Original Report:
Hypertension

The Burden of Hypertension and Diabetes in an Emergency Department in Northern Tanzania

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Introduction: Little is known about the burden of hypertension and diabetes on emergency department (ED) utilization and hospitalizations in sub-Saharan Africa.

Methods: A retrospective review of adult ED patients in northern Tanzania was performed from September 2017 through March 2018. Hypertension was defined as documented diagnosis of hypertension or blood pressure ≥ 140/90 mm Hg. Diabetes was defined as documented diagnosis of diabetes mellitus or random glucose ≥ 200 mg/dL.

Results: Of 3961 adult ED patients, 1359 (34.3%) had hypertension, 518 (13.1%) had diabetes, and 273 (6.9%) had both. Both hypertension (OR 1.42, 95% CI 1.23-1.63, P<.001) and diabetes (OR 2.05, 95% CI 1.66-2.54, P<.001) were associated with increased odds of admission. Of 2418 hospital admissions, 694 (28.7%) were for complications of hypertension or diabetes. Of 499 patients admitted for hypertensive complications, the most common admission diagnoses were: heart failure (163 patients, 32.7%); stroke (147 patients, 29.5%); and severe hypertension (139 patients, 27.9%). Of 278 patients admitted for diabetic complications, the most common admission diagnoses were: hyperglycemia (158 patients, 56.9%); infection (60 patients, 21.6%); and stroke (28 patients, 10.1%).

Conclusions: The burden of hypertension and diabetes in a Tanzanian ED is high, and the ED may serve as an opportune location for case identification and linkage-to-care interventions. Given the large proportion of Africans with undiagnosed hypertension and diabetes, an ED-based screening program would likely identify many new cases of these diseases. The high burden of hypertension- and diabetes-related hospitalizations highlights the urgent need for improvements in primary preventative care in Tanzania. *Ethn Dis*.2019;29(4):559-566; doi:10.18865/ed.29.4.559

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Introduction

Hypertension and diabetes are leading risk factors for death and disability worldwide.[1] In sub-Saharan Africa (SSA), the prevalence of these diseases has rapidly increased in recent years, contributing to a growing burden of chronic non-communicable diseases (NCDs) across the region.[2,3] Hypertension is currently estimated to affect approximately 30% of adults in SSA and the estimated prevalence of diabetes in SSA is 5%.[3,4]

Health systems in SSA must overcome multiple challenges to effectively manage the rising epidemic of hypertension and diabetes, including medication shortages, lack of diagnostic equipment, poor patient and physician knowledge and training, absent or inadequate treatment guidelines, cost of long-term treatment, and lack of effective screening programs, among others.[5-11] In Tanzania, for example, primary care provision is limited and in 2012 there were only 7.1 health care workers per 10,000 people,[12,13] an inadequate number to effectively manage and prevent NCDs. Furthermore, recent surveys of Tanzanian health care facilities have demonstrated that many lack basic functioning diagnostic equipment such as blood pressure cuffs or glucometers, and the majority of facilities lack protocols for NCD management.[11-14] Equally concerning, these surveys found inadequate knowledge and training regarding hypertension and diabetes to be widespread among health care workers across diverse settings.[11,13,14]

Such challenges have resulted in large numbers of patients with undi-

agnosed and uncontrolled hypertension and diabetes across SSA. A recent systematic review of hypertension in SSA estimated that 73% of all adults with hypertension are unaware of their diagnosis, and only 7% of adults with hypertension have achieved adequate blood pressure control.[4] Similarly, a systematic review of diabetes in SSA found that >40% of patients with diabetes were unaware of their diagnosis,[15] and a recent study in Kenya found that < 5% of patients with diabetes had achieved adequate glycemic control.[16]

In places like Tanzania, where the existing primary care system is ill-equipped to manage large numbers of individuals with uncontrolled hypertension and diabetes, patients may ultimately end up seeking care in emergency departments (EDs) and inpatient settings. Preliminary evidence suggests that hospital admissions for uncontrolled hypertension are common in SSA. For example, recent studies in northwest Tanzania and Nigeria found that hypertension-related diagnoses accounted for 14%-18% of all adult hospitalizations.[17,18] Similarly, a separate study in Nigeria reported that 4% of hospital admissions were due to uncontrolled diabetes.[19]

Much remains to be learned about the burden of hypertension and diabetes on emergency departments and inpatient settings in SSA. The purpose of this study was to determine the prevalence of uncontrolled hypertension and diabetes among ED patients and to describe the burden of hypertensive and diabetic complications on hospital admissions in northern Tanzania. To do so, we conducted a retrospective observational study at a tertiary care center in Moshi, Tanzania.

