Original Article

Medical Ward In-Patient Mortality Patterns at a Tertiary Hospital in Urban Zambia: A One Year Review June 2018-June 2019

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ABSTRACT

Background: Very little information exists about the causes of death in Zambian Hospitals. Recording of health related vital events in Zambia is often incomplete, and thus government relies on inaccurate verbal autopsies and models to guide policy and monitor increasing amounts of donor aid given towards the eradication of specific diseases. As most developing regions of the world are undergoing gradual epidemiologic transition, in-patient hospital mortality patterns become more important in reflecting this transition.

Objectives: The purpose of this study was to establish the inpatient mortality patterns among patients admitted to the adult medical wards of Kitwe Teaching Hospital between June 2018 and June 2019.

Methods: The files of patients who had died between June 2018 and June 2019 were reviewed and death information extracted by a combined team of clinicians. This information was then inputted and analysed using SPSS version 16.0 for Statistical Analysis.

Results: It was observed that most (n=145, 56.60%) deaths occurred within 72 hours of admission, 47% of these deaths were of Human Immune-deficiency Virus (HIV) positive patients (p=0.04). 55% of all HIV positive related mortalities occurred within 72 hours of admission. There was a bimodal distribution of causes of death with deaths due to communicable diseases (n=118, 46.09%) occurring in the younger age groups (median age 36, p=0.000) and HIV positive and deaths due to non-communicable diseases (n=138, 53.9%) occurring in the older age groups (median age 54, p=0.000) and HIV negative. HIV (n=124, 48.44%) and TB (n=54, 21.10%) were the leading communicable causes of death. Stroke (n=37, 14.50%) and heart failure (n=24, 9.40%) were leading non-communicable causes of death. Hypertension was the most common associated cause of death (n=38, 13.80%). Overall, more men died than women (male to female ratio 1.49:1), men died at a younger age (median age 42, p=0.180) compared to women (median age 46, p=0.180).

Conclusion: Most patients died within 72 hours of admission, with the young dying mainly from communicable diseases associated with HIV and the elderly from non-communicable diseases associated with hypertension.

INTRODUCTION

Most people in Africa and Asia, and many in other regions, are born and die without leaving a trace in any legal record or official statistics [1]. Barely a third of countries outside North America and Europe

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have the capacity to obtain usable mortality statistics, and half the countries in Africa and Southeast Asia do not record cause of death data [2]. Stagnation in the maintenance of civil registration systems and the resulting failure to develop sound data for vital statistics and cause of death over the past 30 years are at the root of this problem of invisibility, which renders most of the world's poor unseen, uncountable, and hence uncounted [3]. As demands to measure the effectiveness of health aid have grown, so have calls for good monitoring of vital events and data for cause of death [4, 5,6-10]. Although civil registration with high and representative coverage should be the long-term goal, investment in complementary, interim sources of statistics in the short term to medium term is needed—particularly for statistics on mortality levels and causes of death [11].

Hospital inpatient mortality is one of the quality measures that can reflect both improvements in health care and patterns in mortality over time [13]. Studies on the trends of inpatient mortality can also help researchers and policymakers assess the impact of health care quality efforts. Examining these trends across patient and hospital may inform strategies for addressing disparities in health care quality by identifying groups that are leading and lagging behind in improvement [13]. Moreover, to respond effectively to changing epidemiological profiles, countries depend on reliable information on causes of mortality [14]. Monitoring mortality trends over time is also crucial to understanding whether or not interventions are having an impact. The desire for better health statistics is not new. With 2030 defined as the next major global health horizon the majority of targets and indicators related to the 3rd Sustainable Development Goal (SDG3, 'Ensure healthy lives and promote well-being for all at all ages') require an ability to measure population health status [12]. We expect a national health information system (HIS) to furnish such measurement.

Improved hospital data will become especially important as many Low to Middle Income Countries (LMIC) enter the epidemiologic transition providing opportunities for extended time series analyses that would be highly informative [19]. Enabling countries to generate quality health information at national and sub-national levels in the same way that high income countries do is also clearly preferable to a future that continues to rely on modelling and the uncertain estimates it produces, to understand local disease burdens [19].

