurements were?
- Where did this happen?
- Why did they check your blood pressure?
- How many times did they check your blood pressure before they told you that you have high blood pressure?
- What was your reaction to the diagnosis?

- Were you diagnosed with high blood pressure first or HIV first?
- What have your healthcare providers told you about your high blood pressure?
- Did you feel that you were helped to understand what high blood pressure is?
- What do *you* think caused your high blood pressure?
- What did your *health providers* tell you was the cause of your high blood pressure?
- Do you have any symptoms from your high blood pressure? [IF YES], what symptoms do you have from your high blood pressure?

IV. FEELINGS AND ATTITUDES ABOUT HYPERTENSION

Please tell me what it's been like for your since you first learned that you had high blood pressure.

- How do you feel emotionally about having high blood pressure?
- How has high blood pressure impacted your life?
- Are you concerned about having high blood pressure?
- Does having high blood pressure effect your thoughts about your future?
- Do you feel that high blood pressure is a problem in Tanzania? Why or Why not?
- Do you know of anyone that has high blood pressure? [If yes], can you tell me what you know about their blood pressure? What do you think of their high blood pressure?
- How does it feel as someone who has both high blood pressure and HIV?
- Do you think your high blood pressure is linked to your HIV? Why or why not?
- Do you think that high blood pressure is linked to ARVs?
- Do you feel that high blood pressure is a problem among people living with HIV?
- How dangerous is it to have high blood pressure?
- How serious (dangerous) is it to have both high blood pressure and HIV?
- Which is more serious (dangerous), HIV or high blood pressure? Why?

V. KNOWLEDGE OF HYPERTENSION

I'd now like to talk to you about what you know about high blood pressure. To begin, can you tell me what you know or have been told about high blood pressure.

- What does it mean if someone has high blood pressure? (What do you mean by the term pressure?) What is high blood pressure?
- What is a normal blood pressure measurement?
- What is a high blood pressure measurement?
- What are some of the causes of high blood pressure?
  What is the most common cause?
  Do you think stress is related to blood pressure? How?
  Is alcohol linked to high blood pressure?

Is smoking linked to high blood pressure?
Can high blood pressure be passed down through the family?
Is weight linked to high blood pressure?
Is age linked to blood pressure?
How do you think these things cause (produce) high blood pressure?

- What are some of the symptoms a person with high blood pressure may have? What are some things that may indicate that a person has high blood pressure?
  What is the most common symptom?
  Do you think it is possible for someone with high blood pressure to not have any symptoms?
- What are some of the risks (complications) of having high blood pressure? What effects do high blood pressure have on the body?
  What is the most serious risk (complication) of having high blood pressure?
- What are ways to control high blood pressure?
  What do you think is the most effective way to control high blood pressure?
  What are some ways to control high blood pressure without using medication prescribed by a doctor?
  Stress reduction techniques? What are ways to reduce stress?
  Have you heard of losing weight to control blood pressure?
  Have you heard of making dietary changes to control blood pressure? What dietary changes?
  Have you heard of using medication to control high blood pressure?
  Have you heard of using herbal treatment or traditional medication to control blood pressure?
- What are some concerns people may have about using blood pressure medication?
- Can high blood pressure be cured? How?
- Can you prevent high blood pressure? How?

VI. HYPERTENSION CARE

Let's talk about the care you've received for your high blood pressure.

- Where do you get your care for your high blood pressure?
  Have you ever received care for your high blood pressure anywhere else?
- How often do you see a health care provider for your high blood pressure?
- Do you expect you will always have high blood pressure?
  Who told you? What did they tell you? How do you feel about this?
- Have you received any education about your high blood pressure?
  Who provided the education?
  What was discussed?
  How was the attitude of the provider?

Were all your questions answered?
Did you understand everything that was discussed about your high blood pressure?
How often do you receive education sessions about high blood pressure?

