

ORIGINAL ARTICLE

Magnitude and leading causes of in-hospital mortality at Aminu Kano Teaching Hospital, Kano, northern Nigeria: A 4-year prospective analysis

Zubairu Iliyasu MBBS MPH FWACP, Isa Sadeeq Abubakar MBBS FWACP, Auwal Umar Gajida MBBS FWACP

Departments of Community Medicine, Aminu Kano Teaching Hospital and Bayero University Kano, Nigeria

Abstract

Background: Population based mortality data are scarce especially in developing countries including Nigeria. Despite its limitations, hospital mortality analysis assesses the quality of health-care delivery and provides a proximate measure of mortality. We reviewed the magnitude and causes of death among in-patients in a tertiary hospital in northern Nigeria.

Methods: Analysis of mortality rate and causes of death for the period 2005-2008 (inclusive) in Aminu Kano Teaching Hospital. Causes of death were prospectively entered on a database and classified according to the International Classification of Diseases (ICD-10).

Results: Out of 51,975 patients admitted to the hospital, 4,029 of them died. This gives a mortality rate of 7.8% (95% Confidence Interval of 7.5% to 8.0%). Specifically, of the 15,484 males admitted, 2,361 died giving a mortality rate of 15.2% while of the 36,491 females admitted, 1,668 died giving a mortality rate of 4.6%. The median age for all patients that died was 32.4 years (range: less than 1 day to 101 years), but 36.1 years (range: less than 1 day to 101 years) for the male and 29.3 (range: less than 1 day to 87 years) for the female subsets. The ten most common causes of mortality were HIV/AIDS (8.3%), Septicaemia (6.8%), cerebrovascular disease (6.3%), chronic renal failure (3.9%) chronic liver disease (3.3%), diabetes mellitus (3.2), neonatal jaundice (2.9%), severe birth asphyxia (2.6%), prematurity (2.5%) and bronchopneumonia (2.4%).

Conclusion: The mortality rate and causes of death are comparable to similar centres. Regular mortality audits could identify management errors and prevent recurrence of avoidable deaths.

Key words: Mortality, causes, Teaching hospital, Kano, Nigeria

Date Accepted for Publication: 18th Dec 2009

NigerJMed 2010: 400 - 406

Copyright©2010 Nigerian Journal of Medicine

Introduction

More than half of the world's deaths pass by undocumented as to cause.¹ Whilst the appropriate focus of health services is on the care of the living, consistent and reliable cause-of-death data also constitute a crucial and major resource for health planning and prioritization, and their lack in many settings is a major concern.² Whilst richer settings have traditionally aggregated physician death certificates and autopsy data as the basis for public health reporting, in poorer circumstances alternative approaches have to be used. Over the last 25 years, these strategies have often involved so-called "verbal autopsy" (VA) interviewing relatives and witnesses of deaths and interpreting the interview material to arrive at cause(s) of death.³ However, this approach makes large demands on limited resources, especially, physician's time.⁴

Hospital mortality reviews have been used to assess quality of care since the 19th century.⁵ Wide variations in such mortality rates have been a consistent finding. Some of these may be due to differences in case mix of patients being treated. However, much remains unexplained and may reflect variation in quality of care.⁶ The latter provides critical input to quality improvement programs. Unfortunately, in many developing countries including Nigeria, periodic hospital mortality reviews are not yet routine despite the fact that civil registration systems are either not in place or are non-functional. In such countries, hospital mortality statistics remain the main source of diagnostic description of mortality and morbidity despite its recognized limitations. When accurately generated, it gives some insight into the leading causes of death among the populace that utilizes the hospital services. In addition, analysis of hospital statistics with realistic assumptions and careful circumspection of its distortions brings forth useful inputs for formulating strategies and setting up priorities not only for internal management of the hospital but also in organizing effective health care for the catchment community.

Hospital mortality reports from Nigeria have been limited. Some of these review include; the analysis of causes of death at Ahmadu Bello University Teaching Hospital Zaria by Singha and colleagues between 1999 and 2001⁷, a retrospective review of mortality in Jos University Teaching hospital from 1995-1999⁸ by Mandong et. al and a review of mortality in the medical wards of the University College Hospital from 1960 to 1973 by Adetuyibi and others.⁹ At our center Mahmud and colleagues reported on the mortality rate in medical wards and among HIV/AIDS patients.^{10,11} However, no hospital wide report of mortality among in-patients in our hospital has been reported. Therefore, the objectives of this study were to assess mortality rates and leading causes of death in the hospital and its various wards/units. Such periodic analysis of mortality data could provide useful information for assessing the quality of health care delivery at this centre and also provide a proximate measure of mortality and main causes of death among those who utilize the centre.

