

EXPLORING THE PATTERNS AND CHARACTERISTICS OF DEATH IN NORTHEASTERN NIGERIA: A STUDY OF UNIVERSITY OF MAIDUGURI TEACHING HOSPITAL MORTALITY CASES

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ABSTRACT

Background: Northeastern Nigeria has been marked by conflicts, epidemics, and natural disasters, resulting in high mortality rates. Understanding the patterns and characteristics of death in this region is crucial for developing effective public health policies.

Aim: This study aimed to explore the patterns and characteristics of death in Northeastern Nigeria using mortality data from the University of Maiduguri Teaching Hospital.

Methods: Mortality data from January 2019 to December 2020 were analyzed (including age, sex, time of death, type of death, clinical conditions, month of death, and address of the deceased).

Results: Out of 713 recorded deaths, 79.7% were hospital deaths, and 20.3% were brought-in-dead cases. Male deaths slightly outnumbered female deaths, with a ratio of 1.2:1. The highest frequency of hospital deaths occurred in the age group of 30-39 years, while the age groups 50-59 and 60-69 had the highest frequency of brought-in-dead cases. Chronic kidney disease was the most frequent clinical condition associated with hospital deaths, while cardiopulmonary arrest was the most common condition for brought-in-dead cases. Hospital deaths were more common in April, and brought-in-dead cases had a higher frequency in December. Most deaths occurred within the metropolis, with a smaller proportion from outside the metropolis.

Conclusion: This study provides valuable insights into the patterns and characteristics of death in Northeastern Nigeria, highlighting the need for targeted interventions to reduce mortality rates in the region. Understanding these patterns and characteristics is essential for developing effective public health policies and interventions.

Keywords: Pattern of death, Northeastern Nigeria, Mortality, Hospital death, Brought-In-Dead

INTRODUCTION

Northeastern Nigeria is one of the most conflict-ridden regions in Africa, with a long history of insurgency and communal conflicts (Oyefara *et al.*, 2020; Oladosu *et al.*, 2021). The region has also been hit by epidemics such as cholera and meningitis, as well as natural disasters such as floods and

droughts, which have resulted in significant loss of life (Kene *et al.*, 2021; Iorfa *et al.*, 2020). Mortality rates in Northeastern Nigeria are among the highest in the country, with a recent study showing that the region accounts for more than half of all deaths due to violent conflict in Nigeria (Kamaldeen *et al.*, 2021).

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This study aims to explore the patterns and characteristics of death in Northeastern Nigeria using mortality data collected from the University of Maiduguri Teaching Hospital including factors associated with death, clinical conditions, and demographic factors, which will help to have inform public health interventions and policies aimed at reducing mortality rates in the region.

Methods

Study Area

This was a retrospective study carried out using the mortality data records of university of Maiduguri Teaching Hospital. The hospital is located at Maiduguri metropolis in Borno State of Nigeria. Maiduguri is the capital and largest city of Borno State is located in the North-East geopolitical zone of Nigeria Latitude 11° 49' 59.99" N and Longitude 13° 08' 60.00" E with a population of 1,907,600 people. Most inhabitants of the state are farmers (Pulse.ng, 2021).

University of Maiduguri Teaching Hospital is a tertiary healthcare institution and serves as tertiary referral Centre to all other hospitals within Borno State.

Study design

This was a retrospective cross-sectional study. Mortality data from the University of Maiduguri Teaching Hospital were collected for a period of 2 years before and during the COVID-19 pandemic, from January 2019 to December 2020. The study included all deaths recorded during this period that met the inclusion criteria.

Inclusion criteria:

The study encompassed deaths recorded at the University of Maiduguri Teaching Hospital in Northeastern Nigeria, with complete data on age, sex, time of death, time received, type of death, clinical condition associated with death, month of death, and address of the deceased.

Exclusion criteria:

Deaths not recorded at the University of Maiduguri Teaching Hospital, deaths occurring outside of Northeastern Nigeria, and deaths lacking complete data on age, sex, time of death, time received, type of

death, clinical condition associated with death, month of death, or address of the deceased were excluded from the study.