There is dearth of information on causes and trends of hospital mortality in most Sub-Saharan Africa [20-22]. In the region, only few published studies in Ethiopia, Nigeria, South Africa and Tanzania, have focused on hospital-based mortality data [20, 22–23, 24]. In Zambia, more than half of deaths occurred at a hospital or health facility, while a large proportion of deaths still occurred at home. Since out-of-hospital deaths are rarely medically certified, most of the physician-certified deaths come from hospitals [25]. The most common causes of death in adults are medical conditions [26].There is dearth of information on the mortality patterns in medical wards in Zambian hospitals. This retrospective analysis was carried out to determine the cause-specific mortality patterns among inpatients in the adult medical wards of Kitwe Teaching Hospital between June 2018 and June 2019.

METHODS

Study design

This was a cross sectional study carried out to determine the mortality patterns of inpatient medical patients at KTH over a course of one year (June 2018 – June 2019). The study also aimed to establish any associations between demographic and social variables on patterns of mortality. This method best suited this study as it helped establish the most frequent causes of death among inpatients on the medical wards of KTH and for these to be presented as proportions. The method also allowed for the quantification and subsequent testing of causal relationships of patient demographic and social variables on the causes of death.

Population and sampling procedures

This study was done on the adult medical wards of Kitwe Teaching hospital (KTH) Kitwe, Copperbelt province Zambia. With a population of 522,092 (*2010 census provisional*) Kitwe is one of the most developed commercial and industrial areas in the country. KTH is a third level referral hospital serving the second largest populated city in Zambia. It has a bed capacity of 664 with a daily patient traffic of up to 1300. The hospital provides health care services not only for the residents of Kitwe but also serves as a referral centre for the surrounding towns and surrounding provinces such as Luapula and North western provinces.

All inpatient deaths on the medical wards that occurred between June 2018 and June 2019 were eligible for this study. Death files from the study period mentioned above were obtained from the hospital registry. Inclusion criteria were age 15 and older, death occurring on medical wards or in the Intensive Care Unit (ICU) in the period under review. Files with incomplete information or missing information where excluded.

Data extraction and analysis

A team of six assistants comprised of doctors and nurses were trained in the use of the Statistical Package for Social Sciences (SPSS) version 16.0 for windows. The files were then reviewed and information extracted about patient demographics, diagnosis at time of death, treatment, duration of hospital stay, date and time of death, HIV status at time of death and other disease conditions noted to be associated with the death but not as a direct cause of death. This information was then subsequently entered into SPSS. Categorical variables were summarized as proportions. Simple descriptive statistics were done. Student's *t* test was used to compare means of continuous variables, while Chi square test was used to test significance of differences between two proportions with $p<0.05$ being used to make an inference of a statistically significant association. Some data analysis was performed using Microsoft excel to generate tables and figures.

Consent was obtained from the Hospital management to conduct this study.

RESULTS

A total number of 256 files where reviewed. Most of the files reviewed (n=238, 92.97%) were of patients initially seen at health facilities within Kitwe district. Within the district, most patients came from high density residential areas notably from Chimwemwe and Kwacha townships.

The minimum and maximum ages were 15 and 101.The Median age was 44 with an interquartile range of 29.25. Most deaths recorded were in the age group between 15 and 60 years (n=184, 72.40%).

They were more males than female (n=153, 59.77% verses n=103, 40.23%) with a male to female ratio of 1.49:1 (p=0.074). There was no difference between the causes of death in males and females (p=0.533).

Table 1: Baseline Characteristics

	Characteristic		*n*	*%*
1	AGE GROUPS	36-45	58	22.70
		26-35	49	19.10
		46-55	34	13.30
		25 AND YOUNGER	31	12.10
		56-65	26	10.20
		66-75	26	10.20
		76-85	20	7.80
		86 AND OLDER	10	3.90
		Total	254	99.20
		Missing	2	0.80
		Total	256	100
2	SEX			
		MALE	153	59.80
		FEMALE	103	40.20
		Total	256	100
3	RESIDENTIAL DENSITY			
		HIGH	202	78.90
		LOW	26	10.20
		MEDIUM	22	8.60
		Total	250	97.70
		Missing	6	2.30
		Total	256	100
4	HOSPITAL STAY			
		< 72 HOURS	145	56.60
		1 WEEK	56	21.90
		2 WEEKS	55	21.50
		Total	256	100
5	HIV STATUS			
		POSITIVE	124	48.40
		UNKNOWN	82	32.00
		NEGATIVE	50	19.50
		Total	256	100

