Published in final edited form as:

J Hypertens. 2013 September ; 31(9): 1806–1811. doi:10.1097/HJH.0b013e328362bad7.

HYPERTENSION-RELATED DISEASES AS A COMMON CAUSE OF HOSPITAL MORTALITY IN TANZANIA: A 3-YEAR PROSPECTIVE STUDY

Robert N. PECK^{a,b,c}, Ethan GREEN^d, Jacob MTABAJI^e, Charles MAJINGE^f, Luke R. SMART^{a,b,c}, Jennifer A. DOWNS^{a,b,c}, and Daniel W. FITZGERALD^c

^aDepartment of Medicine, Bugando Medical Centre, Mwanza, Tanzania

^bDepartment of Medicine, Weill Bugando School of Medicine, Mwanza, Tanzania

^cCenter for Global Health, Weill Cornell Medical College, New York, New York

^dCornell University, Ithaca, New York

^eDepartment of Physiology, Weill Bugando School of Medicine, Mwanza, Tanzania

^fDirector General, Bugando Medical Centre, Mwanza, Tanzania

Abstract

Objective—Hypertension is believed to be an increasingly common driver of the epidemic of non-communicable diseases (NCDs) in sub-Saharan Africa, but prospective data are scarce. The objective of this prospective study was to determine the contribution of hypertension to deaths, admissions, and hospital days at a Tanzanian zonal hospital. **Methods:** Between 2009 and 2011, diagnoses were recorded for all medical admissions together with age, gender, length of hospitalization and in-hospital mortality.

Results—Among 11,045 consecutive admissions, NCDs accounted for nearly half of all deaths, admissions, and hospital days. Among NCDs, hypertension-related diseases were the most common and accounted for 314 (33.9%) of the total NCD deaths, 1,611 (29.9%) of the NCD admissions, and 12,837 (27.8%) NCD hospital days. Stroke (167 deaths) was the leading cause of hypertension-related death. Hypertension was the leading cause of death in patients over the age of 50 years and 57% of hypertension-related deaths occurred in patients <65 years old.

Conclusion—NCDs account for half of all deaths, admissions and hospital days at our Tanzanian hospital and hypertension-related diseases were the most common NCD. Hypertension accounted for 34% of NCD deaths and 15% of all deaths. Hypertension was the second most common cause of death overall and the leading cause of death in patients >50 years old. More than half of hypertension-related deaths occurred before retirement age. These findings have important

Corresponding Author: Dr. Robert Peck. Bugando Medical Centre, Bugando Hill Road, Box 1370, Mwanza, Tanzania. Telephone: +255687084038. Fax: +255282500789. rnp2002@gmail.com.

Conflicts of Interest: NONE

Previous Presentations: Part of this work was presented as a poster at the 2012 Conference of the American Hypertension Association in Washington, DC.

implications for public health and medical education in sub-Saharan Africa, where hypertension and related diseases have not traditionally been given a high priority.

Keywords

hypertension; non-communicable diseases; sub-Saharan Africa; hospital; mortality; admissions; hospital days; stroke

Introduction

Historically, communicable diseases have been the leading causes of hospital mortality among adults in sub-Saharan Africa. According to both medical records and published reports from our hospital in Northwestern Tanzania, for example, HIV, malaria, and tuberculosis have traditionally been described as the predominant causes of medical admissions and hospital mortality [1-3]. The contribution of non-communicable diseases (NCDs), though, has not been formally quantified in a large, prospective study.

Recent reports suggest that NCDs may be a rapidly growing cause of mortality in sub-Saharan Africa and that hypertension may be a major driver of this epidemic, but contemporary data are limited [4,5]. Although previously considered rare [6-9], the prevalence of hypertension in sub-Saharan Africa seems to be rising due to the effects of urbanization and industrialization on diet, exercise and obesity [6,8,10,11]. Hypertension-related diseases including strokes, heart failure, kidney disease and hypertensive emergencies have been suggested as an increasing cause of death in sub-Saharan Africa [12-14]. Prospective data regarding the precise contribution of hypertension to in-hospital mortality and morbidity in sub-Saharan Africa, though, are lacking.

Therefore, we conducted a 3-year prospective evaluation of diagnoses and deaths among adult admissions to Bugando Medical Centre (BMC) in Northwestern Tanzania from 2009-2011. We hypothesized that NCDs, and specifically hypertension-related conditions, were major causes of death.