Methods

Established in 1988, the Aminu Kano Teaching Hospital commenced clinical services in 1994 at a temporary site in Murtala Mohammed Specialist Hospital, Kano and later moved to the permanent site in 1997. Situated in Kano, the largest commercial nerve centre of northern Nigeria with over 9 million people,¹² this 500-bed hospital receives patients from within Kano, the neighbouring states of Jigawa, Katsina, Kaduna, Bauchi and Zamfara states. The majority of patients are indigenous Hausa Fulani, although the Ibo and Yoruba ethnic groups are also well represented. Most of the people are farmers, traders, businessmen and civil servants.

This was a hospital-based study that analysed prospectively collected data on the causes of death among in-patients who were treated in Aminu Kano Teaching Hospital, during the four years starting on 1st January 2005 and ending on 31st December 2008. The last physician in attendance certifies the patient dead and completes both the international form of death certificate as recommended by the World Health Organization (WHO)¹³ and a specially designed hospital mortality form. When the cause of death is not clear the deceased is referred for autopsy. However, consent is required from the relatives of the deceased before the conduct of autopsies.

Data source and measurements

A data entry clerk collects all mortality forms and prospectively enters the data on an electronic database in

the Epidemiology unit of the Department of Community Medicine in the same hospital. Information includes demographics, medical specialty involved in the care of the patient, underlying cause of death, dates of admission and death. The causes of death were coded according to the International Classification of Diseases, 10th Revision (ICD-10).¹⁴ When more than one cause of death was stated, the proper sequence of the underlying cause was selected. The underlying cause of death was the disease or injury that initiated the train of morbid events leading directly to death, or the circumstances of the accident or violence that produced the fatal injury.¹³ The Institutional ethics committee of Aminu Kano Teaching Hospital approved this study.

Data analysis

All statistical analyses were performed using the Statistical Package for the Social Sciences version 15 (SPSS, Chicago, Illinois, USA).¹⁵ A mortality rate for the 4-year period with a 95% confidence interval was calculated. Similarly, annual mortality rates were also obtained to determine significant variation in trend over the study period. This was tested using χ^2_{trend} . The proportional mortality ratio (PMR), which measures the relative magnitude of the frequency of a cause over the overall mortality, was used to rank the causes of death. The reliability of the diagnostic conditions were assessed by comparing the number of deaths recorded in ward registers with the number of patients whose mortality forms were filled by the certifying physicians. The proportion of deaths whose underlying cause is unknown or ill defined indirectly gives the quality of the data. The χ^2 test was used to compare mortality rates between males and females. A $P < 0.05$ was considered statistically significant.

Results

Over the four-year period, 4,029 patients out of 51,975 admitted to Aminu Kano Teaching Hospital died. This gives an overall hospital mortality rate of 7.8% (95% Confidence Interval of 7.5% to 8.0%). Of the 15,484 males admitted, 2,361 died giving a mortality rate of 15.2%. In contrast, of the 36,491 females admitted, 1,668 died giving a significantly lower mortality rate of 4.6% [OR=3.8, 95%CI 3.5-4.0] ($\chi^2=1731.6$, $P < 0.001$). The median age for all patients that died was 32.4 years (range: less than 1 day to 101 years), but 36.1 years (range: less than 1 day to 101 years) for the male and 29.3 (range: less than 1 day to 87 years) for the female subsets. As to the ages at death, 959 (23.8%) of the

deceased were under five years of age, 1,441 (35.7%) were over 45 years old, while 823 (20.4%) of the deceased were 60 years or older. The gender and age distribution of those that died are shown in Table I.

Leading causes of death

From Table II, which covers the entire period reviewed, conditions which emerged as the top ten leading causes of death in Aminu Kano Teaching Hospital are given from the first to the tenth order based on PMR. It can be seen that HIV/AIDS [B23.8] (n=307, 8.3%), septicaemia [A41.9] (n=249, 6.8%), cerebrovascular disease [I51.6] (n=234, 6.3%), chronic renal failure [N18] (n=140, 3.9%) and chronic liver disease [K76.9] (n=122, 3.3%) were the top five in descending order. They are followed by diabetes mellitus [E14], neonatal jaundice [P59.9], severe birth asphyxia [P21.9], prematurity [P07.0] and bronchopneumonia [J18.0]. The ten causes are made up of six communicable and four non-communicable diseases. The last four causes were mostly neonatal (prematurity, neonatal jaundice and severe asphyxia) or paediatric (bronchopneumonia) conditions. Over 40% of the deaths that occurred in the hospital are accounted for by these ten conditions.

