ORIGINAL RESEARCH ARTICLE

TITLE: TRENDS OF IN-PATIENT MORTALITY BETWEEN 2018 AND 2019 AT KISUMU COUNTY LEVEL FOUR HOSPITAL, KENYA

ABSTRACT

Introduction: Due to a lack of information on patient mortality, healthcare planners rarely use local data for resource allocation and hospital management. This results in missed opportunities to build hospital capacity to address common causes of death, as well as a poor hospital reputation, fewer patients seeking hospital care, increased medical errors, and increased inpatient mortality.

Objective: To determine trends of hospital mortality between 2018 and 2019 at Level Four Kisumu County Hospital, Kenya.

Methods: The study was a cross sectional retrospective study design. The study targeted files of patients who died between January 2018 and December 2022. Systematic sampling was used in which every file per ward was given a serial number. Each department formed a stratum. Sample size was determined using Yamane Taro formula ($N/1+N(e^2)$ which yielded 203 as sample size from population of 680. The risk of death based on the presence or absence of doctor and nurse was analyzed by odds ratio. Chi-square was used to check association of appropriateness of facility, delay of care and distance and mortality. Variation in ward mortalities was analyzed using ANOVA to assess and data presented as line graphs.

Results: According to the current study, the medical ward had the highest 2-year in-hospital mortality rate of 13.86%, while obstetrics and gynecology (reproductive health) had the lowest mortality rate of 0.47 percent. Infections were responsible for 42% of hospital deaths in patients under the age of 35, while noncommunicable diseases were responsible for 41% of hospital deaths in patients over the age of 60. According to the study, 3% of hospital deaths could have been avoided. When a nurse and a doctor were all present, there was a significant difference in the odds of a patient dying (OR=0.697). Comorbidity was a significant risk factor for death among patients who died in 2018 and 2019 ($p=0.05$). Patient characteristics such as age, education level, and gender were not associated with hospital deaths ($p>0.05$).

Conclusion: Hospital deaths among the elderly are caused by noncommunicable diseases, while deaths among the young are caused by infectious diseases, raising the question of the

need to improve the nurse-doctor relationship in order to reduce avoidable deaths among patients admitted.
Key words: Mortality; in-hospital deaths; Avoidable deaths

Introduction

Reliable and timely specific mortality data form the basis for the allocation of health planning resources and the timely evaluation of health care interventions. Inadequate quality health care data can misrepresent local health care problems making it difficult to develop good health care policies (Sifuna et al., 2011). In-patient mortality reflects the quality of healthcare. Information on the causes and trends in hospital mortality can improve hospital care for patients. Model-based estimates of mortality trends are widely used in sub-Saharan African countries but are subject to errors due to lack of information on hospital mortality. Examining patient and hospital trends can help identify those who are on-going and those who are lagging so you can strategize to address gaps in health care quality (Mboera et al., 2018). The risk of in-hospital mortality associated with specific comorbidities is relatively higher in surgical patients compared to those without specific comorbidities but the frequency of postoperative complications is increased in elderly patients with acute trauma such as hip fracture (Ma et al., 2017; Sifuna et al., 2011). The purpose of the current study was to generate evidence that can be used by hospital management to reduce avoidable deaths and optimize resources in the hospital.

1. Objective

To determine trends of all-cause in-patient mortality between January 2018 and December 2019 at Level Four Kisumu County Hospital, Kenya

Methodology

2. Research Approach

This study utilized quantitative methods and primary and secondary data sources to achieve the research objectives.

3. Research design

This study was a cross sectional retrospective study design that involved review of records of patients who died between 2018 January 1 and 2019 December 31, at Level Four Kisumu County hospital. This design was used because the data on patients who died during the study period could only be collected in health records department. Patient file review focused on the number of deaths during the study period. The collected information was segregated in

terms of age, sex, length of stay and diagnosis at death certification. Demographic data including location of the patient was characterized as to whether the patient was a referral to hospital or not.