Study Population: The study population consist all deaths recorded at the hospital and the ones brought in dead (BID) between January 2019 to December 2020, that meet the inclusion criteria.

Data Collection:

Mortality data were extracted from hospital records, including age, sex, time of death, time received, type of death, clinical condition associated with death, month of death, and address of the deceased.

Data Analysis:

Data extracted from the hospital records were entered into Statistical Package for Social Sciences (SPSS) version 20. Descriptive statistics such as means, medians, and frequencies were used to summarize the data. Crosstabulations were conducted to explore the relationships between the various factors and patterns of death. The results of the study were presented using tables and figures.

Ethical Considerations: Ethical approval was obtained from the Research Ethics Committee of the University of Maiduguri Teaching Hospital: (OHRP-IRB00013572 UMTH/REC/22/1043).

All data within the inclusion criteria were anonymized, and no identifiable information was included in the analysis.

RESULTS

Table 1: The study covers the years 2019 and 2020, recording a total of 713 deaths. Approximately 79.7% of these deaths (568) were classified as hospital deaths, while the remaining 20.3% (145) were brought-in-dead cases.

Table 2: Gender distribution of hospital deaths and brought-in-dead cases shows that out of 568 hospital deaths, 51.2% were male deaths, while 48.8% were female deaths. In the case of brought-in-dead cases, 65.5% were male deaths, while 34.5% were female deaths, resulting in a total of 145 deaths. The overall male-to-female death ratio was approximately 1.2:1.

Table 3: The distribution of hospital deaths and brought-in-dead cases by age groups reveals that the age group of 30-39 had the highest frequency of hospital deaths, while the age groups of 50-59 and 60-69 had the highest frequency of brought-in-dead cases.

Figure 1: This figure presents information on associated clinical conditions with hospital deaths and brought-in-dead cases. Chronic kidney disease was the most frequent clinical condition associated with hospital deaths, while cardiopulmonary arrest was the most frequent clinical condition associated with brought-in-dead cases. Notably, cases with unknown associated clinical conditions were also observed.

Figure 2: This figure illustrates the association of clinical conditions with different age groups. Congenital disease was prominent in the age group 0-9 years, while chronic kidney disease was prevalent across other age groups.

Figure 3: The chart shows the distribution of hospital deaths and brought-in-dead cases by month. A high rate of hospital deaths was observed in April, while December had the highest frequency of brought-in-dead cases.

Table 4: Information on the type of death categorized by address location is presented. The majority of deaths were from within the metropolis (95.2%). However, outside the metropolis, brought-in-dead cases were notable.

Table 5: This table categorizes deaths by occupation, highlighting that housewives had the highest frequency of recorded hospital deaths, while civil servants had the highest frequency of Brought-in Dead (BID) cases.

Figure 4: The number of Brought-in Dead cases categorized by the time of arrival, showed that the majority of BID cases were received at night.

Table 1: Distribution of Death Types by Year

Year	Type of Death		Total
	Hospital	BID	
2019	291	92	383
2020	277	53	330
Total	568	145	713