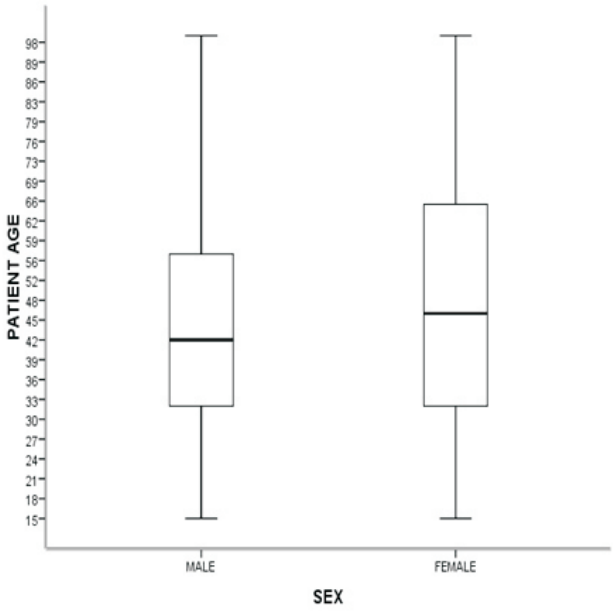

Figure 1. Sex-age distribution

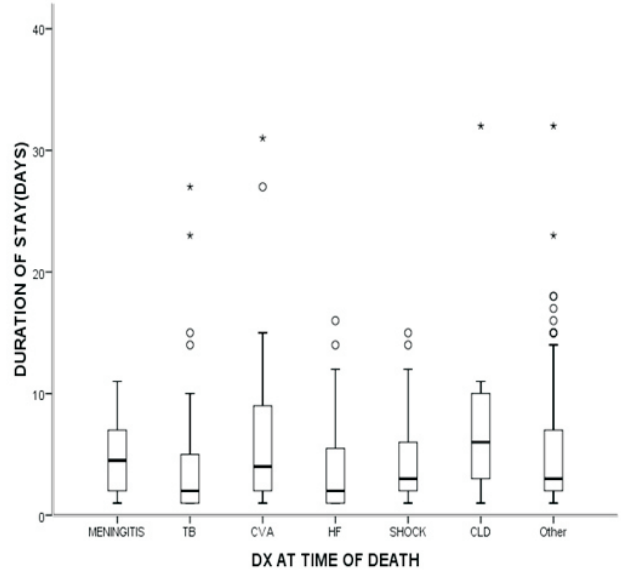

Figure 2. Relationship between the duration of admission before death and the cause of death.

*CVA-Cerebral Vascular Accident, HF-Heart Failure, TB-Tuberculosis, CLD-Chronic Liver Disease