Methods

Study Population

We prospectively and systematically collected de-identified data between January 1, 2009 and December 31, 2011 in the adult medical wards of BMC. BMC is a tertiary referral and teaching hospital that serves the Lake Victoria region of northwestern Tanzania (population: 13 million). BMC is located in the city of Mwanza, the second largest urban center in Tanzania and the capital of the Mwanza region. BMC has 100 adult medical beds located in 4 wards: 2 male and 2 female. The HIV prevalence in the Mwanza region is approximately 6%. Tuberculosis, schistosomiasis, malaria and Hepatitis B are highly endemic in this region. By hospital policy, all patients are offered counseling and testing for HIV at the time of admission and undergo routine screening of glucose and creatinine. Blood pressure is also measured at admission by a registered nurse. Blood pressure measurement is typically done at least twice (once on each arm) after 5 minutes of sitting using a mercury sphygmomanometer. If either or both of the first 2 blood pressure measurements are

elevated, a 3rd blood pressure measurement is taken and the average of the 2nd and 3rd measurements is considered for the diagnosis of hypertension.

Data Collection

Unlinked data were systematically collected on all persons admitted to the adult medical wards of BMC during the study period. Patients admitted to the adult medical ward were 13 years old as this is the standard threshold in Tanzania at which patients are admitted to adult rather than pediatric wards. The following data were recorded in all patients: age, gender, dates of admission and discharge, primary diagnosis, secondary diagnoses and in-hospital outcome (alive or dead).

In January of 2008 we began a quality-controlled system for recording discharge diagnoses, length of stay and in-hospital mortality for all patients admitted to our adult medical wards. At the time of discharge or death, data regarding each patient are recorded in a standardized discharge report book by the medical interns assigned to each ward. All discharge information is then reviewed and confirmed or revised by the supervising physician. Discharge information is cross-checked on a weekly basis with the nurses' discharge and death logs to assure that all patients are recorded.

In December of 2008, a standard list of recommended primary diagnoses was created based on the results of the first 12 months of data collection. These diagnoses were adapted from the WHO's International Classification of Diseases version 10 (ICD-10) [15]. This standard list included all of the diagnoses reported in this study. The interns and attending doctors of BMC were taught monthly about the proper recording of both primary and secondary discharge diagnoses. We emphasized that the primary discharge diagnosis should be the single most important reason for which the patient was admitted to the hospital and should be as specific as possible, according to the definition of primary diagnosis in the WHO ICD-10 system [15].

Since we were interested in defining the role of hypertension as an underlying cause of NCDs, we specifically coded hypertension as the primary diagnosis for all patients admitted with hypertensive emergency, hypertensive stroke, hypertensive heart failure and hypertensive kidney disease. Analogously, we did the same with HIV. When a patient with HIV was admitted with an opportunistic infection, HIV was listed as the primary diagnosis and the opportunistic condition as the secondary diagnosis.

Hypertension was listed as the primary diagnosis only if the patient met the clinical definitions for hypertensive emergency, hypertensive stroke, hypertensive heart failure, or hypertensive kidney disease. Hypertensive emergency was diagnosed by the criteria of JNC-7 [16]. As in previous studies, hypertensive stroke was diagnosed if the patient had stroke plus a history of blood pressure >160/100 mmHg or persistently elevated blood pressures above this level after admission [17,18]. In the same way, hypertensive heart failure was diagnosed if heart failure was present plus a history of blood pressure >160/100 mmHg or persistently elevated blood pressures above this level after admission. Hypertensive renal disease was only diagnosed if the history of hypertension could be

demonstrated to predate the onset of renal disease. If hypertension was present but the above criteria were not met, hypertension was not described as the primary diagnosis.

Measures

The primary outcome was mortality. Secondary diagnoses included number of admissions and number of hospital days. We also documented age and gender for all hospital admissions. We further classified admission diagnoses as due to communicable or non-communicable diseases (NCDs).

Data Analysis

Data were entered into Microsoft Excel and analyzed using STATA version 11 (StataCorp, College Station, Texas). Categorical variables were described as proportions (percentiles) and continuous variables were described as means (standard deviations) or medians [interquartile ranges]. Proportions were compared using Fisher's Exact Test. Means were compared using a t-test and medians were compared using Wilcoxon rank-sum. Two-tailed tests were used and $p < 0.01$ was considered significant due to multiple comparisons.