Table I: Gender and age distribution of deceased in-patients at Aminu Kano Teaching Hospital, Kano, 2005-2008

Age group	Frequency No.(%)		
	Males	Females	Total
0-4	578(24.5)	381(22.8)	959(23.8)
5-9	79(3.3)	52(3.1)	131(3.3)
10-14	64(2.7)	37(2.2)	101(2.5)
15-19	73(3.1)	34(2.0)	107(2.7)
20-24	74(3.1)	103(6.2)	177(4.4)
25-29	127(5.4)	101(6.1)	228(5.7)
30-34	113(4.8)	89(5.3)	202(5.0)
35-39	141(6.0)	118(7.1)	259(6.4)
40-44	172(7.3)	107(6.4)	279(6.9)
45-49	165(7.0)	98(5.9)	263(6.5)
50-54	92(3.9)	67(4.0)	159(3.9)
55-59	127(5.4)	69(4.1)	196(4.9)
60-64	119(5.0)	81(4.9)	200(5.0)
65-69	111(4.7)	70(4.2)	181(4.5)
70-74	107(4.5)	68(4.1)	175(4.3)
75-79	72(3.0)	45(2.7)	117(2.9)
80-84	49(2.1)	41(2.5)	90(2.2)
e85	36(1.5)	24(1.4)	60(1.5)
Missing	62(2.6)	83(5.0)	145(3.6)
Total	2,361(100.0)	1,668(100.0)	4,029(100.0)

Table II: Leading causes of death among in-patients in Aminu Kano Teaching Hospital, Kano, 2005-2008

Rank	ICD 10 Code	Underlying cause of death	No.	*PMR(%)
1 st	B23.8	HIV/AIDS	307	8.3
2 nd	A41.9	Septicaemia	249	6.8
3 rd	I51.6	Cerebrovascular disease	234	6.3
4 th	N18	Chronic renal failure	140	3.9
5 th	K76.9	Chronic liver disease	122	3.3
6 th	E14	Diabetes mellitus	121	3.2
7 th	P59.9	Neonatal Jaundice	104	2.9
8 th	P21.9	Severe birth asphyxia	94	2.6
9 th	P07.0	Prematurity	93	2.5
10 th	J18.0	Bronchopneumonia	91	2.4

*PMR(%): Proportional mortality ratio percent

Table III: Leading causes of mortality in the different units/wards of Aminu Kano Teaching Hospital 2005-2008

WARDS/UNITS	Top three causes of death No.(PMR%)		
	1 st	2 nd	3 rd
Male Medical (n=787)	HIV/AIDS 137(17.4)	Cerebrovascular disease 84 (10.7)	Chronic Liver Disease 41(5.2)
Female Medical (n=386)	HIV/AIDS 65(16.8)	Cerebrovascular disease 61(15.8)	Chronic renal failure 41(10.6)
Male Surgical (n=201)	Cancer of the urinary bladder 37(18.4)	Typoid perforation 21(10.4)	Cancer of the prostate 12(6.0)
Female Surgical (n=101)	Breast cancer 17(16.8)	Head injury 13(12.9)	Colorectal cancer 8(7.9)
Paediatric Medical (n=218)	Protein Energy Malnutrition 18(8.3)	Disseminated tuberculosis 17(7.8)	Retinoblastoma 12(5.5)
Paediatric Surgical (n=52)	Typoid perforation 7(13.5)	Influenzae infection 5(9.6)	Hirschsprung disease 3(5.8)
Gynaecology (n=102)	Cancer of the uterine cervix 21(20.6)	Ovarian cancer 8(7.8)	Septic abortion 4(3.9)
Labour (n=51)	Eclampsia 28(56.9)	Severe pre-eclampsia 13(25.5)	Diabetes mellitus 4(7.8)
Postnatal (n=43)	Eclampsia 5(11.6)	Puerperal sepsis 4(9.3)	Severe anaemia 4(9.3)
Accident & Emergency (n=725)	Cerebrovascular disease 53(7.3)	Road Traffic Accident 37(5.1)	Diabetes Mellitus 32(4.4)
Emergency Paediatric (n=564)	Septicaemia 61(10.8)	Diarhoeal disease 38(6.4)	Bronchopneumonia 29(5.1)
Special Care Baby unit (n=658)	Neonatal sepsis 124(18.8)	Severe Birth Asphyxia 93(14.1)	Prematurity 72(10.9)
Intensive Care (n=95)	Head injury 13(13.7)	Tetanus 9(9.5)	Burns 7(7.4)
Male Surgical Speciality	Head injury 3(27.3)	Nasopharyngeal carcinoma	Cancer of the oesophagus 1(9.1)

Table IV: Mortality rate (%) of admissions in different wards/units of Aminu Kano Teaching Hospital, 2005-2008