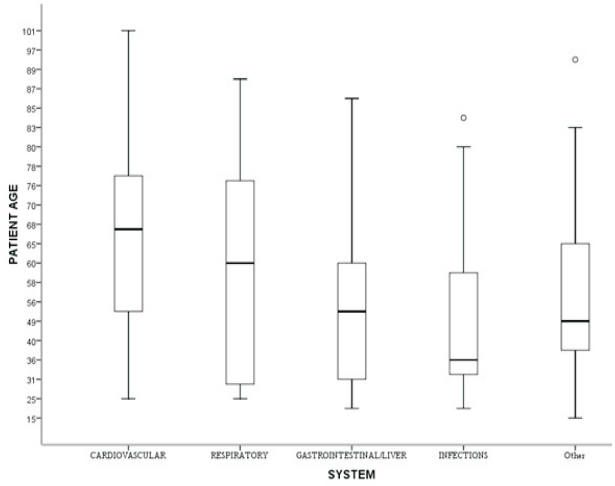

Figure 3. Relationship between the cause of death by systems and age

*Others-Genito-urinary, Nervous, Hematological, Endocrine, Malignancy

Table 2: ***Frequency of Attributable diagnosis at time of Death***

	Diagnosis	Frequency	Percent
1	TUBERCULOSIS	54	21.09
2	CEREBRAL VASCULAR ACCIDENT	37	14.45
3	HEART FAILURE	24	9.38
4	MENINGITIS*	20	7.81
5	SEPSIS	19	7.42
6	SHOCK	18	7.03
7	PNEUMONIA	13	5.08
8	CHRONIC LIVER DISEASE	9	3.52
9	DIABETES	6	2.34
10	KIDNEY FAILURE**	6	2.34
11	CANCER	5	1.95
12	BRAIN DISEASE***	3	1.17
13	CANDIDIASIS	3	1.17
14	DIARRHOEAL DISEASE	3	1.17
15	EPILEPSY	3	1.17
16	MALARIA	3	1.17
17	SICKLE CELL DISEASE	3	1.17
18	TYPHOID FEVER	3	1.17
19	COPD	2	0.78
20	HEPATITIS	2	0.78
21	HYPERTENSION	2	0.78
22	HYPERTHYROIDISM	2	0.78
23	MYOCARDIAL INFARCTION	2	0.78
24	ORGANOPHOSPHATE POISONING	2	0.78
25	ATRIAL FIBRILATION	1	0.39
26	ALCOHOL RELATED	1	0.39
27	ANAEMIA	1	0.39
28	AORTIC ANUERYSM	1	0.39
29	DEEP VEIN THROMBOSIS	1	0.39
30	EMPYEMA THORACIS	1	0.39
31	PNEUMOCYSTIC CARINI PNEUMONIA	1	0.39
32	PELLAGRA	1	0.39
33	PSOARIAS	1	0.39
34	RHEUMATOID ARTHRITIS	1	0.39
35	TTP	1	0.39
36	UPPER GIT BLEEDING	1	0.39
	Total	256	100

COPD, Chronic Obstructive Pulmonary Disease, TTP-Thrombotic Thrombocytopenic Purpura

*from all causes, clinical and lab confirmed, **Acute kidney injury and Chronic kidney disease, *** Unspecified organic brain disease excluding epilepsy

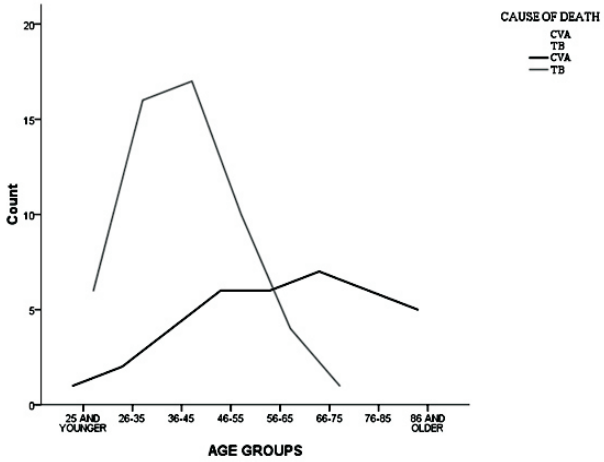

Figure 3. Age distribution of the top two causes of death

*CVA-cerebral vascular accident, TB- Tuberculosis

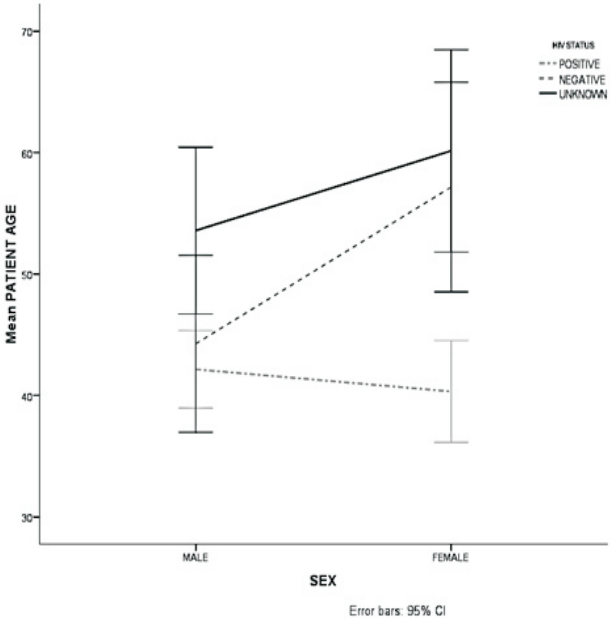

Figure 4. Relationship between HIV status, patient age and sex

Nearly half of the mortality files reviewed were known to be HIV positive at the time of death (n=124, 48.4%) . Amongst the HIV positive, the largest proportion were residents of Kwacha and Chimwemwe townships (n=14, 11.30% and n=10, 8.10% respectively). 84.3% (n=102) of the HIV positive patients came from high residential density areas. More males were HIV positive than females(58.1% and n=52,41.9% respectively) (p=0.770).