Ethical Issues

The unlinked and de-identified data collected in this study were stored in a password-secured computer. Ethical approval was obtained from the ethics committee of BMC and the institutional review board of Weill Cornell Medical College.

Results

Enrollment

During the study period, a total of 11,045 adults were admitted to the medical wards of BMC: 3,738 in 2009, 3,836 in 2010 and 3,471 in 2011. Demographic information was available for all 11,045 admitted patients and discharge diagnoses were recorded in 11,016 (99.7%) of admissions.

Study Population

Among the 11,045 adult medical patients admitted between 2009-2011, the median age was 40 years [IQR 28-56] and 5,648 (51.1%) were female. The median length of stay was 6 days [4-10] and the total number of hospital days for all admissions during the study period was 94,621 days. Of these 11,045 admissions, 2,049 patients (18.6%) died in the hospital before discharge.

Mortality and Primary Diagnoses

The 20 most common causes of death are reported in Table 1 and the contribution of NCDs and hypertension-related diseases to hospital mortality are displayed in Figure 1. Among the 2,049 hospital deaths during the study period, 927 (45.2%) were due to NCDs. The leading 3 causes of death were HIV (684 deaths), hypertension (314 deaths) and non-hypertensive heart failure (123 deaths). Of the 10 most common causes of death, 6 were NCDs.

Hypertension accounted for 33.9% of NCD deaths and 15.3% of all deaths. The specific diagnoses for patients with hypertension-related conditions are shown in Table 2. Hypertensive stroke and hypertensive heart failure accounted for 167 (53.2%) and 85 (27.1%) of all hypertension-related deaths. The in-hospital mortality rate for hypertension-related admissions was 19.5 / 100 admissions.

Age and Gender of Leading Causes of Death

Patients who died from NCDs were older than those who died from communicable diseases but 65.6% were still <65 years old. The median age of death for patients with NCDs was 54 years [35-70] versus 38.5 years [30-50] for communicable diseases ($p<0.0001$). The numbers of deaths in each age category due to non-communicable and communicable diseases are displayed in Figure 2A.

When the analysis was restricted to patients who died from hypertension-related diseases, these patients were also older than those who died from other causes, although 56.7% were still <65 years old. The median age of patients who died from hypertension-related diseases was 61 years [48-72] versus 40 years [30-56] for all deaths not due to hypertension ($p<0.0001$). The number of deaths and percentage of total deaths due to hypertension-related diseases in each age category are displayed in Figure 2B. Hypertension-related diseases were the overall leading cause of death, admission and hospital days in patients over the age of 50 years, accounting for 28.9% of all deaths, 28.5% of all admissions and 27.8% of all hospital days in this age group.

Male gender was associated with death. Of all patients who died, 56.1% were male versus 47.1% of patients who survived ($p<0.0001$). Male gender was similarly associated with death in both patients who died from NCDs (56.4% vs 47.5%, $p<0.0001$) and those who died from hypertension-related diseases (52.9% vs 41.7%, $p<0.0001$). Men with NCDs and hypertension-related diseases also died at a younger median age than women with similar conditions: 52 vs. 57 years and 59.5 vs. 63 years respectively ($p<0.0001$ for both).

Admissions and Primary Diagnoses

The most common causes of hospital admissions are listed in Table 1. Among the 11,045 admissions during the study period, 5,394 (48.8%) admissions were due to NCDs. Of NCD admissions, the median age was 47 years [30-63] and 51.2% were female. The leading 3 causes of admissions were HIV, hypertension and malaria.

Hypertension accounted for 29.9% of NCD admissions and 14.6% of all admissions. Of hypertension-related admissions, the median age was 56 years [43-69] and 56.0% were female. As shown in Table 2, hypertensive emergency and hypertensive heart failure accounted for 39.5% and 30.9% of hypertension-related admissions respectively.

Hospital Days and Primary Diagnoses

Table 3 reports the 10 leading causes of hospital days. Of the 94,621 total hospital days during the study period, 46,246 (48.9%) were attributable to NCDs. The median length of stay was 6 days [4-10] both for patients with NCDs and those with communicable diseases.

Hypertension-related diagnoses accounted for 27.8% of NCD-related hospital days and 13.6% of all hospital days. Hypertensive emergency and hypertensive heart failure accounted for 4,546 (35.5%) and 4,381 (34.1%) of these hospital days.