4. Target population

The target population in this study was records of all patients who died while receiving treatment at Kisumu County Level four hospital between January 1 2018 12 AM and December 2019 11:59PM.

5. Sampling methods

Systematic sampling and stratified sampling methods were used into order to avoid bias. In systematic sampling, all files for deceased patients who died between January 1 2018 12: 00 AM and December 31, 2019 11:59 were determined by counting (N). Files were then allocated numbers and listed in order of death occurrence per month from January 2018 to December 2019 and this constituted the sampling frame. The files were then segregated per department. After segregation per department, the files were serialized per month each year. The four departments included medical department, surgical department, pediatrics department and reproductive health department. By use of computer program, files serial numbers were picked randomly to arrive at the sample size of 203.

6. Data collection methods and procedures

In each file, information on date of admission, sex of the patient, dead of death, diagnosis on admission, diagnosis at death time, address, other pre-existing medical condition were collected and recorded. The data was then entered into SPSS version 29 for windows and coded appropriately.

7. Data analysis techniques and procedures

Data analysis was done by SPSS for windows version 29. Chi-square was used to check association between age, education level, gender, comorbidities, sepsis, hospital acquired infection and mortality. Goodness of fit was run which confirmed that the data was normally distributed thus appropriate for ANOVA which was used to assess variation in ward mortalities and data presented as line graphs.

RESULTS

Table 1: Sociodemographic characteristics

		sex		Total
		Male	Female	
Age	Below 10 years	18	16	34
	10 - 35 years	32	28	60
	36 - 59 years	38	18	56
	> 60 years	22	31	53
Total		**110**	**93**	**203**

Majority of deaths occurred between the ages of 10 and 35, 60 (29.6%), followed by 56 (27.6%) patients between the ages of 36 and 59, 53 (26.1%) patients over 60, and 34 (16.7%) patients under the age of 10. Males died more 110 (54%) than females 93 (46%). **(Table 1).** .

4.0 Trends and all-cause In-patient Mortality between January 2018 and December 2019

Table 2: Hospital admissions and trends of all-cause in-patient mortality rate per ward

Ward	Admission	Admission%	Deaths	Deaths proportion	Overall Hospital death rate (%)
Medical ward	3904	40.4%	541	79.1%	13.86%
Surgical Ward	1477	15.3%	66	9.6%	4.47%
Paediatrics ward	2373	24.6%	68	9.9%	2.87%
Obstetrics/Gyn	1907	19.7%	9	1.4%	0.47%
Total	**9661**	**100%**	**684**	**100%**	**7.08%**

The total number of patients admitted in all the wards between January 2018 and December 2019 was 9661. Medical ward admitted majority 3904 (40.4%) of patients followed by 1477 (15.3%) in surgical ward, 2373 (24.6%) in pediatric ward and 1907 (19.7%) in obstetrics ward **(Table 2).** The overall hospital 2-year mortality was 7.08% (684 deaths). Of the recorded deaths, medical ward contributed most 79% (541), followed by pediatrics 68 (9.9%), surgical 66 (9.6%), and obstetrics and gynecology 9 (1.3%). Medical ward had the highest overall hospital mortality 541 (13.86%), followed by pediatrics 68 (9.9%), surgical ward 66 (4.47%) and gynecology 9 (1.4%) **(Table 2).**

4.0.1 Monthly Mortality Rates Per ward in 2018 and 2019

In 2019, medical ward had a mean monthly mortality of 17.25, followed by pediatric and surgery with mean monthly mortality of 2.33 and 1.67 respectively**. (Table 3).** Obstetrics and gynecology recorded the least mean monthly mortality of 0.08. Compared to most deaths that occurred in 2018, medical ward had a mean monthly mortality of 27.83, followed by surgery 3.83 and pediatrics at 3.33. Obstetrics and gynecology recorded least monthly mortality in 2018. **(Table 3)**. There was significant difference between deaths in 2018 and 2019 at Kisumu County hospital. (p=<0.05).