Most HIV positive individuals were between the ages of 15 and 65 (n=116, 93.55% of all HIV positive) (p=0.000).

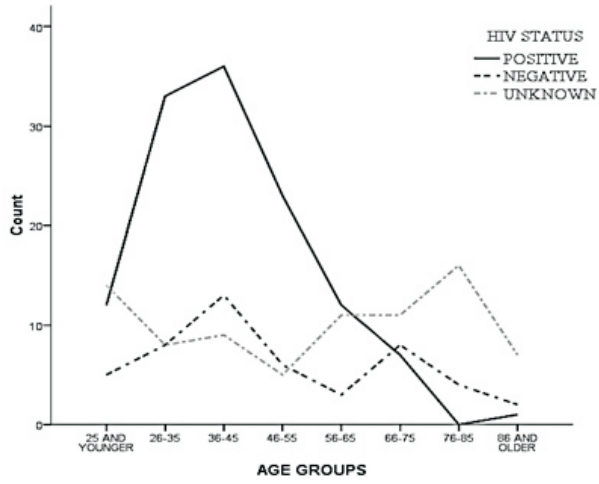

Figure 5. HIV status distribution by age

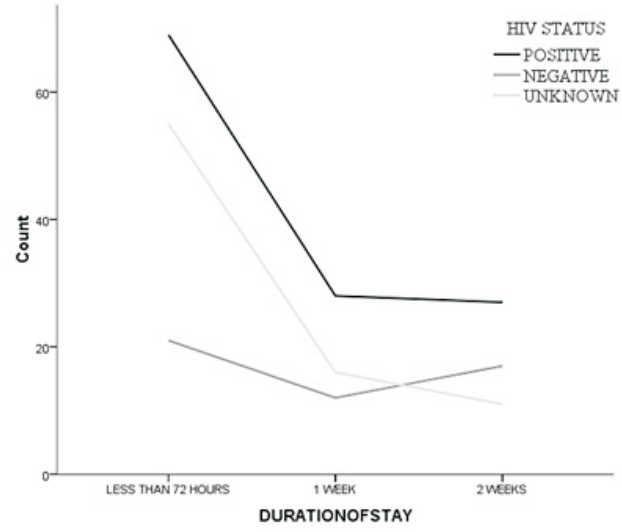

Figure 6. Relationship between HIV status and duration of stay

Within 24hrs of admission, more HIV positive and HIV unknown individuals died than HIV negative patients (p=0.047).

Table 3: ***Relationship Between HIV Status and Cause of Death***

HIV STATUS	POSITIVE			NEGATIVE			UNKNOWN		
	DIAGNOSIS	*n*	%	DIAGNOSIS	*n*	%	DIAGNOSIS	*n*	%
1	TB	44	35.50%	CVA	15	30.00%	CVA	19	23.20%
2	MENINGITIS	15	12.10%	TB	7	14.00%	HF	10	12.20%
3	SEPSIS	12	9.70%	HF	6	12.00%	SHOCK	7	8.50%
4	SHOCK	10	8.10%	CLD	3	6.00%	PNEUMONIA	6	7.30%
5	HF	8	6.50%	SEPSIS	3	6.00%	CLD	4	4.90%
6	PNEUMONIA	6	4.80%	CANCER	2	4.00%	DIABETES	4	4.90%
7	KIDNEY FAILURE	5	4.00%	MENINGITIS	2	4.00%	SEPSIS	4	4.90%
8	BRAIN DISEASE	3	2.40%	ALCOHOL RELATED	1	2.00%	MALARIA	3	3.70%
9	CANDIDIASIS	3	2.40%	AORTIC ANUERYSM	1	2.00%	MENINGITIS	3	3.70%
10	CVA	3	2.40%	DIABETES	1	2.00%	TB	3	3.70%
	OTHER	15	12.00%	OTHER	9	18.00%	OTHER	19	22.80%

*TB-tuberculosis, HF-heart failure, CVA-cerebral vascular accident, AGE-acute gastroenteritis, CLD- chronic liver disease

There was a difference in the top 10 diagnosis at time of death depending on the HIV status (p=0.000).