WARDS/UNITS	2005		2006		2007		2008		2005-2008
	Deaths	MR(%)	Deaths	MR(%)	Deaths	MR(%)	Deaths	MR(%)	
Male Medical	177	(23)	223	(28)	205	(26)	182	(22)	P>0.05 787 (25)
Female Medical	75	(17)	101	(22)	87	(19)	123	(21)	P>0.05 386 (20)
Male Surgical	39	(8)	48	(11)	51	(13)	63	(14)	*P=0.003 201 (11)
Female Surgical	22	(6)	34	(11)	21	(6)	24	(10)	P>0.05 101 (9)
Paediatric Medical	30	(7)	63	(13)	62	(11)	63	(8)	P>0.05 218 (10)
Paediatric Surgical	5	(8)	30	(10)	8	(4)	9	(3)	*P=0.001 52 (6)
Gynaecology	15	(4)	18	(3)	29	(4)	40	(4)	P>0.05 102 (4)
Labour*	8	(4)	21	(9)	15	(5)	7	(2)	*P=0.01 51 (5)
Postnatal*	7	(3)	12	(5)	11	(7)	13	(6)	P>0.05 43 (5)
Accident & Emergency	110	(4)	239	(9)	232	(9)	144	(8)	*P<0.001 725 (8)
Emergency Paediatric	77	(10)	142	(16)	152	(15)	193	(13)	P>0.05 564 (13)
Special Care Baby unit	88	(16)	189	(26)	184	(21)	197	(17)	P>0.05 658 (20)
Intensive Care	2	(4)	17	(27)	30	(38)	46	(42)	*P<0.001 95 (31)
Male Surgical Speciality	NA	NA	NA	NA	6	(3)	5	(2)	- 11 (2)
Female Surgical Speciality	NA	NA	NA	NA	13	(3)	22	(4)	- 35 (4)
TOTAL	655	(6)	1,137	(9)	1,106	(9)	1,131	(7)	P>0.05 4,029 (8)

MR%=Mortality rate percent *Per 1000 deliveries
NA=Not Applicable-Unit not in operation during period *Significant trend

Causes of death in the different wards/units of the hospital

For the period reviewed, the top three causes of mortality in the wards of the hospital are shown in table III. Apart from the ones shown, other common causes of mortality in the male medical ward were chronic renal failure (n=36, 4.6%), primary liver cell carcinoma (n=29,

3.7%) and diabetes mellitus (n=28, 3.6%). Similarly, in the female medical ward other causes include hypertension (n=28, 7.3%), diabetes mellitus (n=21, 5.4%) and chronic liver disease (n=7, 1.8%). In the male surgical ward, the other causes of mortality include cancer of the colon (n=6, 3.0%) and head injury (n=4, 2%) while in the female surgical ward other causes include burns (n=7, 6.9%) and complications of diabetes mellitus (n=5, 4.9%). In the paediatric surgical ward other causes of death were acute volvulus (n=2, 2.1%) and meningomyelocele (n=2, 2.1%). In the paediatric medical wards other causes of mortality include sickle cell anaemia (n=8, 3.7%), measles (n=7, 3.2%) and non-Hodgkin's lymphoma (n=3, 1.4%). Furthermore, in the special care baby unit, the other causes were congenital anomalies (n=6, 0.9%) and neonatal tetanus (n=5, 0.8%), while in the emergency paediatric unit other causes include HIV/AIDS (n=28, 5.0%) and severe malaria (n=21, 3.7%). In gynaecological ward, additional causes of mortality include choriocarcinoma (n=4, 3.9%), hepatitis in pregnancy (n=3, 2.9%) and ruptured ectopic gestation (n=1, 0.9%) while in the labour and postnatal wards other causes of death were abruptio placentae (n=3, 5.9%), amniotic fluid embolism (n=1, 2%) and peripartum cardiac failure (n=1, 2%). In the intensive care unit additional causes of death include hypertensive heart failure (n=3, 3.2%) acute myocardial infarction (n=2, 2.1%) and end stage renal disease-post transplant (n=2, 2.1%).

Mortality rates and trend in different wards/units of the hospital

Table IV shows the distribution of deaths per total admissions in the different units/ward of the hospital. It can be seen that the mortality rate was highest in the intensive care unit (n=95, 31%), followed by male medical ward (n=787, 25%), female medical (n=386, 20%) and special care baby units (n=658, 20%) respectively. The lowest mortality rates were seen in labour and postnatal wards with 5 deaths per 1,000 deliveries each. Furthermore, the accident and emergency unit and the emergency paediatric units contributed substantially in the absolute number of deaths, however, these were diluted by the higher patient turn over in these units.