Discussion

This 3-year prospective study of 11,045 consecutive admissions to the adult medicine ward of one of the largest Tanzanian zonal and teaching hospitals reveals a startlingly high burden of hypertension-related mortality and morbidity. To the best of our knowledge, this is the first prospective, multi-year study to describe the causes of death in a medical ward in sub-Saharan Africa. The findings provide detailed support for the emerging consensus that hypertension is the major driver behind the epidemic of NCDs in sub-Saharan Africa [13,19,20].

Among all adult medical admissions to our hospital between 2009-2011, nearly 1/2 of all deaths, admissions, and hospital days were due to NCDs and 1/3 of NCD-related deaths, admissions and hospital days were due to hypertension-related conditions. These results confirm and extend the findings of several prior smaller or retrospective studies from Nigeria and South Africa that consistently report 15-20% of all hospital admissions in Africa are due to hypertension-related diagnoses [13,21-23], as well as autopsy and death certificate studies that show that a large proportion of in-hospital deaths are hypertension-related even among younger adults [24-27]. Hypertension is the leading cause of NCD-related hospital mortality and healthcare-utilization at our hospital.

Among patients over the age of 50 years, hypertension-related diseases were the leading cause of death, admission and hospital days. The majority of hypertension-related deaths at our hospital occurred in the working-age males (median age of death: 61 years). These findings illustrate the tremendous burden of hypertension-related conditions in younger adults in sub-Saharan Africa which is likely related to 2 major factors: 1) the rising prevalence of hypertension at younger ages in sub-Saharan Africa and 2) the low rates of outpatient diagnosis, treatment and blood pressure control [11,19,28-30]. In a recent large community-based study in Tanzania, for example, 21% of adults between the ages of 35-44 years had hypertension; of these, only 18% were aware of their diagnosis, only 14% were on treatment and only 5% were controlled [11]. Rates of awareness, treatment and control are even lower among males [29]. As communicable diseases are brought under control, the mortality and morbidity attributable to hypertension-related diseases will continue to swell [29].

In our study, stroke was the leading cause of death among patients with hypertension-related conditions, and 1/3 of adults admitted with hypertensive stroke died before hospital discharge. The stroke mortality rate are particularly high among black Africans [31]. Tanzanian adults 30-69 years old, for example, have one of the highest stroke mortality rates in the world (120/100,000 person years), 6-10 fold higher than the US, UK and Canada [14]. Most of these strokes are due to hypertension and the mortality rate is high [14,25,28,32]. Public health measures originally developed for HIV in sub-Saharan Africa may provide valuable models for preventing stroke through community education and screening for

hypertension, linking to care after diagnosis, simplified drug regimens and maintaining adherence [29,33].

Our study was large, prospective, carefully quality-controlled and spanned multiple years; nevertheless we do recognize some limitations. The prevalence of some communicable diseases such as tuberculosis and malaria may appear underreported as they may have occurred in conjunction with HIV, and HIV was considered the primary diagnoses. Because this was a hospital-based study, there may have been selection bias. Blood pressure measurement was typically done only once in each arm. Neither autopsies nor follow-up after discharge were performed as part of this study, and data regarding cardiovascular risk factors such as hyperlipidemia, smoking, and obesity were not available.

In conclusion, although previously considered rare in sub-Saharan Africa, hypertension is now the leading cause of these NCD-related deaths, admissions, and hospital days at our Tanzanian zonal hospital. Hypertension-related conditions were second only to HIV as a cause of adult deaths, admissions, and hospital days and were the leading cause of all 3 in patients over the age of 50. More than half of hypertension-related deaths occurred below the age of 65 years. This study provides further robust evidence for the growing consensus that hypertension is the major driver behind the epidemic of NCDs in sub-Saharan Africa. We urge that more attention and funding should be devoted to hypertension in sub-Saharan Africa, and should span a broad variety of disciplines including medical education, research and public health.

Acknowledgments

We would like to thank the hundreds of WCMC and BMC doctors who have contributed to this project over the last 5 years by both recording and confirming data. We would like to thank the members of the BMC Department of Medicine who assisted in this project, particularly Prof. Samuel Kalluvya, Prof J.B.Kataraihya, Dr. Rodrick Kabangila, Dr. Hyasinta Jaka, Dr. Bahati Wajanga and Dr. Andrew Luhanga. We would also like to thank Fiona Ewing, Naomi Shike, Judith Briant, Santosh Vardhana and Abraham Korn for their assistance with the database as well as Dr. Saidi Kapiga, Dr. Robin Davisson and Dr. Allyn Mark for their helpful revisions to this manuscript.