Table 3: Mean Monthly mortality trends per Ward

Descriptive statistics									
		N	Mean	SD	SE	95% CI for Mean		Minimum	Maximum
						Lower	Upper		
Deaths in 2019	Medical Ward	12	17.25	16.821	4.856	6.56	27.94	0	46
	Pediatrics Ward	12	2.33	2.807	.810	.55	4.12	0	9
	Surgical Ward	12	1.67	2.535	.732	.06	3.28	0	8
	Obstetrics /Gynecology	12	.08	.289	.083	-.10	.27	0	1
	Total	**48**	**5.33**	**10.891**	**1.572**	**2.17**	**8.50**	**0**	**46**
Deaths in 2018	Medical Ward	12	27.83	15.514	4.479	17.98	37.69	0	57
	Pediatrics Ward	12	3.33	2.348	.678	1.84	4.83	0	7
	Surgical Ward	12	3.83	2.588	.747	2.19	5.48	0	8
	Obstetrics/Gynecology	12	.58	.515	.149	.26	.91	0	1
	Total	**48**	**8.90**	**13.524**	**1.952**	**4.97**	**12.82**	**0**	**57**

There was significant variation in ward mortality in 2018 (p <0.001, F 30.606, CI 95%, df 3) and also in 2019 (p <0.001, F 10.33, CI 95%, df 3)**.**

Mortality trends in 2018

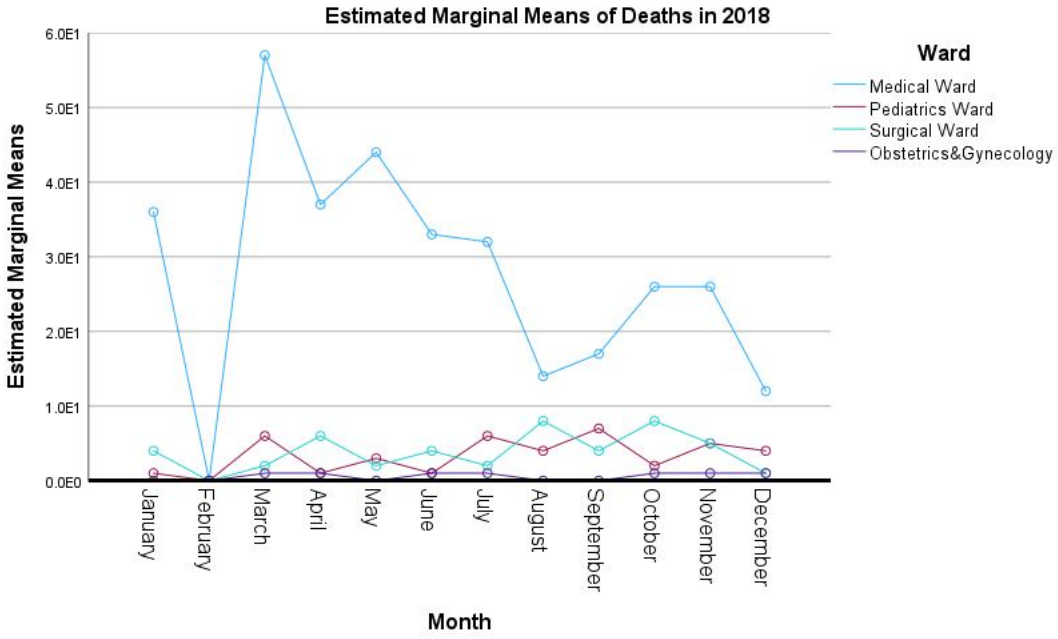

Figure 1: Mortality trends in 2018

The mortality for medical, pediatrics, surgery and obstetrics/gynecology wards were compared monthly during the year 2018. **(Figure 1).** Generally, patients died in the wards throughout the year except in February. More deaths occurred in medical ward all through the year, with a spike in deaths between February and August 2018. The trends in ward mortality are relatively lower in the surgical and pediatric wards throughout the year, with a slight spike in the number of deaths in both wards during March and April 2018 and again between August and December of the same year. The Obstetrics and Gynecology Department recorded the lowest monthly mortality of all time, with deaths recorded between March and April, June and July, and October and December 2018. The current study results may suggest that more deaths occurred during the rainy season between March and July.