The mortality trend in the hospital rose from 6% in 2005 to 9% during 2006 and 2007 and then dropped to 7% in 2008. This trend was not statistically significant ($X^2_{trend}=2.1$, $P=0.14$). However, there were statistically significant rise in mortality rates in the intensive care unit ($X^2_{trend}=24.3$, $P<0.001$), accident and emergency unit ($X^2_{trend}=24.6$, $P<0.001$) and the male surgical ward ($X^2_{trend}=8.7$, $P=0.003$). In contrast, there was a significant decline in mortality in the paediatric surgical ward

($X^2_{trend}=10.4$, $P=0.001$) and the labour ward ($X^2_{trend}=6.1$, $P=0.01$). All other wards maintained a fairly stable mortality rate over the period ($P>0.05$). The annual proportion of undefined causes of death was 1.3%, 1.7%, 0.8% and 1.1% for the years 2005 through 2008. Unfortunately, consent for autopsy is rarely given due to socio-cultural and religious factors. Therefore, the causes of death in these patients remained largely unknown.

Discussion

This study found a mortality rate of 7.8% among in-patients over the four year period. This rate is higher than that reported from Jos University Teaching Hospital, Nigeria (5.7%)⁸, Algericas hospital, Spain (4.1%)¹⁶ and Nikaias Piraeus hospital in Greece (3.4%).¹⁷ These differences could be due to variations in the demographic structure of the catchment populations, selection of high risk cases and late presentation of patients in our centre in addition to differences in quality of care. The significantly higher mortality rate among males compared to females at our center is similar to observations from medical wards in other Nigerian teaching hospital located in Ilorin¹⁸ and Kaduna.¹⁹ This disparity could be partly explained by the fewer number of male patients seen compared to females and additional admissions for maternal conditions which also carry better prognosis compared to indications for male admissions. Furthermore, researchers have been puzzled by the mechanism that could underlie profound gender difference in mortality.²⁰ Apart from genetic, hormonal and lifestyle factors, recent findings suggest a key role of physiological stress responses, i.e. how men and women respond differently to psychosocial stressors in every day life.²¹ The low median age (32.4 years) of deceased patients seen in this series could be a reflection of the demographic characteristics of our catchment population and the low average life expectancy.²²

The leading causes of death among in-patients at our center were HIV/AIDS (8.3%), septicaemia (6.8%), cerebrovascular disease (6.3%), chronic renal failure (3.9%) and chronic liver disease (3.3%). Some of these causes are similar to the ones reported by Singha and colleagues in Zaria⁷, Nigeria where they found Road transport accident (14.3%), septicaemia (5.2%), protein energy malnutrition (5.1%), HIV infection (4.7%), diarrhoeal disease (4.3%) as the leading causes of death among in-patients in Ahmadu Bello University Teaching Hospital Zaria, Nigeria. The low contribution of Road traffic accidents in our study may not be

unconnected with the referral of cases with fracture to the National Orthopaedic hospital, Dala, located in the same city. Our findings also share some similarities with the in-hospital mortality in Alwwahda Hospital, Derna, Libya²³ except for the preponderance of HIV/AIDS at our centre. The later study showed that the leading causes of death were cardiovascular diseases (36.1%), followed by stroke and cerebrovascular disease (18.2%), accidental injuries (7.9%), cancers (7.7%) and renal diseases (7.2%). Even in the two European hospitals cited earlier^{16,17}, there were some similarities in the leading causes of death with our center, where for instance, in the Nikaias Piraeus Hospital, Greece¹⁶ the leading causes were cerebrovascular diseases (15.8%), ischaemic heart disease (10.3%), cardiac failure (7.9%), diseases of the digestive system (6.7%) and diabetes mellitus (6.6%). Similarly, in Algericas hospital, Spain¹⁷, the leading causes of death were cerebrovascular disease, HIV/AIDS, bronchial and lung neoplasias, acute myocardial infarction and chronic obstructive pulmonary disease. In the USA²⁴, the leading causes of death in 1996 were heart diseases, malignant neoplasms, cerebrovascular disease and chronic lower respiratory diseases. Others include accidents, diabetes mellitus, influenza and pneumonia, Alzheimer's disease, HIV/AIDS and intentional self-harm (suicide). These variations could be due to socio-demographic, industrialization and lifestyle factors in addition to differences in health seeking behaviour and quality of health care.