BID = Brought-In Dead

Table 2: Distribution of Death Types by Gender

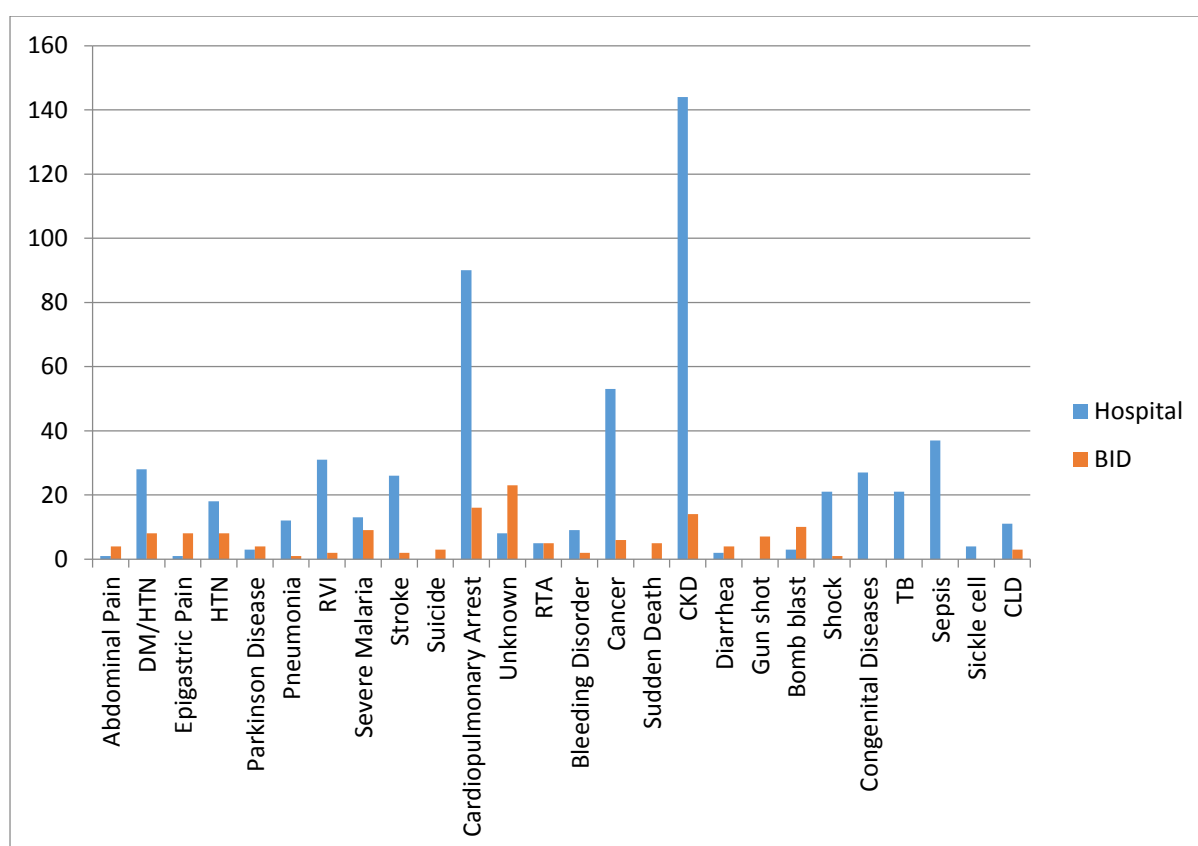
Sex	Type of Death		Total (%)
	Hospital	BID	
Male	291	95	386 (54.1)
Female	277	50	327 (45.9)
Total	568	145	713 (100)

