

The Burden of Hypertension in the Emergency Department and Linkage to Care in
Moshi, Tanzania; a Prospective Cohort Study

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 in the Graduate School
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ABSTRACT

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Abstract

Background: Globally, hypertension affects one billion people and disproportionately impacts the developing world. Sub-Saharan Africa has a high prevalence of hypertension with a low rate of awareness and compliance with treatment. The current model of community-based screening does not always ensure follow-up for treatment initiation. In high-income countries, emergency department (ED)-based screening has been successful at capturing undiagnosed/uncontrolled hypertension cases.

Methods: Between July 2017 and March 2018 we conducted a prospective cohort study of hypertensive patients in the emergency department of Kilimanjaro Christian Medical Center (KCMC) in Moshi, Tanzania. Adults patients with a triage blood pressure $> 140/90$ were recruited, completed a demographic and knowledge, attitudes and practices (KAP) survey and were followed for one month. Hypertension was defined as a single blood pressure $\geq 160/100$ mmHg or a three-time average of $\geq 140/90$ mmHg. Successful follow-up was defined as seeing a medical doctor within one month of the ED visit. Basic demographics were performed and to investigate relationships with potential risk factors and failure to follow-up, generalized linear models were used.

Results: We enrolled 595 adults (mean age 59.6) including 175 men (39.2%) and 271 women (60.7%). Of the 600 patients enrolled, 590 (99%) meet our definition for

hypertension. Overall, the prevalence of hypertension was 10.3 % (95% CI 9.5,11.0) and 303 (56.2%) of participants failed to follow-up with a primary care physician within 1 month of the ED visit. Successful follow-up was independently associated with understanding that hypertension requires lifelong treatment (RR 1.11; 95% CI 1.03,1.21) and inversely associated with being worried about a future with hypertension (RR 0.80; 95% CI .64,1.00). The majority (78.6%) of the participants were aware of their disease, but many 223 (37.2%) had uncontrolled hypertension and 265 (44%) had evidence of end-organ damage.

Conclusion: The emergency department in Moshi Tanzania experiences a high burden of hypertensive patients, the majority of which fail to follow-up within one month of the ED visit. Multi-disciplinary strategies should be employed to improve linkage to care for high-risk patients from the emergency department.

Dedication

This thesis is dedicated to Eva Galson.

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1. Introduction

Cardiovascular disease is the leading cause of global morbidity and mortality and disproportionately impacts low-and-middle income countries (LMICS) (IHME, 2015, WHO, 2013). Sub-Saharan Africa (SSA) is acutely vulnerable to the growing cardiovascular disease epidemic due to the rapid rise of lifestyles diseases such as hypertension, obesity, and diabetes (Abegunde et al., 2007). Hypertension, in particular, is the most widespread and contributes the greatest attributable risk to overall cardiovascular death (Lopez et al., 2006). Currently, in SSA the prevalence of hypertension is 28% - 40% and less than 10 % of those with previously detected hypertension are adequately controlled (Mosha et al., 2017) (Galson et al., 2017). Furthermore, by the year 2025, 125 million people in SSA are projected to have hypertensive disease (Whitworth, 2003) and the region is mostly underprepared to address this looming public health crisis (Twagirumukiza et al., 2011).

Concurrent with the rise of non-communicable diseases (NCDs) worldwide, the field of emergency medicine is also growing rapidly, and visits to emergency departments are projected to increase globally (Pines et al., 2011). Currently, it is unclear what role the emergency department (ED) should play in the process of screening and initiating care for hypertension in LMICs (Brody et al., 2015). Previous data suggests that mass community hypertension screening programs in LMIC utilize valuable resources, are not effective or cost-effective, and are unsustainable (Duraio et al., 2015, Paccaud et

al., 2008, Nielsen et al., 2016). Multiple studies in high-income countries (HIC) have established that the ED is a useful venue to screen for hypertension, particularly because a sustained abnormal blood pressure in the ED is highly sensitive for hypertension ((Ackerson et al., 2003, Diertele, 2005),(Tan and Taylor, 2013)). The ED may also be the ideal place to educate patients and ensure linkage to follow-up care (Tan and Taylor, 2013). However, in SSA, even preliminary epidemiological data concerning the burden of hypertension and linkage to care from the ED is severely lacking.