The highest mortality rates seen in the intensive care unit and medical wards in the present study concur with earlier reports from Jos University Teaching hospital,⁸ Nigeria where medical wards contributed 71.5% of all in-hospital mortality. The mortality rates in the medical wards are also comparable with earlier figures of 25.3% and 23.9% reported from our center¹⁰ and Ilorin University Teaching Hospital, Nigeria

respectively.¹⁸ In contrast, our mortality experience is much higher than the rate (11.2%) obtained by Garko et al¹⁹ in similar wards of Ahmadu Bello University Teaching Hospital, Kaduna, Nigeria. The report from Greece also showed that the highest death rates occurred in the intensive care unit (23.3%), general medicine (10.7%), cardiology (6.5%) and nephrology (5.5%).¹⁶ This level of mortality could be due to the high risk nature of their patients²⁵, while the medical cases referred to teaching hospitals are mostly those with terminal illness, end organ failure, HIV/AIDS or other diseases with poor prognosis. The level of poverty among our catchment population deters early seeking of specialist care. These facilities are therefore used as a last resort when all else has failed

thereby contributing to the poor outcome. The variations in mortality between wards/units could be due to differences in the risk status, socio-demographic characteristics and disease prognosis in addition to variations in quality of care. Similarly, the variations between centers may be explained by differences in catchment population, case load, case selection and quality of care.

This study observed that HIV/AIDS, cerebrovascular disease, chronic renal failure, diabetes mellitus and chronic liver disease are the commonest causes of death in the medical wards. This concurs with an earlier report from our center where Mahmud et al¹⁰ identified cerebrovascular disease (17.0%), HIV/AIDS (13.6%), chronic renal failure (12.5%) as the leading causes of death in these wards. It also concurs with the findings from Jos University Teaching Hospital, Nigeria⁸ where HIV/AIDS (23.3%), chronic liver disease (20.0%), neoplasia (19.6%) and cardiovascular disease (18.2%) were the leading causes of death. Similarly, in Ilorin University Teaching hospital, Nigeria,¹⁹ the commonest causes of mortality in the medical wards were infectious diseases (35.6%) including septicaemia, tuberculosis, HIV/AIDS; diseases affecting the nervous system (13.2%), gastrointestinal system and liver (11.3%) and cardiovascular system (8.6%). In Port Harcourt, Nigeria, Onwuchekwa et. al²⁶ reported that cerebrovascular disease (24.5%) and HIV/AIDS (22.7%) were the leading causes of mortality among patients admitted to their medical emergency unit. In an earlier study in the medical ward of the University College Hospital Ibadan, southwest Nigeria,⁹ most of the deaths resulted from cardiovascular diseases especially hypertension.

The leading causes of death among male surgical patients-cancer of the urinary bladder, typhoid perforation and cancer of the prostate. In contrast, female surgical patients died mainly from cancer of the breast, head injury and colorectal cancer. Gynaecological deaths were mainly due to cancers of the cervix and ovary and septic abortion. This is similar to the findings reported by Gharoro and others in Benin city, Nigeria.²⁹ Like in some other Nigerian hospitals,^{30,31} eclampsia took a high toll of maternal deaths at this center. Other causes of maternal deaths include severe pre-eclampsia, puerperal sepsis and severe anaemia, while neonatal sepsis, birth asphyxia and prematurity top the list among neonates as earlier reported from our center.³² Paediatric surgical deaths were due to typhoid perforation, intussusception and hirschsprung's disease. These causes are also common in Zaria³³, Ife³⁴

and Owo³⁵, all in Nigeria. It is however, at variance with the common causes of mortality among Gambian children³⁶ who died mostly from burns, congenital anomalies and other injuries. Deaths in the paediatric medical and emergency paediatric units were respectively dominated by protein energy malnutrition, tuberculosis, septicaemia, bronchopneumonia and diarrhoeal disease largely similar to reports from other Nigerian hospitals located in Abakaliki³⁷ and Zaria.³⁸ Causes of mortality in the accident and emergency unit were cerebrovascular diseases, RTA and diabetes mellitus. This concurs with the experience among medical emergencies in Port Harcourt²⁶, while in the ICU head injury, tetanus and burns predominate. The significant rise in mortality rates in the ICU, Accident and Emergency and the male surgical ward call for regular mortality audits. This will identify gaps in management and recommend measures to reduce avoidable deaths to the barest minimum. The challenge of effective joint management of patients admitted to the different wards and most especially, the intensive care unit need to be addressed.

The limitations of this study include variation in the skills and experiences of certifying doctors. Some of the inaccuracies associated with the identification of the causes of death may be related to diagnostic errors⁵, to errors in completing the death certificates/mortality forms⁶, as well as to errors with respect to the coding process. The low level of autopsies due to socio-cultural factors may also increase the proportion of patients whose cause of death remains unknown. Similarly, the extrapolation of hospital mortality statistics needs to be done with caution due to recognized selection bias.