Methods

Study Location

This study was performed at Kilimanjaro Christian Medical Centre (KCMC), a tertiary care center in northern Tanzania. KCMC is located in the city of Moshi and serves both the urban population of Moshi as well as the surrounding rural populations of the Kilimanjaro Region. The KCMC ED receives all high-acuity patients who present to the hospital; there is a separate outpatient department (OPD) for low-acuity same-day unscheduled care. The ED has access to an array of laboratory tests as well as computed tomography scanning, electrocardiography, and echocardiography for diagnostic testing. ED physicians also have full access to the patient's paper hospital chart including any prior diagnoses or diagnostic testing. In 2014, a community-based screening study found that the local prevalence of hypertension was 28% and the prevalence of diabetes was 5.7%.[20,21] KCMC was chosen as the study site given its wide catchment area as well as the high local prevalence of hypertension and diabetes.

Study Procedures

An ED patient logbook is maintained by ED nursing staff. The information recorded in this logbook includes date of visit, patient age, address, ED vital signs (blood pressure, heart rate, oxygen saturation, temperature, and respiratory rate), blood glucose, diagnosis, and disposition (admitted, discharged, or died in the ED). Vital signs in the ED are generally only taken once, at the time of triage. Blood pressure is measured by a nurse using either a manual cuff and sphygmomanometer or the Philips M3046A patient monitor (Philips Healthcare, Amsterdam, Netherlands). Random blood glucose is measured using the GlucoPlus glucometer (Glucoplus Inc, Montreal, Canada). Diagnosis is copied directly from the patient's chart. Diagnoses are free-texted by the admitting physician and are not generally standardized to ICD-10 taxonomy. All patients who present for care to the ED are recorded in the logbook; OPD patients are not included in the logbook. All patient data from the ED logbook was entered retrospectively into an electronic database for a six-month period, from September 21, 2017 to March 22, 2018. Data were entered exactly as recorded; no abstraction or interpretation of data was performed during the data entry process. Diagnoses were copied verbatim from the ED physician's documentation in the patient chart; the clinical and diagnostic data supporting these diagnoses were not reviewed during the data entry process.

Hypertension Study Definitions

Cases of hypertension were defined as any patient for whom the ED physician documented a diagnosis of hypertension, or any patient with measured systolic blood pressure ≥ 140 mm Hg or diastolic blood pressure ≥ 90 mm Hg. Although guidelines generally require two elevated blood pressure readings on separate occasions for new diagnoses of hypertension,[22] only a single blood pressure reading was used in our study definition as follow-up visits were not conducted during this study. Cases of uncontrolled hyperten-

sion were defined as any patient with a documented diagnosis of hypertensive emergency or hypertensive urgency, or systolic blood pressure ≥ 160 mm Hg or diastolic blood pressure ≥ 100 mm Hg. In cases where no blood pressure was recorded, it was assumed to be normal.

Diabetes Study Definitions

Cases of diabetes were defined as any patient for whom the ED physician documented a diagnosis of diabetes mellitus or any patient with a random glucose ≥ 200 mg/dL (consistent with American Diabetes Association guidelines[23]). Cases of uncontrolled diabetes were defined as any patient with a documented diagnosis of diabetic ketoacidosis or hyperosmolar hyperglycemic state (HHS), or random glucose ≥ 250 mg/dL. Although previous research in SSA found that a random glucose ≥ 135 mg/dL was indicative of poorly controlled disease in patients with an established diagnosis of diabetes,[24] the more conservative threshold of ≥ 250 mg/dL was chosen for this study since it was assumed that many patients in this study population may have undiagnosed diabetes. In cases where no glucose was recorded, it was assumed to be normal. If the glucose reading was "HI", then the blood glucose level was assumed to be 600 mg/dL, the maximum possible reading for the GlucoPlus glucometer, according to manufacturer instructions.