Sources of Funding: This project was supported by a grant from the United States National Institute of Health Fogarty International Center (TW 00018).

References

1. Mshana SE, Kamugisha E, Mirambo M, Chakraborty T, Lyamuya EF. Prevalence of multiresistant gram-negative organisms in a tertiary hospital in Mwanza, Tanzania. *BMC Research Notes*. 2009; 2:49. [PubMed: 19323805]
2. Wandwalo ER, Mørkve O. Delay in Tuberculosis Case-Finding and Treatment in Mwanza, Tanzania. *Int J Tuberc Lung Dis*. 2000; 4(2):133–8. [PubMed: 10694091]
3. Wajanga BM, Kalluvya S, Downs J a, Johnson WD, Fitzgerald DW, Peck RN. Universal screening of Tanzanian HIV-infected adult inpatients with the serum cryptococcal antigen to improve diagnosis and reduce mortality: an operational study. *J Int AIDS Soc*. 2011; 14(1):48. [PubMed: 21988905]
4. World Health Organization. WHO Global Report: Non-communicable diseases country profiles. Geneva, Switzerland: 2011. Available from: http://www.who.int/nmh/publications/ncd_profiles2011/en/index.html
5. Mayosi BM, Flisher AJ, Lalloo UG, Sitas F, Tollman SM, Bradshaw D. The burden of non-communicable diseases in South Africa. *Lancet*. 2009; 374(9693):934–47. [PubMed: 19709736]

6. Twagirumukiza M, De Bacquer D, Kips JG, De Backer G, Stichele R Vander, Van Bortel LM. Current and projected prevalence of arterial hypertension in sub-Saharan Africa by sex, age and habitat: an estimate from population studies. *J Hypertens*. 2011; 29(7):1243–52. [PubMed: 21540748]
7. Pauletto P, Puato M, Caroli MG, Casiglia E, Munhambo a E, Cazzolato G, et al. Blood pressure and atherogenic lipoprotein profiles of fish-diet and vegetarian villagers in Tanzania: the Lugalawa study. *Lancet*. 1996; 348(9030):784–8. [PubMed: 8813985]
8. Pauletto P, Caroli M, Pessina a C, Dal Palù C. Hypertension prevalence and age-related changes of blood-pressure in semi-nomadic and urban Oromos of Ethiopia. *Eur J Epidemiol*. 1994; 10(2):159–64. [PubMed: 7813693]
9. Swai AB, McLarty DG, Kitange HM, Kilima PM, Tatalla S, Keen N, et al. Low prevalence of risk factors for coronary heart disease in rural Tanzania. *Int J Epidemiol*. 1993; 22(4):651–9. [PubMed: 8225739]
10. Njelekela M, Negishi H, Nara Y, Tomohiro M, Kuga S, Noguchi T, et al. Cardiovascular risk factors in Tanzania: a revisit. *Acta Tropica*. 2001; 79(3):231–9. [PubMed: 11412807]
11. Hendriks ME, Wit FWNM, Roos MTL, Brewster LM, Akande TM, De Beer IH, et al. Hypertension in Sub-Saharan Africa: Cross-Sectional Surveys in Four Rural and Urban Communities. *PLoS ONE*. 2012; 7(3):e32638. [PubMed: 22427857]
12. Seedat YK. Hypertension in black South Africans. *J Hum Hypertens*. 1999; 13(2):96–103. [PubMed: 10100057]
13. Kolo PM, Jibrin YB, Sanya EO, Alkali M, Peter Kio IB, Moronkola RK. Hypertension-Related Admissions and Outcome in a Tertiary Hospital in Northeast Nigeria. *Int J Hypertens*. 2012; 2012:1–6.
14. Mensah G. Epidemiology of stroke and high blood pressure in Africa. *Heart*. 2008; 94(6):697–705. [PubMed: 18308869]
15. World Health Organization. International Classification of Diseases - Version 10. 2010. Geneva, Switzerland: Available from: <http://apps.who.int/classifications/icd10/browse/2010/en#/160-169>
16. Chobanian AAV, Bakris GL, Black HR, Cushman WC, Green L a, Izzo JL, et al. Seventh report of the joint national committee on prevention, detection, evaluation, and treatment of high blood pressure. *Hypertension*. 2003; 42(6):1–104. [PubMed: 12782643]
17. Kinoshita T, Okudera T, Tamura H, Ogawa T, Hatazawa J. Assessment of Lacunar Hemorrhage Associated With Hypertensive Stroke by Echo-Planar Gradient-Echo T2*-Weighted MRI. *Stroke*. 2000; 31(7):1646–50. [PubMed: 10884467]
18. Ramirez MFL, Tibayan RT, Marinas CE, Yamamoto ME, Caguioa EVS. Prognostic value of hemodynamic findings from impedance cardiography in hypertensive stroke. *Am J Hypertension*. 2005; 18:65S–72S.
19. Addo J, Smeeth L, Leon D. Hypertension in sub-saharan Africa: a systematic review. *Hypertension*. 2007; 50(6):1012–8. [PubMed: 17954720]
20. Mittal BV, Singh AK. Hypertension in the Developing World: Challenges and Opportunities. *Am J Kidney Dis*. 2010; 55(3):590–8. [PubMed: 19962803]
21. Ogunbanjo NO, Ndjeka GA. Disease patterns in the medical wards of a rural South African hospital. *S Afr Fam Pract*. 2003; 45(4):10–1.
22. Ike SO. Prevalence of hypertension and its complications among medical admissions at the University of Nigeria Teaching Hospital, Enugu. *Niger J Med*. 2009; 18(1):68–72. [PubMed: 19485152]
23. Ukoh VA. Admission of hypertensive patients at the university of Benin teaching hospital, Nigeria. *East Afr Med J*. 2007; 84(7):329–35. [PubMed: 17886427]
24. Merwe C, Steenekamp JH, Simson IW, Van der Merwe CA. Causes of death at Tshepong, a rural hospital, 1986-1987. *SAMJ*. 1989; 76(8):422–6. [PubMed: 2799593]
25. Steenekamp JHB, Simson IW, Theron W. Cardiovascular causes of death at Tshepong Hospital in 1 year, 1989-1990. A necropsy study. *SAMJ*. 1992; 81(3):142–6. [PubMed: 1734552]
26. Isaacson C. The changing pattern of heart disease in South African Blacks. *S Afr Med J*. Nov 5; 1977 52(20):793–8. [PubMed: 607491]