The most common associated cause of death was hypertension. Other notable associated causes of death were the chest infections, Pneumonia and TB (table 4).

Table 4: ***Frequency of Associated Causes of Death.***

	ASSOCIATED COD	*n*	%
1	Hypertension	38	14.8
2	Pneumonia	20	7.8
3	Tuberculosis	20	7.8
4	Anaemia	18	7
5	Kidney failure	12	4.7
6	Meningitis	9	3.5
7	Diarrhoeal disease	8	3.1
8	Malnutrition	7	2.7
9	Heart failure	5	2
10	Shock	5	2
	Other	43	19.6
	Missing	61	23.8
	Total	256	100

*COD- cause of death

HTN-hypertension, TB-tuberculosis, CKD-chronic kidney disease, AGE- acute gastroenteritis,

TABLE 5: ***Differences Between Patient Characteristics Dying from Communicable and Non-communicable Diseases***

CHARECTERISTICS	COMMUNICABLE DISEASE	NON-COMMUNICABLE DISEASE	P-VALUE
N	120	136	-
%	46.90	53.10	0.000
Median Age	36	53	0.000
Male/Female	1.85	1.22	0.109
HIV+Ve/HIV-Ve	3.57	1.2	0.000

DISCUSSION

The findings of this study indicate that more in hospital deaths in medical wards at Kitwe Teaching Hospital occur among men than women (n=153, 59.77%; n=103,40.23%) with a male to female ratio of 1.49:1. This is in contrast to the demographic characteristics of the Zambian population that has more females than males (49.3 percent males and 50.7 percent females) [31]. Sex differences in mortality have been reported to vary by country [22, 28–30]. Studies in Africa show that men are more likely to be admitted to hospitals than women. This is most likely to be due to the fact that African men are less health conscious than women, hence most women report for treatment earlier than men. Men are reported to attend to their health when complications have set in [22].

The overall median age at death was 44. Men died younger in this study with the median age at death of 42, compared to the median age in women of 46 (p=0.180). The median age at death in this study and in other African countries is younger than elsewhere in the world [37]. This observation is not uncommon in similar studies done in sub Saharan Africa where the average life span is short [32-36]. Zambia has one of the youngest populations in the world, ranked 8th globally with a median age of 16.9 according to the United Nations. These findings demonstrate that the key productive population driving the economy is also the population at highest risk of death.

More than half (n=145, 56.60 %) of all deaths occurred within 72 hours of admission. This could be due to primary or patient dependent delays in reaching the facility, or due to secondary or facility dependent delays in patients receiving appropriate and timely treatment at the facility. Primary delays may be attributable to patients often seeking medical help elsewhere before going to a medical facility as studies have shown that 69.00% of Zambians visit traditional healers at some point during the course of their illness [38]. Additionally, 40.10% of the Zambian population has to travel for more than 2 hours to get to a health facility [44] and thus present late to the emergency department after an acute medical event. These delays ultimately result in patients presenting with advanced forms of disease or with complications of these diseases that make management difficult especially in resource limited settings. At the facility, the high patient to doctor ratio may lead to further delay before appropriate treatment is initiated. The unavailability of some diagnostic tests or the long turnaround time for those available may further delay the establishment of a diagnosis and subsequent treatment. Those who stay long in hospital do well as shown in this study with only 14% of all deaths occurring after the 10th day of admission. Leading causes of death within 72 hours were TB, CVA, HF, shock, sepsis and Pneumonia (Figure 2). This mixed picture of communicable and non-communicable diseases highlights an epidemiological transition from deaths mainly due to communicable diseases.

There were more deaths due to Non Communicable Diseases (NCDs) than due to Communicable diseases (CDs) as shown in table 5. This was unexpected as similar studies done in sub Saharan Africa consistently show CDs as the predominant cause of death in this region of the world [33-36]. Latest global projections of mortality and burden of disease indicate the rising proportion of deaths due to NCDs is projected to rise from 59% in 2002 to 69% in 2030 [39]. This observation could be due to the urban setting of this study or due to the projected epidemiological transition of the disease profile in low and middle income countries which is being driven by the 'westernization' of diets and lifestyles that expose this population to more modifiable risk factors for cardiovascular disease. Deaths due to NCDs were more common among the elderly (median age 53, p = 0.000) and HIV negative (Table 5). According to the WHO, people of all age groups, regions and countries are affected by NCDs, however, these conditions are often associated with older age groups, but evidence shows that 15 million of all deaths attributed to NCDs occur between the ages of 30 and 69 years. These diseases are driven by forces that include rapid unplanned urbanization, globalization of unhealthy lifestyles and population ageing. The most common NCDs were Cerebral