Primary Diagnosis Definitions

The primary admission or primary discharge diagnosis was defined as the first diagnosis listed for each admitted or discharged patient. If the first diagnosis was hypertensive emergency or hypertensive urgency or if the only diagnosis recorded was hypertension, then the primary diagnosis was defined as "severe hypertension." If the first diagnosis was diabetic ketoacidosis, hyperosmolar hyperglycemic state, or hyperglycemia, or if the only diagnosis recorded was diabetes mellitus, then the primary diagnosis was defined as "hyperglycemia." Any primary diagnosis relating to an acute infection, such as gangrene, cellulitis, or sepsis, was categorized as "infection."

Hypertensive Complications and Hypertension-related Visits

An admission for hypertensive complications was defined *a priori* as an admitted patient meeting the study definition for hypertension with any of the following primary admission diagnoses: heart failure; stroke; renal failure; ischemic heart disease; aortic aneurysm; or severe hypertension. A hypertension-related ED visit was defined *a priori* as a discharged patient meeting the study definition for hypertension with any of the following primary discharge diagnoses: heart failure, stroke, renal failure, ischemic heart disease, aortic aneurysm, severe hypertension, chronic kidney disease, or antihypertensive medication refill.

Diabetic Complications and Diabetes-related Visits

An admission for diabetic complications was defined *a priori* as an admitted patient meeting the study definition for diabetes with any of the following primary admission diagnoses: stroke; renal failure; ischemic heart disease; diabetic gastroparesis; diabetic retinopathy; infection; hypoglycemia; or hyperglycemia. A diabetes-related ED visit was defined *a priori* as a discharged patient meeting the study definition for diabetes with any of the following primary discharge diagnoses: stroke; renal failure; ischemic heart disease; diabetic gastroparesis; diabetic retinopathy; infection; hypoglycemia; hyperglycemia; chronic kidney disease; or diabetes medication refill.

Statistical Analyses

All data analysis was performed in RStudio (v 1.1.456, RStudio Inc, Boston, MA). Continuous variables are presented as means with standard deviations or medians with interquartile ranges (IQR). Categorical variables are presented as proportions. Unadjusted odds ratios were constructed from contingency tables. Associations between categorical variables were assessed using Pearson's chi-squared, and associations between continuous and categorical variables were assessed using the Welch two sample t-test.

Research Ethics

This study received ethics approval from the Duke Health Institutional Review Board, the Kilimanjaro Christian Medical Centre Research Ethics Committee, and the Tanzania National Institutes for Medical Research Ethics Coordinating Committee. As this was a retrospective observational study, the requirement for individual informed consent was waived.

Results

During the study period, 3961 adult patients presented to the ED; of these, 2194 (55.4%) were female. The median (IQR) age of patients was 50

(32, 67) years. Three patients died in the ED, 2418 (62.1%) were admitted to the hospital, and 70 (1.8%) patients did not have a disposition recorded. A blood pressure was recorded for 3435 (86.7%) patients and a random blood glucose was recorded for 2171 (54.8%) patients. All patients had at least one diagnosis recorded.

Of all ED patients, 1359 (34.3%) met the study definition for hypertension. The mean (sd) systolic and diastolic blood pressure of ED patients with hypertension was 157.1 (30.2) mm Hg and 88.3 (18.3) mm Hg, respectively. Of those with hypertension, 575 (42.3%) met the definition for uncontrolled hypertension. Of all ED patients, 518 (13.1%) met the study definition for diabetes. The mean (sd) random blood glucose of ED patients with diabetes was 306.0 (138.4) mg/dL. Of those with diabetes, 253 (48.8%) met the study definition for uncontrolled diabetes. There were 273 (6.9%) patients with both hypertension and diabetes. Patients with hypertension had increased odds of also having diabetes (OR 2.42, 95% CI 2.01-2.92, P<.001). Of the admitted patients, 903 (37.3%) patients had hypertension and 387 (16.0%) patients had diabetes.

Table 1 presents the prevalence of hypertension, uncontrolled hypertension, diabetes, and uncontrolled diabetes among both admitted and discharged patients in the ED. Hypertension and diabetes were associated with increased odds of hospital admission: both hypertension (OR 1.42, 95% CI 1.23-1.63, P<.001) and diabetes (OR 2.05, 95% CI 1.66-2.54, P<.001) were more common among patients admitted to the hospital than those discharged home from the ED.

Table 2 presents basic demographic and clinical features of ED patients with and without hypertension and diabetes. ED patients with hypertension were older than other ED patients (mean age 59.8 vs 46.3 years, P<.001), as were ED patients with diabetes (mean age 58.8 vs 49.7 years, P<.001). There was no association between gender and either hypertension or diabetes.