Conclusion

From this study, it can be seen that as we continue to deal with the challenges of communicable diseases especially HIV/AIDS and neonatal conditions, non-communicable diseases (NCDs) such as cerebrovascular disease, diabetes mellitus and hypertension are emerging as serious public health problems-the so called epidemiologic transition. This concurs with the WHO report on chronic diseases that indicate that, communicable diseases, maternal and perinatal conditions, and nutritional deficiencies will still be the leading causes of death in Nigeria in 2015 but deaths from chronic diseases are not far behind.⁷ In essence, chronic

diseases have not displaced acute and infectious diseases; rather there is an ongoing double burden of disease in our catchment population. The Nigerian Federal Ministry of Health has recognized the increasing prevalence of chronic diseases in the country and now has as part of its vision "to reverse the increasing prevalence of non-communicable diseases."²⁸

Many of the leading causes of death in our center are preventable or curable when managed optimally. It is therefore imperative for departments to conduct mortality meetings during which review of management could identify errors in management thereby preventing future recurrence. This could reduce the case fatality rates from the different conditions. Understandably the prognosis of some diagnostic categories such as cancers is poor, especially among patients in our catchment populations due to several factors; late presentation and hence late stage at diagnosis, low uptake of cancer screening services such as cancer of the cervix, breast self examination, mammography among females and screening for cancer of the prostate among males. Community based programmes are rudimentary even for highly effective screening tests such as Pap smear while the prostate screening at community level is unheard of here. It is therefore essential that these screening services are scaled up to reach the rural poor who may benefit most from these services. A major challenge that needs to be addressed is the level of poverty, which prevents early presentation for specialist care. Comprehensive health insurance coverage for those outside the formal sector will address this. Another challenge that needs to be addressed is the near loss of confidence in the lower levels of care leading to overcrowding of the teaching hospitals with patients, whose problems could be handled at the primary and secondary health care levels, thereby diluting the quality of care that is offered to those in need of specialist tertiary care at the teaching hospital.

Acknowledgement

The authors are grateful to Surajo Tafida Kazaure, the health records and statistical officer who was responsible for collection of the mortality forms, data entry and maintenance of the database at the Epidemiology Unit.

References

1. Mathers CD, MaFat D, Inoue M, Rao C, Lopez AD. Counting the dead and what they died from: an assessment of the global status of cause of death data. *Bull World Health Organ* 2005; 83:171177.