Mortality trends in 2019

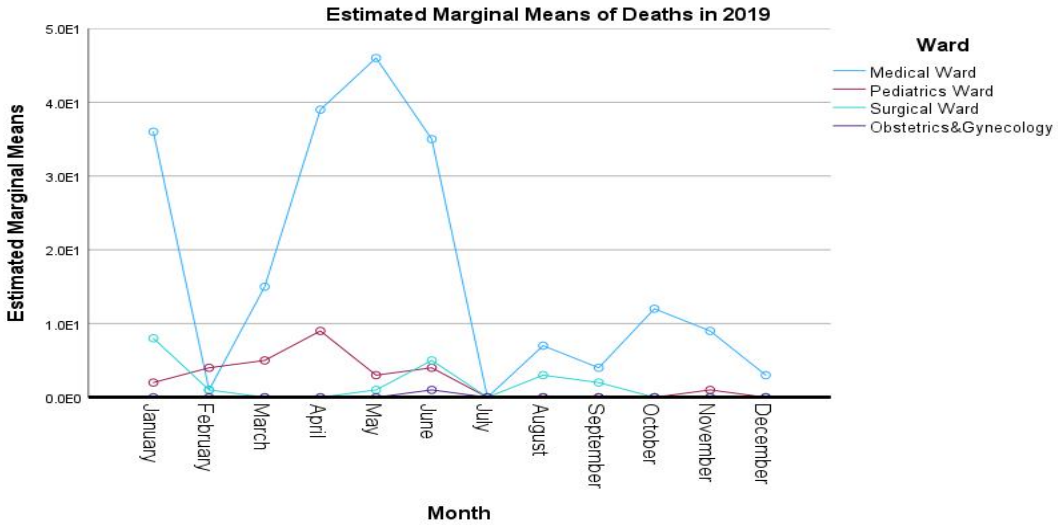

Figure 2: Mortality trends in 2019

Deaths occurred throughout the year, with the medical ward recording the highest number of deaths compared to other wards, and January had a high number of deaths, which dropped in February, and there is a sharp rise in number of deaths in February, which drops in July, and then steadily rises before sloping in December 2019. The pediatric ward had the second highest number of deaths, which shows a steady rise from January, peaks in April before sloping down in July, and maintains the low death record before slightly rising again in November 2019 and falling again in December 2019. There was a drop in mortality in the surgical ward in January, which continued through February and April before steadily rising again to reach peak in August and September. **(Figure 2).**

4.0.2 Causes of Deaths

Majority of deaths occurred due to infections 86 (42.4%) and non-communicable 85 (41.9%). Injuries from trauma and accidents accounted for least causes of deaths at 2%. Other deaths 25 (12.3%) occurred due to other diseases. Infections caused more deaths among patients aged 10 and 59 years than in patients at extreme of ages (below 10 years and more than 60 years). **(Table 4)**. There was statistically significant variation in mortalities across ages in relation to causes of death (P=0.135). However, non-communicable diseases caused more deaths among the elderly (>60 years) than in any other age group (p=2.84)

Table 4: Distribution of deaths by age category based on non-communicable diseases

		Non-Communicable Diseases				Total
		Hypertension	Diabetes Mellitus	Cancer	Other	
Age	**Below 10 years**	0	0	0	9	**9**
	10 - 35 years	1	0	2	29	**32**
	36 - 59 years	2	1	2	20	**25**
	> 60 years	6	5	7	15	**33**
Total		**9**	**6**	**11**	**73**	**99**

In relation to age specific non-communicable diseases, hypertension, diabetes mellitus and cancer were more common among the elderly (>60 years) than in any other age group. Cancer was more prevalent followed by hypertension and diabetes mellitus. Other non-communicable diseases are listed in increasing frequency. **(Table 5).** The study found that cancer, hypertension and diabetes mellitus were the leading non communicable causes of deaths.