Table 3 presents the primary admission and discharge diagnoses for all ED patients with hypertension. Of the 903 admitted patients with hypertension, 499 (55.3%) were admitted for hypertensive complications, including 163 patients admitted for heart failure (18.1%), 147 patients admitted for stroke (16.3%), and 139 patients admitted for severe hypertension (15.4%). Of the 435 discharged patients with hypertension, 207 (47.6%) had hypertension-related discharge diagnoses, including 191 (43.9%) who were seen for severe hypertension.

Table 4 presents the primary admission and discharge diagnoses for all ED patients with diabetes. Of the 387 admitted patients with diabetes, 278 (71.8%) were admitted for diabetic complications, including 158 (40.8%) patients admitted for hyperglycemia, 60 (15.5%) patients admitted for infection, and 28 (7.2%) patients admitted for stroke. Of the 125 discharged patients with diabetes, 106 (84.8%) visited the ED for a diabetes-related diagnosis, including 91 (72.8%) patients who were seen for hyperglycemia.

Of the 273 patients with both hypertension and diabetes, 203 (74.4%) were admitted to the hospital. Of these, the most common admission diagnoses were hyperglycemia (50 patients, 24.6%), severe hypertension (49 patients, 24.1%), stroke (25 patients, 12.3%), infection (23 patients, 11.3%), and heart failure (21 patients, 10.3%).

Overall, 694 (28.7%) of all admissions were for complications of hypertension or diabetes, including 499 (20.6%) admissions for compli-

Table 1. Proportion of adult emergency department patients with hypertension, uncontrolled hypertension, diabetes, and uncontrolled diabetes, northern Tanzania, September 2017 - March 2018

	All patients, N=3961, n (%)	Patients admitted to the hospital, N=2418, n (%)	Patients discharged home from the ED, N=1470, n (%)	OR (95% CI), admission vs discharge	P
Hypertension	1359 (34.3)	903 (37.3%)	435 (29.6)	1.42 (1.23, 1.63)	<.001[a]
Uncontrolled hypertension	575 (14.5)	420 (17.4)	142 (9.7)	1.96 (1.61, 2.41)	<.001[a]
Diabetes	518 (13.1)	387 (16.0)	125 (8.5)	2.05 (1.66, 2.54)	<.001[a]
Uncontrolled diabetes	253 (6.4)	221 (9.1)	30 (2.0)	4.80 (3.32, 7.22)	<.001[a]
Hypertension and diabetes	273 (6.9)	203 (8.4)	67 (4.6)	1.92 (1.45, 2.56)	<.001[a]

a. P<.05.
ED, Emergency department.

Table 2. Features of patients with hypertension and diabetes compared with other patients presenting to the emergency department, northern Tanzania, September 2017 - March 2018

	Patients with hypertension, n=1359	Patients without hypertension, n=2602	OR (95% CI)	P
Male, n (%)	616 (45.4)	1149 (44.2)	1.05 (.92, 1.20)	.476
Age, mean (sd), years	59.8 (18.3)	46.3 (20.8)		<.001[a]
	Patients with diabetes, n= 518	**Patients without diabetes, n=3443**	**OR (95% CI)**	**P**
Male, n (%)	236 (45.7)	1529 (44.4)	1.06 (.88, 1.27)	.572
Age, mean (sd), years	58.8 (17.3)	49.7 (21.2)		<.001[a]

a. P<.05.

cations of poorly controlled hypertension and 278 (11.5%) admissions for complications of poorly controlled diabetes. Similarly, of ED visits resulting in discharge, 207 (14.1%) were hypertension-related and 106 (7.2%) were diabetes-related (Tables 3 and 4).

Discussion

In northern Tanzania, hypertension and diabetes were prevalent among ED patients, and many of these patients had uncontrolled hypertension and diabetes. Moreover, complications of poorly controlled hypertension and diabetes were common reasons for ED visits and accounted for more than a quarter of all adult hospitalizations, emphasizing the urgent need to create effective community preventative care services and interventions. More effective outpatient chronic disease care programs are needed to reduce the burden of poorly controlled hypertension and diabetes on limited ED and inpatient resources.