Therefore, this study was conducted to determine the burden of hypertension in the Emergency Department and to explore the chain of care in a high-risk population in Moshi, Tanzania. The objectives were to 1) describe the prevalence of hypertensive from a representative sample of ED patients 2) determine primary care follow-up rates one month after ED visits 3) explore patient predictors for failure to follow-up including both sociodemographic risk factors and patient knowledge, attitudes and practices surrounding hypertension. The overall goal was to explore the journey of hypertensive patients and identify those at high-risk of failure to follow-up who may be ideal targets for future interventions.

2. Methods

2.1 Ethics

The study protocol was approved by Duke University Institutional Review Board (#Pro000), the Kilimanjaro Christian Medical College (KCMC) Ethics Committee (EC#502), and the National Institute for Medical Research (NIMR) in Tanzania. Written informed consent (by signature) was obtained from all participants, and all participants with abnormal findings received counseling, educational pamphlets, and referral for follow-up.

2.2 Setting

The study was conducted between July 2017 and March 2018 in the emergency department of Kilimanjaro Christian Medical Center (KCMC). KCMC is located in Moshi, a town in the Kilimanjaro region of Northern Tanzania. The Kilimanjaro region has a population greater than 900,000 with a female majority (58%) (2013). The largest ethnic group is Chagga and the primary language spoken is Swahili. The HIV prevalence is 3-5% (2013, 2013). Most residents have a primary education and the unemployment rate is 19% (2013)

KCMC serves as a referral hospital for northwestern Tanzania with over 630 beds and a regional training center (Center, 2017). It serves a population of over 11 million people from Moshi Urban and the surrounding rural area in addition to the districts of

Hai, Rombo, Mwanga, Same and Siha. In 2011, the KCMC emergency department received an average of 90 patients a day.

2.3 Sampling and Data Collection

2.3.1 Patient Recruitment

Patients were recruited from the emergency department at KCMC hospital by a trained, local, bilingual research nurse if they meet inclusion criteria. All non-pregnant, adults (age ≥ 18 years old) with triage blood pressures $\geq 140/90$ were recruited into the study. Patients with an inability to respond to the survey due to the severity of their illness or injury were excluded. The sample size goal of 600 was powered both to estimate the prevalence of hypertension with a precision of 5% and to detect a 10% differences in proportions (assuming 95% power and a significance level of .05) between the follow-up and non-follow-up cohorts. We anticipated a 40% loss to follow-up rate based on previous studies in this setting (cite).

The research nurses worked in sequential morning and evening shifts until desired sample size was reached in order to capture a representative sample of all ED patients. Initially night shift were included in the rotation however, these were stopped due to very low total patient volume at night (average < 2 patients total) compared to day/evening and study budget restraints. After informed consent, patients were administered a survey by a research nurses verbally in the native language of KiSwahili. The survey was translated for administration in the local language of Kiswahili. Back

translation of the survey to verify content and of the qualitative responses was performed by bilingual trained researchers.

2.3.2 Survey Instruments

Each participant completed a demographic and medical history survey. Information gathered included age, gender, level of education, alternative medicine use, alcohol use, and tobacco use. If participants were receiving biomedical treatment in the form of hypertensive therapy, then specific drug information was collected. Women additionally gave a self-reported history for pregnancy or menstruation. Awareness was defined as giving a self-reported disease history and subsequently testing positive in our screening process.

Participant also completed a knowledge, attitudes and practices (KAP) survey at the time of enrollment. using previously validated questions which were developed in Moshi, Tanzania for chronic kidney disease will be administered 26. The survey will be adapted for hypertension and piloted on a small sample (N<20) of persons (who will be excluded from the final study) in order to report upon the internal consistency or reliability of the survey in Kiswahili and to assess the content validity of the survey in Kiswahili. It will be necessary to audio record the pilot interview sessions in order to allow for complete translation into English. Participants will not be identified by name on the tapes, and all recordings will be discarded after translation. This pilot will occur

before the start of the study recruitment. After acceptability is assured the survey will then be given to all patients enrolled in the study

2.3.3 Blood Pressure and Urinalysis

The research nurses also measured blood pressure using the automated Omron HEM-712 sphygmomanometer (Omron Healthcare, Inc.; Bannockburn, IL) which has an adjustable cuff size. The machine was calibrated monthly during data collection. All participants were seated in an erect position with feet flat on the floor for a minimum of five minutes before measurements. Initial triage blood pressure were recorded and repeat blood pressure measurements were taken 60 mins into the ED stay (Diertele, 2005). Two blood pressure measurements were obtained at the second time point and average of the three readings were taken according to WHO recommendations (Whitworth, 2003).