BID = Brought-In Dead

Table 3: Distribution of Death Types by Age Group

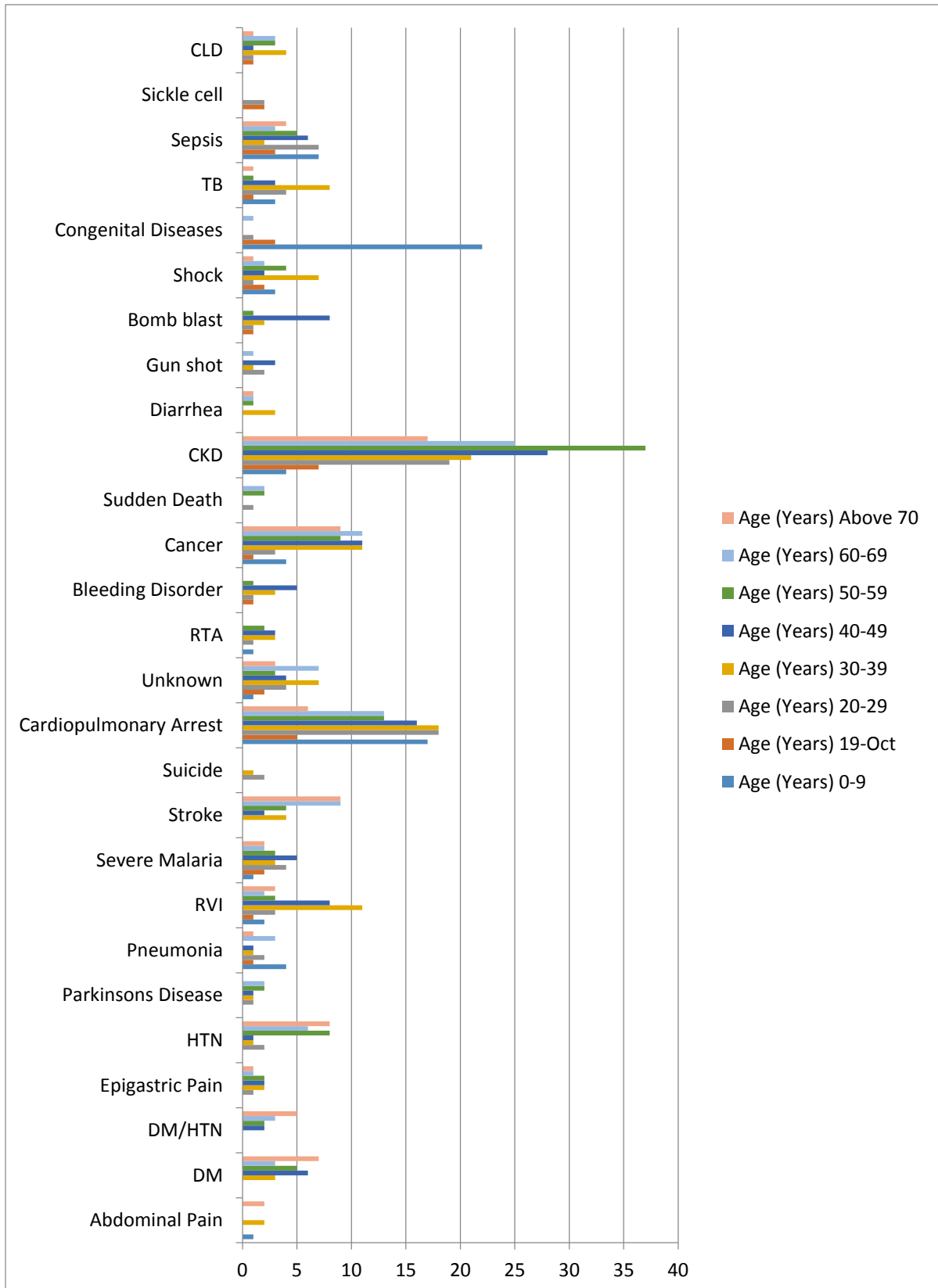
Age (years)	Type of Death		Total
	Hospital	BID	
0-9	68	2	70
10-19	32	1	33
20-29	66	15	81
30-39	92	26	118
40-49	87	31	118
50-59	84	27	111
60-69	73	27	100
70Above	65	16	81
Total	568	145	713

BID = Brought-In Dead



DM= Diabetes Mellitus; HTN= Hypertension; RVI= Retroviral Infection; RTA= Road Traffic Accident; CKD= Chronic Kidney Disease; TB= Tuberculosis; CLD= Chronic Liver Disease.

Figure 1: Distribution of Death Types by Associated clinical conditions



DM= Diabetes Mellitus; HTN = Hypertension; RVI = Retroviral Infection; RTA = Road Traffic Accident; CKD = Chronik Kidney Disease; TB = Tuberculosis; CLD = Chronic Liver Disease.