Table 5: Other non-communicable diseases

NCD	Frequency	%
Severe anemia	**16**	21.9
Heart failure	10	13.7
Dehydration	5	6.8
Sickle cell disease	4	5.5
Stroke	4	5.5
Birth asphyxia	2	2.7
Malnutrition	2	2.7
Perforated PUD	2	2.7
RDS.	2	2.7
Appendicitis	1	1.4
Chronic kidney disease	1	1.4
Convulsive disorder	1	1.4
Hemorrhoids	1	1.4
Hepatic encephalopathy	1	1.4
Lymphoma	1	1.4
Severe burns	1	1.4
Shock	1	1.4
Others	18	24.7
	73	100

Deaths based on site of infection

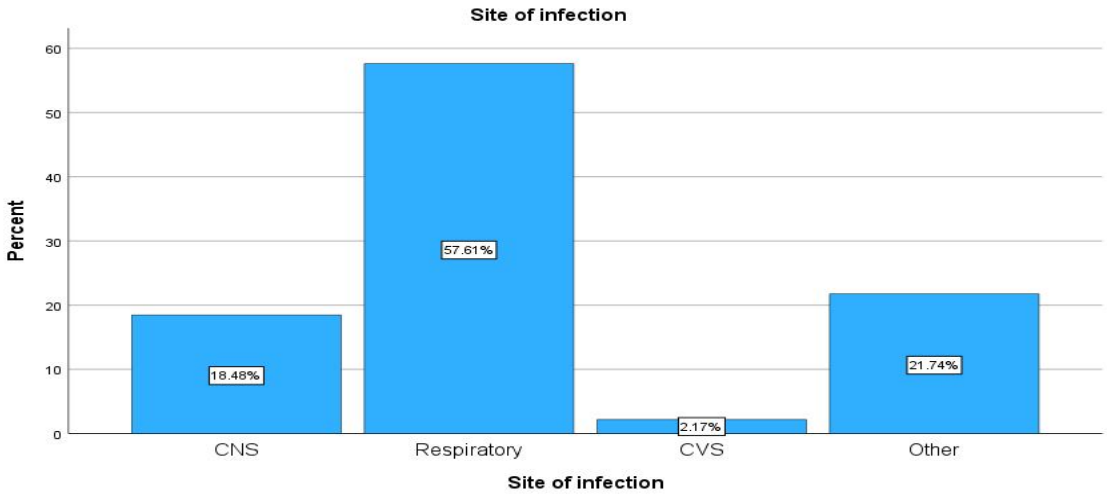

Figure 3: Site specific infection

Among patients who died due to infections, the current study found that the majority 50 (26.1%) had respiratory infections, 17 (8.4%) had CNS infections and 19 (9.4%) had other infections. **(Figure 3).**

Death category based on Specific Infection

The leading specific respiratory infection was pneumonia 22 (10.8%) and pulmonary tuberculosis 16 (7.9%). HIV/AIDs and Meningitis accounted for 9 (4.4%) and 14 (6.9%) of deaths respectively during the study period. **(Table 6)**. Pneumonia and pulmonary tuberculosis were the leading respiratory infections in the patients who died in 2018 and 2019.