27. Seedat Y. Perspectives of research in hypertension. *Cardiovasc J Afr.* 2009; 20(1):39–42. [PubMed: 19287815]
28. Seedat YK. The clinical pattern of hypertension in the South African black population: a study of 1000 patients. *New Zeal Med J.* 1974; 79(515):946–51. [PubMed: 4528019]
29. Ibrahim MM, Damasceno A. Hypertension in developing countries. *Lancet.* 2012; 380(9841):611–9. [PubMed: 22883510]
30. Cappuccio FP, Micah FB, Emmett L, Kerry SM, Antwi S, Martin-Peprah R, et al. Prevalence, detection, management, and control of hypertension in Ashanti, West Africa. *Hypertension.* 2004; 43(5):1017–22. [PubMed: 15037552]
31. Opie LH, Seedat YK. Hypertension in sub-Saharan African populations. *Circulation.* 2005; 112(23):3562–8. [PubMed: 16330697]
32. Kengne AP, Anderson CS. The neglected burden of stroke in Sub-Saharan Africa. *Int J Stroke.* 2006; 1(4):180–90. [PubMed: 18706015]
33. Harries AD, Zachariah R, Jahn A, Schouten EJ, Kamoto K. Scaling up antiretroviral therapy in Malawi-implications for managing other chronic diseases in resource-limited countries. *JAIDS.* 2009; 52:S14–6. [PubMed: 19858929]

Figure 1.

Proportion of Deaths Attributable to Non-Communicable and Hypertension-Related Causes Among Adult Medical Inpatients at Bugando Medical Centre (2009-2011).

Panel A

Panel B

Figure 2.

Numbers of Deaths Due to Different Causes by Age Category Among Adult Medical Inpatients at Bugando Medical Centre (2009-2011). Panel A Displays the Number of Deaths Due to Communicable and Non-Communicable Diseases in Each Age Category. Panel B Displays the Number of Deaths and the Percentage of Total Deaths Due to Hypertension-Related Diseases.