Figure 2: Distribution of Age Groups by associated clinical conditions

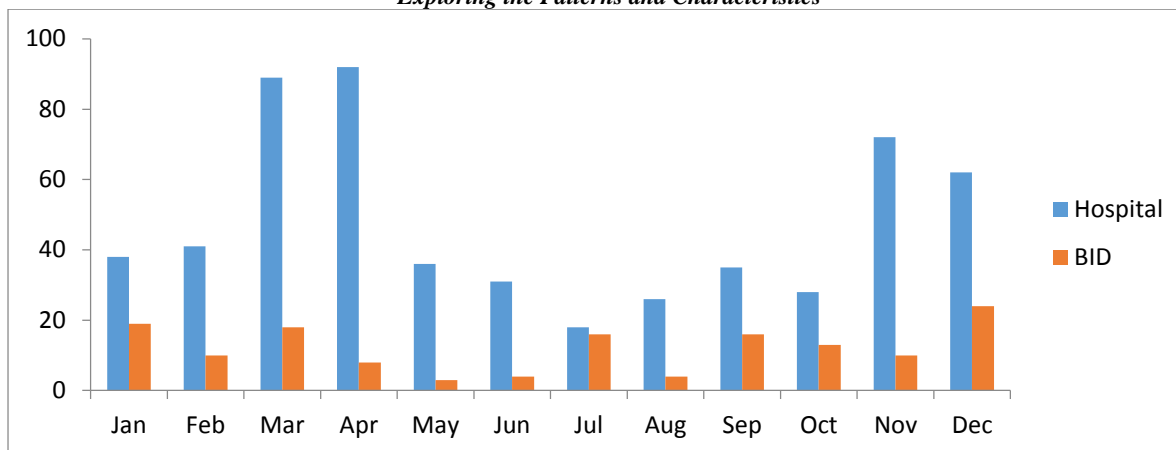


Figure 3: Distribution of Death Types by Month

Table 4: Distribution of Death Types by Address

Address	Type of Death		Total
	Hospital	BID	
Within The Metropolis	568	111	679
Outside Metropolis	0	34	34
Total	568	145	713

BID = Brought-In Dead

Table 5: Distribution of Death Types by Occupation

Occupation	Type of Death		Total
	Hospital	BID	
Civil Servant	114	44	158
Farmer	35	1	36
House Wife	175	15	190
Business	59	23	82
Security Personnel	13	18	31
Handwork	16	4	20
Others	156	40	196
Total	568	145	713

BID = Brought-In Dead

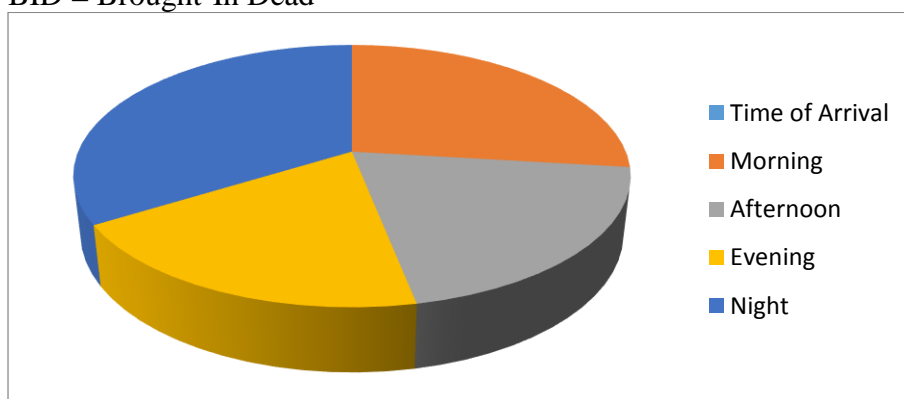


Figure 4: Distribution of BID Deaths by Time of Arrival

DISCUSSION

The patterns and characteristics of mortality in Northeastern Nigeria have significant implications for public health interventions and policies aimed at reducing death rates in the area. This research delved into mortality data collected from the University of Maiduguri Teaching Hospital to gain insights into factors associated with death, clinical conditions, demographic factors, and the timing of mortality.

The distribution of the types of death in the study period indicated that the majority of deaths were categorized as hospital deaths (79.7%), in contrast to brought-in-dead cases (20.3%). This observation aligns with similar findings in a systematic review and meta-analysis conducted by Claudia *et al.* (2015), which concluded that "the majority of global deaths occur within hospital settings." An English study by Campbell *et al.* (2013) also reported that "about 60% of deaths occur in hospitals." The discrepancy in these percentages may largely be attributed to factors such as the absence of basic nursing care, misdiagnosis, delayed investigations and treatment or a lack thereof, prescription errors, non-treatment decisions, misuse of the Mental Capacity Act, such as fluid and nutrition withdrawal leading to patient death from dehydration, hospital-acquired infections/superbugs, surgical errors, undiagnosed Sepsis, etc. (Clare, 2020).