- Do you feel knowledgeable about high blood pressure?
- How do you feel about the care you have received for your high blood pressure?

VII. HYPERTENSION TREATMENT

Now, let's talk about some of the ways that your blood pressure has been controlled. What are some of the ways that your high blood pressure has been reduced?

- What kinds of things have you personally done to improve your high blood pressure?
- Tell me what usually happens when you are seen in the clinic for your high blood pressure?

Has a health provider ever discussed ways to control your high blood pressure with you?
[IF YES], what did they discuss with you? medications, lifestyle modification (i.e. exercise, weight loss, diet changes, salt reduction, alcohol cessation, smoking cessation, stress reduction)
Which of these things did they recommend for you?
Did you follow their recommendations? [If yes], what did you do? [If no], why not?
If you followed their recommendations, do you think that it helped to improve your blood pressure? Why or why not?
How often does your health provider discuss ways to control blood pressure with you?
How long were you told you need to be taking care of your high blood pressure?
Have your health providers helped you to understand the risks and benefits of taking care of your high blood pressure

- Has your health provider referred you to any specialists (i.e. ophthalmologist, nephrologist, endocrinologist, cardiologist)? [If yes], why?
- Have you ever experienced any medical complications from your high blood pressure?

Since you have known you have high blood pressure, Has your health provider ever asked you to do investigations at the lab (i.e. blood work)?
[If yes], do you know what type of blood work?
How often do you get blood work done?
Do you know why your health provider wants you to have blood work done?
Do you know what the results were?
Has your health provider ever discussed the results with you?

- Have you ever used medications for your blood pressure? **IF NO, CONTINUE TO SECTION A. IF YES, SKIP TO SECTION B.**

A. IF THE PATIENT HAS *NOT* TAKEN MEDICATIONS FOR BLOOD PRESSURE:

- Why haven't you used medications for your blood pressure?
- How do you feel about using medications for blood pressure?
- What are your feelings about using a medication for the rest of your life?
- Have you ever *not* used medication for high blood pressure that was recommended to you by your health provider? [IF YES], what were your reasons for not using the medication?

SKIP TO SECTION C

B. IF THE PATIENT HAS TAKEN MEDICATIONS FOR BLOOD PRESSURE:

- What was the name of the medication(s)?
- Who prescribed the medication for you?
- Where did you receive the prescription?
- How many times a day did you use the medication?
- Do you have insurance for getting medication in the clinic?
- [If no], Where did you purchase the medication?
- How much did the medication cost?
- How long did you take the medication for?
- Did you ever miss a dose of the medication? [If yes], why did you miss the dose?
- Have you ever stopped taking your blood pressure medication? [If yes], why did you stop? When did you stop? For how long did you stop?
- Are you still taking the medication or have you stopped taking it?
- What have you been told about how long you need to be on medications for high blood pressure?
- Have you experienced any complications from using the blood pressure medication?
- Have you ever not taken medication for high blood pressure that was recommended to you by your health provider? [IF YES], what were your reasons for not taking the medication?
- What are your feelings about taking medication for high blood pressure?
- What are some concerns you have about taking medication for blood pressure?
- What are your feelings about taking a medication for the rest of your life?
- What are some concerns you have about taking medications for both your high blood pressure and your HIV?

C. TRADITIONAL AND ALTERNATIVE TREATMENT:

- Other than medication is there anything else that you have done to try and reduce your blood pressure?
  Where did you hear about this way to reduce your blood pressure?

Do you think it helped you?

- Have you ever taken traditional medication for your blood pressure?
  What did you take?
  How long did you take it?
  Did it help you?
  Why did you decide to take traditional medication?
  Have you ever seen a traditional healer for your blood pressure?
  Did you take the traditional medication and the blood pressure medication you received from the hospital at the same time?

VIII. HIV AND HYPERTENSION CARE

Now I'd like to spend some time talking about both your HIV and high blood pressure.