Table 6: Specific infection

		HIV/AIDS	Tuberculosis	Pneumonia	Meningitis	Other	Total
Age	Below 10 years	0	2	8	3	6	19
	10 - 35 years	5	7	4	4	6	26
	36 - 59 years	4	4	2	6	10	26
	> 60 years	0	3	8	0	5	16
Total		**9**	**16**	**22**	**13**	**27**	**87**

Other infections are listed. (**Table 7)**

Table 7: Other infections

Infection	Frequency	%
Others	10	37.04
Severe malaria	4	14.81
Hepatitis	3	11.11
Septicemia	3	11.11
Encephalitis	2	7.41
Brain abscess	1	3.70
Cystitis	1	3.70
Esophageal candida	1	3.70
Gastritis	1	3.70
PJP	1	3.70
TOTAL	**27**	**100**

Discussion

According to the current study, medical ward had the highest 2-year in-hospital mortality at 13.86% while obstetrics and gynecology (reproductive health) had the least mortality at 0.47%. The current study findings may suggest that reproductive health department has better clinical supervision or a smaller number of admissions compared to other wards. The finding seems to suggest that there is need to rationalize staff allocation based on workload and technical expertise in various wards. The current study found that most patients died between February and August of each year of the study period. This could be an indication that rainy season contributed to delays in seeking care (Barnes-Josiah et al., 1998), it could also mean respiratory infectious diseases are more observable during rainy season. This study did not delve into mortality by season, and there could be a need for further research in this area. These findings however, agree with a study by (Ogawa et al., 2021) who found that higher mortality was observable in winter and that in winter, increased in□hospital deaths was largely attributed to the increased incidence of respiratory infections. It could also imply that during rainy season, service provision is slowed due to change over delays during watershed hours The current study found that infections caused 42% of deaths in patients aged below 35 years while non communicable diseases caused 41% of hospital deaths in patients aged >60 years. The findings may suggest that infectious diseases are important cause of deaths among the young patients and non-communicable diseases are important causes of deaths among the aged patients admitted for hospital care. The study found that cancer, hypertension and diabetes mellitus were the leading non communicable causes of deaths. Similar findings by (Nigri et al., 2022) reported that cardiovascular diseases and neoplasms are important causes of death among the aged hospitalized patients although there are other important non-

communicable diseases observed such as severe anemia and heart failure. Respiratory infections contributed to 56% of deaths. Pneumonia and pulmonary tuberculosis were the leading respiratory infections in the patients who died in 2018 and 2019. Similar findings by (Aragón & Chalkley, 2018b) and (Ogawa et al., 2021) indicated that the leading causes of death in hospitals include respiratory diseases such as pneumonia. Perhaps preventive interventions during rainy season could be justified.

Conclusions and recommendations

The study aimed to find out trends of inpatient mortality at Kisumu County level four hospital between 2018 and 2019. Based on the study findings, it can be concluded that more deaths occurred in medical ward from infectious diseases such as pneumonia and pulmonary TB among patients aged <35 years while non-communicable diseases such as cancer, hypertension and diabetes mellitus were important causes of death among the people aged >60 years. The results seem to suggest that more deaths occurred during rainy season between February and August. Patient factors such as age, sex and education level were not significantly associated with hospital mortality. Comorbidities particularly the non-infectious diseases were associated with more deaths. This research clearly illustrates that hospital deaths among aged people is due to noncommunicable disease and deaths among young populations is due to infectious diseases but also raises the question of the need to enhance nurse-doctor relationship to reduce avoidable deaths among patients admitted in hospitals. More research is needed to determine the extent of doctor-nurse relationship on patient treatment outcome.

Ethical approval and Consent

This study was approved by the Mount Kenya University School of Graduate studies and ethical committee MKU/ISERC/2581. The study was also approved by National Commission for Science Technology and Innovation (NACOSTI) approval License number NACOSTI/P/23/23547. Authority to access data and conduct the study was obtained from Level four Kisumu County Hospital with approval letter ref number KDH/GEN/VOL. IV (74). All information obtained from the study pertaining to individual patients was not shared. No identifiers were captured during the study.

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