The distribution of hospital deaths and brought-in-dead cases by gender revealed a slightly higher proportion of male deaths (54.1%) compared to female deaths (45.9%), with a male-to-female ratio of approximately 1.2:1. This observation corresponds with studies conducted in Lagos University Teaching Hospital, Nigeria (Olusegun-Joseph *et al.*, 2021), as well as in other countries like Korea (Ryoung-Eun *et al.*, 2023). The higher occurrence of male deaths could be attributed to various factors, including occupational hazards, risky behaviors, and gender-based disparities in healthcare-seeking behavior.

Analyzing the distribution of hospital deaths

and brought-in-dead cases across different age groups revealed variations in mortality patterns. The study noted the highest frequency of hospital deaths in the age group of 30-39 years, which aligns with the 2023 WHO report indicating that "survival chances for adolescents and young adults vary greatly worldwide, with the likelihood of death among young adults being highest in sub-Saharan Africa and lowest in Europe and Northern America." Factors contributing to this include road traffic accidents, drowning, violence, lifestyle factors (malnutrition, alcohol, tobacco, and drug use), mental health issues, communicable diseases (HIV, tuberculosis, and other infectious diseases), early pregnancy and childbirth, environmental health, and physical activity (WHO, 2023). In contrast, the age groups of 50-59 and 60-69 years had the highest frequency of brought-in-dead cases. This outcome is consistent with the findings of a study in Ghana-West Africa that reported that "the majority of brought-in-dead cases (20.7%) were individuals around 70 years of age" (Verner *et al.*, 2014). The increased vulnerability of older individuals to various health conditions and limited access to healthcare services may contribute to higher mortality rates in these age groups.

The distribution of associated clinical conditions with hospital deaths and brought-in-dead cases provided insights into the prevalent health conditions leading to death in Northeastern Nigeria. Chronic kidney disease (CKD) emerged as the most frequent known clinical condition associated with hospital deaths, corroborating the findings of a study in Ibadan, Nigeria, which reported that "Access to renal replacement therapy (RRT) in Nigeria is limited despite the high prevalence of Chronic Kidney Disease, and mortality rates are very high, ranging up to 50%" (Odubanjo *et al.*, 2011). Additionally, Monica identified cardiopulmonary arrest as the leading cause of sudden death associated with brought-in-dead cases (Monica *et al.*, 2023) and also as the most common systemic cause of mortality (Obiorah, 2020).

Hence, strengthening preventive measures and the management of these prevalent health conditions could contribute significantly to reducing mortality rates in the region.

The relationship between clinical conditions and age groups reveals variances in the prevalence of distinct clinical conditions across various age categories. Among individuals aged 0-9 years, congenital diseases were notably the most common clinical condition linked to mortality. However, for all other age groups, chronic kidney disease (CKD) emerged as the predominant clinical condition associated with death. The higher incidence of congenital diseases among children aligns with the global pattern of childhood mortality, where congenital anomalies stand as a leading cause of death within this age group (Liu *et al.*, 2015). It is paramount to prioritize early detection, appropriate management, and access to specialized care for children with congenital diseases to mitigate mortality rates.

The elevated prevalence of chronic kidney disease (CKD) as the primary clinical condition associated with mortality in other age groups parallels the worldwide burden of kidney diseases. CKD is a progressive ailment that affects individuals spanning various age brackets, and its global prevalence is on the rise (Hill *et al.*, 2016). Studies conducted in Lagos, Nigeria, have also identified the dire prognosis for CKD patients in Nigeria, characterized by substantial morbidity and premature deaths (Monica and Erhabor, 2023). Effective management strategies, encompassing early detection, regular screening, and access to appropriate treatment options, are pivotal in mitigating the burden of CKD-related mortality.