Hypertension was defined as a single blood pressure measurement of greater than 160/100 mmHg or a three-time average measurement of greater than 140/90 mmHg. Uncontrolled hypertension was defined as a three-time average measurement of greater than 160/100 mmHg irrespective of treatment status. Burden of hypertension was determined using data on total patients presenting to the emergency room. Measures of end-organ damage was assessed using a point of care urine dipstick to assess for proteinuria. A mid-stream, clean catch urine specimen will be obtained for analysis with an Albutix Reagent test strips. This was collected at any time after the

consent process and during the initial ED stay when the patient was able to provide a sample. Urinalysis and dipstick interpretation is considered a typical nursing task and all research nurses were qualified in this procedure.

2.3.4 Follow-up

One month post-ED visit a follow-up phone call was made by trained nurse to assess follow-up adherence and current treatment plan. Patients were asked if they have sought further medical care since the ED visit and if they are currently on antihypertensive medication. They were asked if they have an appointment made for the future. To reduce non-response rates, we attempted a minimum of five additional phone calls during off-hours (evenings and weekends). When possible data was triangulated with internal medicine outpatient records to ensure accuracy. Successful follow-up was defined as seeing a medical doctor within one month of the ED visit.

2.3.5 Data Collection

Data was collected on paper forms and entered into Redcap by a trained data entry technician (Redcap, 2016). Surveys were verbally administered to patients and families due to variable literacy rates. Surveys were self-administered by healthcare providers in the standard medical language of English or Swahili.

2.4 Data Analysis

The mean and standard deviation (SD) were reported for continuous variables. Alternatively, when distributions were skewed, medians and inter-quartile ranges (IQRs) were used. Differences in likelihood of follow-up for hypertension were compared using chi-square or Fisher's exact for categorical variables with cell sizes with <5 observations.

The third aim of the analysis was to explore associations between risk factors and failure to follow-up after ED visit among the hypertensive patients. Crude and adjusted risk ratios (RR) were estimated using generalized linear models with a log link. Separate regression models to make adjusted bivariate comparisons were fitted to follow-up status for each lifestyle-related variable including alcohol use, tobacco use, traditional medicine use, and current antihypertensive use. Separate regression models were also fitted with responses to key KAP questions including patient knowledge, attitudes, and practices. All models were adjusted for confounding factors potentially associated with hypertension including age, gender, and ethnicity. We did not include education or occupation in our models due to *a priori* assumptions about their potential upstream. All quantitative data were collected on paper and then electronically entered into and managed using REDCap electronic data capture tools hosted at Duke University.

(Redcap, 2016). Approximately 10% of all data were verified after electronic data entry by an independent reviewer to ensure accuracy.

3. Results

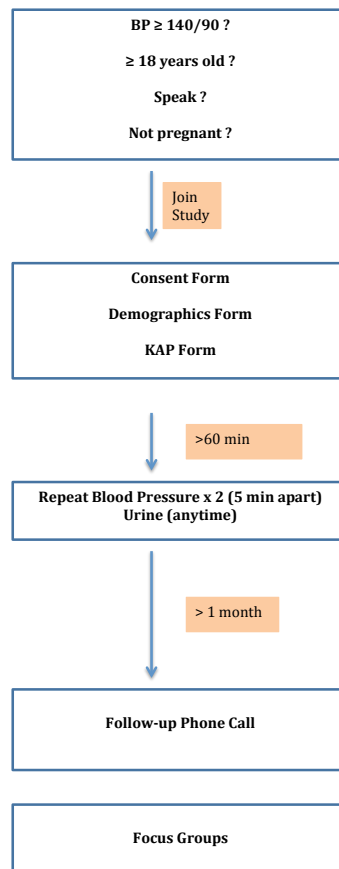


Figure 1: Flow Chart

Overall, 598 adults were enrolled into the study and 539 (90.1%) completed the study (**Figure 1**). The median age was 61 years (IQR 18). Of the participants that completed the study, the majority were women (n =337; 62.5%), ethnically Chagga