We observed large proportions of hospital admissions for complications of uncontrolled hypertension and diabetes, larger than what has been reported elsewhere in SSA. In Nigeria and northwest Tanzania, between 14% and 18% of adult admissions were hypertension-related,[17,18] compared with the 20.6% observed in our study. Similarly, 4% of adult admissions were diabetes-related in Nigeria,[19] compared with the 11.5% observed in our study. The greater proportions of hypertension- and diabetes-related admissions in our study may be related to a larger local burden of poorly controlled hypertension and diabetes or differences in health systems, patient care-seeking behavior, or study design. The large numbers of hospitalizations for poorly

Table 3. Primary diagnoses of admitted and discharged emergency department patients with hypertension, northern Tanzania, September 2017 - March 2018

Admitted patients with hypertension, N=903			Discharged patients with hypertension, N=435		
Primary admission diagnosis	N	%	Primary discharge diagnosis	n	%
Hypertensive complications	499	55.3	Hypertension-related visits	207	47.6
Heart failure	163	18.1	Severe hypertension	191	43.9
Stroke	147	16.3	Heart failure	9	2.1
Severe hypertension	139	15.4	Medication refill	5	1.1
Renal failure	39	4.3	CKD	2	.5
Ischemic heart disease	9	1.0			
Aortic aneurysm	2	.2			
Admissions unrelated to hypertension	399	44.2	Visits unrelated to hypertension	228	52.4
Infection	84	9.3	Infection	33	7.6
Hyperglycemia	50	5.5	Urinary retention	30	6.9
Cancer/malignancy	44	4.9	Cancer/malignancy	25	5.7
Intestinal obstruction	24	2.7	Hyperglycemia	15	3.4
Other	202	22.4	Other	125	28.7

CKD, Chronic kidney disease.

Table 4. Primary diagnoses of admitted and discharged emergency department patients with diabetes, northern Tanzania, September 2017 - March 2018

Admitted patients with diabetes, N=387			Discharged patients with diabetes, N=125		
Primary admission diagnosis	n	%	Primary discharge diagnosis	n	%
Diabetic complications	278	71.8	Diabetes-related visits	106	84.8
Hyperglycemia	158	40.8	Hyperglycemia	91	72.8
Infection	60	15.5	Infection	8	6.4
Stroke	28	7.2	Hypoglycemia	3	2.4
Renal failure	20	5.2	Gastroparesis	2	1.6
Gastroparesis	5	1.3	CKD	1	.8
Ischemic heart disease	4	1.0	Medication refill	1	.8
Hypoglycemia	2	.5			
Diabetic retinopathy	1	.3			
Admissions unrelated to diabetes	109	28.2	Visits unrelated to diabetes	19	15.2
Heart failure	25	6.5	Severe hypertension	7	5.6
Gastrointestinal bleed	18	4.7	Cancer/Malignancy	3	2.4
Severe hypertension	9	2.3	Peptic ulcer	2	1.6
Anemia	8	2.1	Kidney stone	2	1.6
Other	49	12.7	Other	5	4.0

CKD, Chronic kidney disease.

controlled hypertension and diabetes place a substantial burden on limited inpatient resources. Studies conducted elsewhere in Tanzania and in the Congo found that the median duration of hospitalization for hypertension-related admissions was 6-15 days with an inpatient mortality rate of 19.5%-28.7%.[17,25,26] Meanwhile, studies conducted in Ethiopia, South Africa, and Nigeria have reported a median hospital duration of 4-17 days for diabetes-related hospitalizations with inpatient mortality 3.0%-10.6%.[19,27-29] Conservatively assuming that the duration of hospitalization and mortality rates in our study setting would be at the lower end of these ranges, the 499 admissions for hypertensive complications and 278 admissions for diabetic complications observed would have resulted in 4,106 person-days of hospitalization and 106 in-hospital deaths in a six-month period at a single hospital. This tremendous consumption of inpatient resources for treatable chronic diseases warrants the urgent attention of clinicians, researchers, and public health officials. Such high volumes of hypertension- and diabetes-related admissions suggest that additional resources need to be allocated to outpatient non-communicable disease management in northern Tanzania.