- What's it like to be a person living with HIV and with high blood pressure?
- Does having *HIV* effect the health care you've received for your high blood pressure? If yes, in what way?
- Does having *high blood pressure* effect your HIV care? If yes, in what way?
- Do you think that having HIV has made it more difficult for you to receive health care for your high blood pressure? If yes, how so and why?
- Does the same health care provider/clinic manage both your HIV and high blood pressure or is it separate?
  If separate:
  Does your high blood pressure provider know that you have HIV?
  Does this provider ever discuss your HIV with you?
  Does this provider ever ask you what other medications you are taking?
  Does this provider ever ask if you have other health issues besides high blood pressure?
- Does your *HIV* provider know that you have high blood pressure?
  Has your HIV provider ever discussed your high blood pressure with you?
  If so, how often? What does she/he discuss with you?
  Does your HIV provider ever ask if you are taking other medications besides ART?
  Does your HIV provider ever ask you if you have other health issues besides HIV?
- Is your blood pressure ever checked in the HIV clinic?
- *If yes, how often is it checked in the HIV clinic?* Would you like to receive both your HIV and high blood pressure care at the same CTC clinic visit? *Why or why not?*
  Would you feel comfortable if your HIV provider also managed your blood pressure?
  Why or Why not?
- Do you talk to other people about your high blood pressure?
  [If yes],how did they react? What did the people you told say to you?
  [If yes], who have you told?
  What have you told them?
- What are people's reactions if they find out that you have high blood pressure?

- Do you talk to other people about your HIV?
  If yes, who have you told?
  What have you told them?
  What are people's reactions when they find out you have HIV?

IX. BARRIERS TO IMPROVED CARE

Sometimes there may be challenges that arise that make it difficult to receive the medical care you need.

- What are some challenges that you've faced that have prevented you from receiving care for your blood pressure?
- What are some things that prevent you from going to the clinic? Are you always able to make it to clinic on your appointment date? If not, why?
  Transportation issues
  Cost of transportation
  Can't make appointment for other reason (childcare, employment, etc.)
  Stigma of being seen at clinic
- What are things that prevent you from receiving care for your blood pressure when you are at the clinic? When you're at the clinic what challenges are you facing?
  Blood pressure is not checked at clinic
  Medications are not available at the clinic
  Long wait times at the clinic
  Cost of medications, cost of clinic visits, cost of labs
- What are some challenges you have with healthcare providers?
  Healthcare provider doesn't discuss or prescribe treatment for blood pressure
  Not enough healthcare providers
  Healthcare provider doesn't spend a lot of time with patients
  Healthcare provider has poor attitude
- What are some challenges you face with getting medication or using medication?
  Don't want to take medication
  Medication too expensive
  Side effects from medication
- What are some financial challenges you have when it comes to taking care of your blood pressure and your health?
  Costs of transportation, clinic visit, labs or medications are too high
- What are some challenges of having HIV that effect your blood pressure care?
  Stigma related to HIV
  Interaction between ART and blood pressure medications

- What do you think the general public feel about having high blood pressure? What do you think the general public feel about treatment for high blood pressure?
  Belief in cure
  Mistrust/doubt of diagnosis
  Attitudes about treatment
  Stigma associated with high blood pressure
- What would you want to change about the care you have received for your high blood pressure?
- What would you want to change about the care you receive for your HIV?

X. DESIRED SEVICES AND FACILITATORS TO IMPROVED CARE

- What other information would you like to get about your high blood pressure?
- What types of questions do you have about high blood pressure?
- What are some things that health providers could do to help you with your blood pressure?
- What are some other services that would you like to receive for your high blood pressure in the future?
- What does having well controlled blood pressure mean to you?

XI. CONCLUSION

Our interview is coming to an end.

- Do you have anything else you'd like to add or share before the interview is over?

Thank you very much for taking the time to talk with me. Your views and experiences will help us to care for people with high blood pressure and HIV in Tanzania.

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