(n=330; 61.3%), and had a primary school education (n =309; 57.3%) (**Table 1**). The most common occupation among participants was farming. Many participants reported ongoing use of alcohol (n =141; 26.2%) while few (n =17; 35%) reported ongoing use of tobacco. Most families were relatively small with only a minority (n =81; 15.1%) having > 4 adults in the household or > 2 children in the house (n =114; 21.2%). There were no statistically significant (P<0.05) sociodemographic differences between the follow-up and failure to follow-up cohorts.

Table 1: Baseline characteristics of all hypertensive patients who completed the study, successful follow-up patients, and failure to follow-up patients.

Variable (n, %)	Total (n=539)	Successful Follow-up (n=236)	Failure to follow-up (n=303)	p-value
Gender				0.25
Male	202 (37.5%)	82 (34.7%)	120 (39.6%)	
Female	337 (62.5%)	154 (65.3%)	183 (60.4%)	
Age				0.26
18-39 years old	33 (6.1%)	10 (4.2%)	23 (7.6%)	
40-59 years old	219 (40.6%)	96 (40.7%)	123 (40.6%)	
60+ years old	287 (53.3%)	130 (55.15%)	157 (51.8%)	
Ethnicity				0.72

Chagga	330 (61.3%)	151 (64.0%)	179 (59.1%)	
Pare	82 (15.2%)	33 (14.0%)	49 (16.2%)	
Sambaa	10 (1.9%)	4 (1.7%)	6 (2.0%)	
Others ^s	117 (21.6%)	48 (20.3%)	69 (22.8%)	
Education				0.15
None	36 (6.7%)	21 (8.9%)	15 (5.0%)	
Primary	309 (57.3%)	139 (58.9%)	170 (56.1%)	
Secondary	51 (9.5%)	22 (9.3%)	29 (9.6%)	
Post-Secondary	143 (26.5%)	54 (22.9%)	89 (29.4%)	
Occupation				0.99
Unemployed/Retired	74 (15.4%)	55 (16.6%)	19 (12.8%)	
Farmer/Wage Earner	199 (41.4%)	135 (40.7%)	64 (43.0%)	
Small Business/Vendors	158 (32.8%)	121 (36.5%)	37 (24.8%)	
Professional ^t	50 (10.4%)	21 (6.3%)	29 (19.5%)	
Lifestyle Practices				
Ongoing tobacco use	17 (3.5%)	5 (2.12%)	12 (4.0%)	0.22
Ongoing alcohol use	141 (26.2%)	59 (25.0%)	82 (27.0%)	0.59

Total Household Members

> 2 Children	114 (21.2%)	46 (19.5%)	68 (22.4%)	0.41
> 4 Adults	81 (15.1%)	38 (16.0%)	43 (14.2%)	0.53

3.1 Burden of Hypertension

Of the 598 patients enrolled with elevated triage blood pressure > 140/90, 593 (99.2%) met our definition of hypertension (a single blood pressure \geq 160/100 mmHg or a three-time average of \geq 140/90 mmHg). The overall prevalence of hypertension was 10.3% (95% CI 9.59 -10.98) in this ED population. Mean systolic blood pressure was 168.8 mmHg (SD 20.84), mean diastolic blood pressure was 100.4 mmHg (SD 12.03). Many patients had uncontrolled hypertension 223 (37.2%). Overall, 265 (44%) of participants had evidence of protein in their urine, suggestive of end-organ failure. Finally, 15.6 % of all ED patients during the study period were in the emergency department solely to get refills of their antihypertensives. Despite the high disease burden, the majority of participants with elevated blood pressure (78.6%) were previously aware of having hypertension.

3.2 Pathway of Care

Only 45 (7.5%) of all hypertensive patients were admitted to the hospital and the most common admission diagnosis was Hypertensive Emergency. In total, 47.7 % had

antihypertensive medications added or changed on discharge from the ED and 76.0% had a follow-up appointment made. However, the majority (303 (56.2%)) of patients failed to follow-up with a medical doctor in the one month following their ED visit.