2. Murray CJL, Lopez AD, Feehan DM, Peter ST, Yang G. Validation of the symptom pattern method for analyzing verbal autopsy data. *PLoS Med* 2007;4: 327-328.
3. Garenne M, Fontaine O. Assessing probable causes of deaths using a standardized questionnaire: A study in rural Senegal. *Bull World Health Organ* 2007; 84: 248-253.
4. Soleman N, Chandramohan D, Shibuya K. Verbal autopsy: Current practices and challenges. *Bull World Health Organ* 2006; 84: 239-245.
5. Wright J, Dugdale B, Hammond I, Jarman B, Neary M, Newton D, Patterson C, Russon L, Stanley P, Stephens R and Warren E. Learning from death: A hospital mortality reduction programme. *JR Soc Med* 2006; 99:303-308.
6. Jarman B, Gault S, Alves B, et al. Explaining differences in English hospital death rates using routinely collected data. *BMJ* 1999; 318:1515-1520.
7. Singha P, Dahiru T, Oyemakinde A, Sabitu K, Mande A. Cause of death statistics: Ahmadu Bello University Teaching Hospital, Zaria May 1999-December 2001. Zaria: Ahmadu Bello University Press Limited, 2003:7-10.
8. Mandong BM and Madaki AJK. Mortality in a Nigerian Teaching hospital: Experience at Jos University Teaching Hospital (JUTH) 1995-1999. *Highland Medical Research Journal* 2002;1(2):16-18.
9. Adetuyibi A, Akinsanya J. B, Onadeko B. O. Analysis of the causes of death on the medical wards of the university college hospital, Ibadan over a 14-year period (1960-1973). *Nigerian Medical Journal* 1978; 8: 28-34.
10. Sani MU, Mohammed AZ, Bappa A and Borodo MM. A three year review of mortality patterns in the medical wards of Aminu Kano Teaching Hospital, Kano, Nigeria. *Niger Postgrad Med J* 2007;14(4):347-351.
11. Sani MU, Mohammed AZ, Bappa A, Shehu MY, Adamu SA, Borodo MM. AIDS mortality in a tertiary institution-a four year review. *Journal of the National Medical Association* 2006;98(6):862-866.
12. National Population Commission. National Census 2006 Provisional figures. Federal Republic of Nigeria, 2007.
13. Kircher T, Anderson RE. Cause of death: proper completion of the death certificate. *JAMA* 1987; 258(3):349-352
14. WHO. International Classification of Diseases and related health problems. 2nd Edition, Tenth Revision. Geneva 2004:132-133.
15. SPSS for windows. Rel. 15.0.1.2007. Chicago: SPSS Inc.
16. Garcia OC, Almenara BJ, Garcia OJJ. Specific mortality rates at the Algeciras hospital during 1995-96. *Rev Esp Salud Publica* 1997;71(3):305-315.
17. Papadopoulos IN, Papaefthymiou M, Roumeliotis L, Panagopoulos VG, Stefanidou A, Kostaki A. Status and perspectives of hospital mortality in a public urban Hellenic hospital, based on a five-year review. *BMC Public Health* 2008, 8:28-29.
18. Chijioke A and Kolo PM. Mortality pattern at the Adult medical wards of a Teaching Hospital in Sub-Saharan Africa. *International Journal of Tropical Medicine* 2009; 4(3): 27-31.
19. Garko SB, Ekweani CN and Anyiam CA. Duration of hospital stay and mortality in the medical wards of Ahmadu Bello University Teaching hospital, Kaduna. *Annals of African Medicine* 2003; 2(2): 68-71.
20. Jiang SL, Ji XP, Zhao YX, Wang XR, Song ZF, Ge ZM, Guo T, Zhang C, Zhang Y. Predictors of in-hospital difference between male and female patients with acute myocardial infarction. *Am J Cardiol* 2006;98(8):1000-1003
21. Kajantie E. Physiological stress response, oestrogen, and male-female mortality gap. *Current directions in Psychological science* 2008; 17(5):348-352.
22. UNICEF. State of the world's children 2009. New York.
23. Algabsi M, Alokali M, El Shourbagy O, Wassif SM. Hospital mortality in Alwahda hospital, Derna, Libya based on a ten-year review (1997-2006). *Zagazig Journal of Occupational health and Safety* 2008; 1(2):70-86.
24. Ventura SJ, Peters KD, Martin JA, Maurer JD. Births and deaths: United States, 1996. Hyattsville, Maryland: US Department of Health and Human Services, CDC, National Center for Health Statistics. *Monthly Vital Statistics Report* 1997; 46(1):24-26
25. Petty TL, Lakshminarayan S, Sahn SA et al. Long term trends in mortality in the intensive care unit. *JAMA* 2002;287:1805
26. Onwuchekwa AC, Asekomeh EG, Iyagba AM. Medical mortality in the Accident and Emergency unit of the University of Port Harcourt Teaching Hospital. *Nig J Med* 2008;6(2):183-186
27. World Health Organization. *Preventing Chronic Disease: A Vital Investment*. World Health Organization. Geneva, Switzerland 2005:24-35
28. Federal Ministry of Health, Nigeria. Available on: http://www.nigeria.gov.ng/fed_min_health.aspx Accessed on 12th March 2009
29. Gharoro EP, Adeyemo SI. Care for the terminally ill: a review of deaths in the gynaecological wards of a tertiary institution, 1986-2000. *Niger Postgrad Med J* 2004;11(1):64-67
30. Aboyeji AP, Ijaiya MA, Fawole AA. Maternal mortality in a Nigerian teaching hospital-a continuing tragedy. *Tropical doctor* 2007;37(2):83-85
31. Ibrahim SA, Iliyasu Z, Musa J. Maternal mortality in Jos Hospital, northern Nigeria. *Trop J Obstet Gynaecol* 2006; 23(2):152-155
32. Mukhtar-Yola M and Iliyasu Z. A review of neonatal morbidity and mortality in Aminu Kano Teaching Hospital, Northern Nigeria. *Tropical Doctor* 2007;37:130-132
33. Ameh EA. Typhoid ileal perforation in children: a scourge in developing countries. *Ann Trop Paediatr* 1999;19(3):267-272
34. Ademuyiwa AO, Sowande OA, Ijaduola TK and Adejuyigbe O. Determinants of mortality in neonatal intestinal obstruction in Ife, Nigeria. *African Journal of Paediatric Surgery* 2009; 6(1): 11-13
35. Olasinde AA, Oluwadiya KS, Akinkuolie AA, Oginni LM. Paediatric surgical admissions in a tertiary hospital in western Nigeria. *The Internet Journal of Paediatrics and Neonatology* 2005;5(2):12-15
36. Bickler SW, Sanno-Duanda B. Epidemiology of paediatric surgical admissions to a government referral hospital in the Gambia. *Bull World Health Organ* 2000; 78(11):1330-1336
37. Ojukwu JU, Ogbu CN, Nnebe-Agumadu UH. Post-neonatal medical admissions into the paediatric ward of Ebonyi State University Teaching Hospital, Abakaliki; the initial experience and outcome. *Nigerian Journal of Paediatrics* 2004;31(3):79-86
38. Aikhionbare HA, Yakubu AM, Naida AM. Mortality pattern in Emergency Paediatric Unit of Ahmadu Bello University Teaching Hospital, Zaria, Nigeria. *Cent Afr J Med* 1989;35(5):393-396