In our study, the overall prevalence of hypertension and diabetes among ED patients was high. Given the fact that some patients with chronic hypertension likely presented with abnormally low blood pressure due to acute illness as well as the fact that 13% of patients did not have a blood pressure recorded, the 34% prevalence of hypertension reported here likely underestimates the true burden of disease in this population. Similarly, given the fact that 45% of patients did not have a blood glucose recorded and some patients with chronic diabetes may not have had an elevated random glucose at the time of presentation, the 13% prevalence of diabetes reported here also is likely an underestimation of the true disease prevalence in this population. This suggests that that the ED may be an opportune setting to implement screening and linkage-to-care interventions. Given existing data that most adults in SSA with hypertension and diabetes are not aware of their diagnoses,[4,10,15] a case-identification program based in the ED would likely be an efficient way to identify new diagnoses. Using current estimates of the proportion of adults in SSA who are unaware of their diagnoses,[4,10] a case-identification program in the KCMC ED would have identified 992 new diagnoses of hypertension and 378 new diagnoses of diabetes in a six-month period. Given the higher prevalence of hypertension and diabetes in the ED than in the surrounding community,[20,21] an ED-based case-identification program that would not require travel of staff would likely be more efficient and less costly than community-based programs. Com-

munity screening programs, however, remain important for measuring population-wide disease prevalence and identifying patients who may not seek hospital-based care. Beyond new case identification, the ED may also serve as an apt location for education and linkage-to-care mechanisms. Given the large numbers of patients with hypertension and diabetes who are passing through the ED, many of whom presenting with complications of uncontrolled hypertension and diabetes, an ED referral program to outpatient preventative care may be an effective way to link patients to primary care.

Limitations

This study had several limitations. First, in order to be conservative, we assumed that the 13% of patients with no recorded blood pressure were not hypertensive and the 45% of patients with no recorded blood glucose were not hyperglycemic. This almost certainly resulted in an underestimation of the true proportion of patients with these diseases, and likely resulted in under-reporting of hypertension- and diabetes-related admissions. Furthermore, patients with chronic hypertension who were acutely ill in the ED may have presented with an unusually low blood pressure, which would result in further underestimation of hypertension prevalence. On the other hand, as some acute conditions may result in transient elevation of blood pressure that is not indicative of chronic hypertension, use of a single triage blood pressure to define hypertension may have resulted in an overestimation of disease prevalence. However, previous studies have shown that a single incidence of blood pressure elevation in the ED is sensitive for hypertension and is associated with a substantial increase in long-term risk of cardiovascular events.[30] Moreover, multiple studies have shown that most cases of elevated blood pressure readings among ED patients without known hypertension are due to undiagnosed chronic hypertension, rather than pain or anxiety.[31-33] Similarly, fasting blood glucoses and hemoglobin A1c testing would have allowed for more accurate detection of diabetes cases; however, research from elsewhere in SSA has shown that random blood glucoses provide acceptable measures of long-term blood glucose control when hemoglobin A1c testing is unavailable.[24] Additionally, as KCMC is a tertiary care center, the proportions of patients presenting to the ED with hypertension, diabetes, or complications of these diseases may be different from what would be observed in other kinds of health care facilities. Finally, the diagnoses presented here were the clinical diagnoses made by the admitting physician based on available clinical, laboratory, and radiographic data. However, the specific data supporting these diagnoses were not reviewed, and so evaluation of the accuracy of these diagnoses is not possible.

Conclusions

Hypertension and diabetes are prevalent among adult patients in an ED in northern Tanzania, and complications of poorly controlled hypertension and diabetes are common reasons for inpatient admission. The findings presented here underscore the critical need for improved outpatient preventative services to decrease the burden of these diseases on costly and limited ED and inpatient care in Tanzania. These findings also suggest that the ED may be an opportune location for screening and linkage-to-care interventions to improve identification and control of these diseases.

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Conflict of Interest

No conflicts of interest to report.

Author Contributions

Research concept and design: Hertz, Sakita, Manavalan, Madut, Thielman, Mmbaga, Staton, Galson; Acquisition of data: Hertz, Sakita; Data analysis and interpretation: Hertz, Sakita, Manavalan, Madut, Thielman, Mmbaga, Staton, Galson; Manuscript draft: Hertz, Sakita, Manavalan, Madut, Thielman, Mmbaga, Staton, Galson; Statistical expertise: Hertz; Acquisition of funding: Hertz, Mmbaga, Staton; Administrative: Hertz, Sakita, Manavalan, Madut, Thielman, Mmbaga, Staton, Galson; Supervision: Hertz, Sakita, Manavalan, Madut, Thielman, Mmbaga, Staton, Galson

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