Table 1
The 20 Leading Causes of In-Hospital Mortality Among Medical Admissions to Bugando Medical Centre (2009-2011)

Primary Diagnosis	Deaths (% of all deaths) N=2,049	Admissions (% of all admits) N=11,045	In-Hospital Mortality (deaths/100 admissions)
1) HIV-related	684 (33.4%)	2,393 (21.7%)	28.6
2) <i>Hypertension-related</i>	314 (15.3%)	1,611 (14.6%)	19.5
3) <i>Non-Hypertensive Heart Failure</i>	123 (6.0%)	638 (5.8%)	19.3
4) <i>Cirrhosis & Schistosomiasis</i>	110 (5.4%)	735 (6.7%)	15.9
5) <i>Tuberculosis & Pneumonia</i>	102 (5.0%)	628 (5.7%)	16.2
6) <i>Non-Hypertensive Kidney Disease</i>	90 (4.4%)	242 (2.2%)	37.2
7) <i>Cancer</i>	84 (4.1%)	344 (3.1%)	24.4
8) <i>Non-Hypertensive Stroke</i>	80 (3.9%)	199 (1.8%)	40.2
9) <i>Diabetes Mellitus</i>	77 (3.8%)	591 (5.4%)	13.0
10) <i>Malaria</i>	66 (3.2%)	1,173 (10.6%)	5.6
11) <i>Meningitis</i>	43 (2.1%)	78 (0.7%)	55.1
12) <i>Tetanus</i>	31 (1.5%)	69 (0.6%)	44.9
13) <i>Anemia</i>	27 (1.3%)	293 (2.7%)	9.2
14) <i>Peptic Ulcer Disease</i>	17 (0.8%)	366 (3.3%)	4.6
15) <i>Intoxication</i>	14 (0.7%)	92 (0.8%)	15.2
16) <i>Thromboembolic Disease</i>	11 (0.5%)	63 (0.6%)	17.5
17) <i>Diarrhea</i>	10 (0.5%)	204 (1.8%)	4.9
17) <i>Sickle Cell Disease</i>	10 (0.5%)	165 (1.5%)	6.1
17) <i>Chronic Lung Diseases</i>	10 (0.5%)	144 (1.3%)	6.9
20) <i>Seizure Disorders</i>	4 (0.2%)	65 (0.6%)	6.2
20) <i>Ischemic Heart Disease</i>	4 (0.2%)	51 (0.5%)	7.8

NB: Non-Communicable Diseases are in Italics.

Table 2
Specific Diagnoses for Hypertension-Related Deaths and Admissions Among Medical
Admissions to Bugando Medical Centre (2009-011)

Specific Diagnoses for Hypertension-Related Admissions	Deaths (% of all deaths) N=314	Admissions (% of all admits) N=1,611	In-Hospital Mortality (deaths/100 admissions)
Hypertensive Stroke	167 (53.2%)	447 (27.8%)	37.3
Hypertensive Heart Failure	85 (27.1%)	497 (30.9%)	17.1
Hypertensive Emergency	55 (17.5%)	637 (39.5%)	8.6
Hypertensive Renal Disease	7 (2.2%)	24(1.5%)	29.1

Table 3
The 10 Leading Causes of Hospital Days Among Medical Inpatients at Bugando Medical Centre (2009-2011)

Diagnosis	Hospital Days (% of all hospital days) N=94,621	Median Hospital Stay [IQR]
1) HIV-related	22,430 (23.7%)	7 [4-12]
2) <i>Hypertension-related</i>	12,837 (13.6%)	6 [4-10]
3) Malaria	7291 (7.7%)	5 [3-7]
4) Cirrhosis & Schistosomiasis	6467 (6.8%)	7 [4-11]
5) <i>Non-Hypertensive Heart Failure</i>	6392 (6.8%)	8 [5-13]
6) Tuberculosis & Pneumonia	6156 (6.5%)	8 [4-12]
7) <i>Diabetes Mellitus</i>	4880 (5.2%)	7 [4-10]
8) <i>Cancer</i>	3677 (3.9%)	8 [5-13]
9) <i>Anemia</i>	2875 (3.0%)	8 [5-12]
10) <i>Peptic Ulcer Disease</i>	2749 (2.9%)	6 [4-9]

NB: Non-Communicable Diseases are in Italics