Vascular Accident (CVA) (n=36, 14.30%), shock (n=24, 9.60%), heart failure (n=23, 9.20%), and chronic liver disease (CLD) (n=9, 3.60%). In nearly all developed countries, stroke mortality has decreased between 1950 and 2005, often very considerably. In many countries, it has reduced by 50% or more; in Japan by 85%. The large variation in stroke mortality worldwide is likely to be due to differences in environmental factors apart from genetic influence [40, 41]. In the black population, contribution of high salt intake to the development of hypertension has been documented [40]. Similarly, in our environment, hypertension has been reported as a leading factor for stroke and heart failure, and poor control of hypertension has also been observed [42, 43]. In this study Hypertension was noted to be the most common co-morbid condition (n=37, 14.70%). This rise in NCD associated deaths is largely being driven by hypertension which is often diagnosed late and inadequately treated.

TB was the single leading cause of death, similar studies in Africa show that TB remains an important cause of mortality [46]. Patients with TB and other communicable causes of death died younger than those with NCDs (median age 36, p=0.000). This could be due to the high HIV positivity with nearly half of the files reviewed being HIV positive. Only 68 % of patients had a known HIV status before death, which showed that a significant proportion of patients died without having been tested for HIV. In a recent study locally, almost two-thirds of males (65.10%) and 79.20% of females aged 15-59 years reported ever having been tested for HIV and having received their results. Among adults in urban areas, 75.90% reported ever testing for HIV [44]. Within the region, 62.3% of medical admissions to Kamuzu Central Hospital (KCH) in Lilongwe, Malawi had an unknown HIV status [47]. As the UNAIDS roles out its ambitious targets of 90, 90, 90 for treatment to end the AIDS epidemic by 2030 (90% of people living with HIV knowing their HIV status; 90% of people who know their status on treatment; and 90% of people on treatment with suppressed viral loads) it becomes imperative to identify groups being left behind in this drive towards the first 90. Therefore, further HIV case identification strategies should target these demographic groupings.

Although HIV is a chronic disease, in this study over half of HIV positive patients died within 72 hours of admission. This could be due delays at diagnosis and initiating of HAART, poor retention on treatment with subsequent development of Opportunistic infections (OIs). This, in addition to poor health seeking behaviour, results in patients presenting with advanced forms of HIV which are often refractory to treatment. There is need to strengthen HIV case finding, initiation and subsequent retention on treatment. TB was an important cause of mortality, causing the most deaths in the HIV positive, the second most deaths in the HIV negative, and was the 8th most common cause of death in the HIV unknown (Table 3). The high number of deaths due to TB could be due to the high number of HIV positive patients in this study and overcrowding as most of the patients came from high density residential areas. This calls for more case surveillance among these populations. Although malaria remains a significant cause of mortality nationally, only 1.17 % (n=3) of all deaths were due to malaria in this study. Studies in Zambia have shown that the proportion of malarial deaths is lower in urban areas (9.4%) compared to rural areas (16.1%) and that Malaria is the leading cause of death in children below the age of 15 [38]. In addition, as a tertiary referral hospital, most cases of malaria are managed at primary or secondary health facilities.

CONCLUSION

In conclusion, it was observed that most deaths occurred within 72 hours of admission. Further studies are required to investigate the patient specific and facility specific factors associated with this observation. There was a double burden of disease observed. Hypertension and its complications were the most prevalent causes of mortality in the elderly and HIV negative. There is need for public health

awareness tailored towards risk factor modification to reduce the number of preventable deaths from NCDs. HIV and TB infections and their complications still remain an important cause of mortality among the young productive age group in spite of the advent of combined Anti-Viral Therapy (cART) and Anti-Tuberculous Treatment (ATT). This calls for more studies to identify system and patient factors associated with this observation. The observed trends at facility level show that the country is lagging behind global and national goals towards the attainment of the third sustainable development goal.

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