The examination of death types and the total number of deaths classified by month unveils variations in mortality patterns throughout the year. The study noted a heightened rate of hospital deaths in April. Although there is a scarcity of data from Nigeria concerning death and seasonal fluctuations, this trend aligns with a

somewhat analogous study conducted in the Department of Paediatrics at the University of Port-Harcourt Teaching Hospital in Port-Harcourt, Nigeria. The study found that "most deaths occurred between April and September" (George *et al.*, 2009). Diverse factors such as climate, infectious disease outbreaks, and behavioral patterns might contribute to these fluctuations. Notably, the highest frequency of brought-in-dead cases was observed in December. This finding could be attributed to the festive nature of the season, including weddings, increased travel activities, and a surge in road traffic accidents. Insurgent attacks on roads leading to Maiduguri city also contribute to accidents during these significantly busy and potentially risky periods of heightened activity. Recognizing seasonal patterns can aid in the development of targeted interventions and resource allocation to manage and prevent excess mortality during specific months.

The distribution of death types and the total number of deaths categorized by address location underscores that the majority of deaths occur within the metropolis compared to outside areas. This finding is expected as the study was conducted at the University of Maiduguri Teaching Hospital, which serves as a tertiary referral center for the surrounding population. Similar findings have been reported in observational studies conducted in America, where urban Americans experience a higher incidence of hospital deaths compared to their rural counterparts, who have higher rates of deaths occurring outside of hospital settings (Nicole *et al.*, 2017). Verner *et al.* (2014) have also reported analogous findings from Ghana, suggesting that hospital deaths are more prevalent within urban areas, possibly due to better access to healthcare services. Nevertheless, the presence of a considerable proportion of brought-in-dead cases from outside the metropolis underscores the imperative need for improving healthcare access and emergency medical services in rural and remote areas to reduce mortality rates.

The examination of the death types categorized by occupation exposes variances in mortality patterns across different professional groups. Notably, housewives exhibited the highest frequency of hospital deaths. While we did not uncover closely similar studies from Nigeria in the available data, comparable research conducted in Port Harcourt, Nigeria, reported that "the majority (approximately 45.6%) of female mortality occurs among those in marital roles" (Ngozi *et al.*, 2017). This finding aligns with another study from Rome, which indicates that "housewives face a higher mortality risk compared to individuals with other occupations" (Paglione *et al.*, 2020). On the other hand, civil servants had the highest frequency of brought-in-dead cases. These findings shed light on the occupational hazards and vulnerabilities associated with mortality. Furthermore, these findings corroborate the report from the Nigerian government, as released by the head of civil service on January 18, 2023, which expressed concern over the increasing incidence of sudden deaths among civil servants in the country (Yemi, 2023). To reduce mortality risks, it is imperative to tailor occupational health and safety measures, including risk assessments, preventive strategies, and access to healthcare services, to address the distinct needs of various occupational groups. An examination of the number of brought-in-dead cases categorized by the time of arrival reveals that the majority of cases were received during nighttime. This finding suggests a potential gap in emergency medical services and healthcare facility accessibility during nighttime hours. Similar studies conducted in Ghana have reported that approximately 60% of brought-in-dead cases are received between 6:00 pm and 6:00 am (Verner *et al.*, 2014), underscoring the need for improved emergency medical services and healthcare access during

nighttime hours. Addressing this gap is critical to ensure timely and appropriate care for individuals facing life-threatening emergencies outside of regular working hours.

CONCLUSION

This study examined death patterns in Northeastern Nigeria using data from the University of Maiduguri Teaching Hospital, revealing variations based on multiple factors, including the type of death, demographics, clinical conditions, and other variables, underscoring the importance of enhanced healthcare access and safety measures to mitigate mortality rates, while also highlighting the need for further research and comprehensive data collection to inform public health strategies in the region.

Limitations of the Study

The study's findings, may not fully represent the entire population of Northeastern Nigeria, as it focused on hospital deaths and brought-in-dead cases based on data from the University of Maiduguri Teaching Hospital, potentially excluding deaths occurring outside the hospital or in other healthcare facilities, and the accuracy of results could be affected by the quality and completeness of the collected data.

Author's contributions

Hassan Musa Chiwar - Study concept, design and analysis.

Hayatuddeen Umar Bulama - Interpretation of data,

Umar Musa Ahmad - Drafting of the article and revising it critically

Fanta Abba Kolo - Final approval of the version to be published

Conflict of Interest:

The authors declare that there are no real or perceived conflicts of interest of any sort in relation to this manuscript and its publication.

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