Participants with who did not follow-up were more likely to answer “yes” to the question “Do you think the cost of high blood pressure would be a problem for you and “yes ” to the question “If you found out you had high blood pressure would you be worried about your future?” (p<0.05 for all) (**Table 2**). All other questions showed no statistically significant differences between the follow-up and failure to follow-up cohort.

Table 2:Select KAP questions among participants who completed the study, successful follow-up patients, and failure to follow-up patients

Question (n, %)	Total (n=539)	Successful Follow-up (n=236)	Failure to follow-up (n=303)	p-value
Do you think the cost of high blood pressure would be a problem for you?				0.05*
Yes	124 (23.0%)	45 (19.1%)	79 (26.1%)	
No	415 (77.0%)	191 (80.9%)	224 (73.9%)	
If you found out you had high blood pressure would you be worried about your future?				0.04*
Yes	167 (31.0)	62 (26.3%)	105 (34.7%)	

No 372 (69.0) 174 (73.7%) 198 (65.4%)

3.4 Relative Risk

Crude and adjusted risk ratios for the relation between KAP questions and successful follow-up are reported in **Table 3**. In crude models, being worried about a future with hypertension was inversely associated with successful follow-up (RR X; 95% CI X-X) while understanding that those who have hypertension must take medications for years was positively associated with successful follow-up. These associations remained significant even after adjustment for age, gender, and ethnicity, with a RR X (95% CI X) and PRR X (95% CI X) respectively. We did not observe an association between successful follow-up and any sociodemographic factors (p>0.05 for all).

Table 3: Associations between KAP questions and successful follow-up

Variables	Risk Ratios of Follow-Up (95% CI)	
	Unadjusted	Adjusted*
Worried About The Future	0.79 (0.63, 0.99)	0.80 (0.64, 1.00)
Understand They Must Take Medication For Years	1.10 (1.01, 1.19)	1.11 (1.03, 1.21)
*Adjusted for age, gender, and ethnicity BOLD: Significant at the 5% level		

4. Discussion

To our knowledge this is the first study in SSA to explore the burden of hypertension in an emergency department and explore follow-up adherence and patient characteristics. Strengths of this study include its prospective design, representative sampling techniques and very low loss to follow-up rate of less than 10 %. Overall, in an ED-based setting in northern Tanzania, we found a moderate burden of hypertension. The prevalence observed was lower than community prevalence however still higher than similar regions in SSA.

4.1 Future Suggestions

The majority of hypertensive patient are receiving their primary care through rotating emergency department interns without any consistency or long-term relationship that is necessary for successful anti-hypertensive medication titration and monitoring. KCMC already has an effective and efficient diabetes clinic in place. Thus, existing health care infrastructures can easily be modified to implement this effective strategy to combat hypertension by opening a clinic specifically for hypertensive patients.

4.1 Limitations

Our study had some limitations. Importantly, the time interval for follow-up was brief (one month) and it is unclear if patients continued to be adherent to treatment and care. However, our goal was to determine if providers and patients adhere to

international guidelines for initial follow-up interval so long-term follow-up adherence was not a goal of this study. Second, follow-up information for <10% of patients was missing. This is consistent with previous emergency department based studies in this moderately mobile and transient populations. Nonetheless we expect that same patients who did not follow-up to also be unlikely to follow-up with our research team, thus if anything our calculations represent an overestimate of follow-up adherence.

Additionally, we determined follow-up primary by patient self report and only occasionally triangulated this with clinic records when there were discrepancies. However consistent triangulation which would have been challenging in this system which does not use medical records. Previous research has shown that patients are honest 50 % of the time. We used proteinuria which has a sensitivity as a proxy for kidney damage however accuracy would be improved by checking creatinine and albustix.

5. Conclusions

In an ED-based sample of adults from the Kilimanjaro region in northern Tanzania we observed a high prevalence of hypertension, most of which was uncontrolled and evidence of end-organ damage in patients. Follow-up rates from the ED were low and may be an important risk factor for failure to follow-up for hypertension in this setting. These data have many potential global health implications

and suggest that the ED might be an ideal location to initiate interventions to link patients to care. In comparison to the community these patients tend to have higher health literacy and be more comfortable with biomedicine. This points to specific targets for patient education to improve follow-up for patients.

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