Journal of Acute Disease

Original Article

doi: 10.4103/2221-6189.259109 jadweb.org

Utilization of accident and emergency department at a semi-urban Nigerian hospital: a preliminary prospective study

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ARTICLE INFO

Article history:
Received 27 Feburary 2019
Revision 28 April 2019
Accepted 20 May 2019
Available online 27 May 2019

Keywords:
Emergency department
Utilization
Typhoid intestinal perforation
Resource-limited setting
Nigeria

ABSTRACT

Objective: To assess emergency department utilization at a semi-urban (resource-limited) Nigerian hospital.

Methods: A systematic random sampling technique was adopted. A proforma was used to obtain general information such as age, gender, mode of transfer, time of presentation, symptom duration, diagnoses, treatment duration, treatment outcome (transfer to the ward, referral to another hospital, discharge or death) and date and time of discharge. *Chi*-square test and logistic regression analysis were used to determine the association of variables with mortality and predictors, respectively.

Results: Patients were predominantly male (62.2%) with a mean age of (36.0±19.0) years. Most visits occurred in September (49.1%). The median symptom duration was 24 h (interquartile range: 4.0, 72.0). More incidences were caused by non-surgical (61.9%) than surgical reasons. Infectious diseases (predominantly malaria, 34.5%) and injuries from road traffic accidents (mostly head injuries, 9.4%) were the commonest non-surgical and surgical cause, respectively. The mortality rate was 9.2%. Typhoid-intestinal-perforation and sepsis contributed 45.2% of overall mortality. Age (χ^2=16.44, *P*<0.001), symptom duration (χ^2=22.57, *P*<0.001), and visiting month (Fishers exact, *P*=0.002) were associated with mortality. Moreover, age (37 years) (*OR*=4.60, 95%*CI*=1.96-10.82, *P*<0.001) and visiting in September/October (*OR*=4.01, 95%*CI*=1.47-10.93, *P*=0.007) were the predictors of mortality.

Conclusions: Though most patients in emergency department survive, the mortality is still high. Appropriate hospital and community interventions should be implemented to reduce mortality.

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How to cite this article: Michael GC, Aliyu I, Andesati A, Grema BA, Musa AM, Abu RB, et al. Utilization of accident and emergency department in a semi-urban Nigerian hospital: a preliminary prospective study. J Acute Dis 2019; 8(3): 106-112.

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1. Introduction

Emergency department (ED) visits are largely unplanned and occur when patients are preoccupied with the uncertainty of their condition in the context of the challenges besetting the ED environment. Patients visiting the ED face several challenges, such as overcrowding, inadequate communication, lack of privacy and empathy, poor pain control, uncomfortable environment, and inadequate manpower[1,2]. These challenges are more prevalent among low- and middle-income countries (like Nigeria) with weak healthcare systems[2].

The increasing global demand for emergency care services caused by increased population, improved technology, and extended life expectancy necessitates attention to what goes on in the ED[3,4]. The English National Health Service recorded as high as 5.3 million emergency admissions in hospitals from 2012 to 2013 (representing a 47% increase in ED admission over the preceding 15 years); this represented about 67% of hospital bed-days and cost of approximately £12.5 billion in England[5]. Though data for Nigeria is unavailable, only a small proportion (<10%) of Nigerians are enrolled in the National Health Insurance Scheme[6]. Hence, the economic burden of emergency care on the citizenry is expected to be huge.

Furthermore, different uses of the ED can have different implications. Inappropriate use of the ED may cause needless healthcare expenditure, which reflects the cost-ineffective patient care, whereas ED use for emergent but preventable conditions may reflect the access barriers to primary care[7]. However, stringent measures that discourage ED use may result in poor handling of emergent conditions, while underutilization of ED services may cause needless healthcare expenditures due to delay in the provision of appropriate care[8].

To improve ED services, efficient organization, availability of appropriately trained health staff, presence of facility surge and resilience capacity, and continuous quality improvement mechanisms (including regular audit of activities) are imperative[2,9-16]. To our knowledge, study on ED utilization in the hospital is rare. Therefore, we embarked on a 6-months preliminary prospective assessment on the utilization of a semi-urban ED, including the emergency care consumers, reasons for service utilization, outcome of care and factors associated with mortality. A prospective design will reduce limitations of retrospective studies in low- and middle-income countries[2], and the study may provide baseline information for strategic planning in the improvement of the quality of ED services in the hospital.

2. Patients and methods

2.1. Study site and population

This was a prospective, observational study at the ED of Federal Medical Center (FMC) Birnin Kudu, North-west Nigeria, located at about 120 kilometers South-east of Kano (a major city in the region), latitude 11.45°N and 9.475°E[17]. This ED provides surgical and non-surgical emergency services to patients from the study area and neighboring local governments and states; however, pediatric medical emergencies are managed at the emergency pediatric unit of the hospital (pediatric surgical emergencies are managed at this ED). It has 16 beds with a resuscitation bay and is run by senior medical officers and overseen by an orthopedic surgeon. It also receives internal referrals from the family medicine outpatient clinic. The department runs three shifts during weekdays and 48-hour on-call duty during weekends with supporting nursing, health records, pharmacy staff, and cleaners. Following initial triage and commencement of resuscitation, surgeons (general, orthopedic and maxillofacial), specialist medical teams are invited to review and take over the management of respective patients according to the established treatment protocols. All patients attending the ED of the hospital from July to December 2018 were included in this study, and the need for informed consent was waived by the Research Ethics Committee of the hospital.

2.2. Eligibility criteria

Patients who left disregard of medical advice, left before consultation or died before arrival were excluded from the study.

2.3. Sample size estimation

The ED records showed an average of 105 patients weekly in the same period of the preceding year. Using an empirical utilization rate of 50% and the formula for estimating sample size for population ⩾10 000, a sample size of 422 was obtained[18]. When the formula for estimating sample size for populations <10 000 was used, a sample size of 362 was obtained.

2.4. Sampling and data collection

A systematic random sampling technique was adopted. A pretested proforma was included in the case file of every 7th registered patients [(105×6×4)/362 ≈ 7] at the Health Records Unit after the first was selected by balloting. The proforma was used to obtain routine information such as age, gender, mode of transfer, date and time of presentation, symptom duration, diagnoses, treatment duration, treatment outcome (transfer to the ward, referral to another hospital, discharge or death) and date and time of discharge[19]. The treatment duration was the interval between the time of presentation and the time of hospital discharge, death, referral to another hospital, or hospital ward transfer. An average of 2 patients was recruited daily.

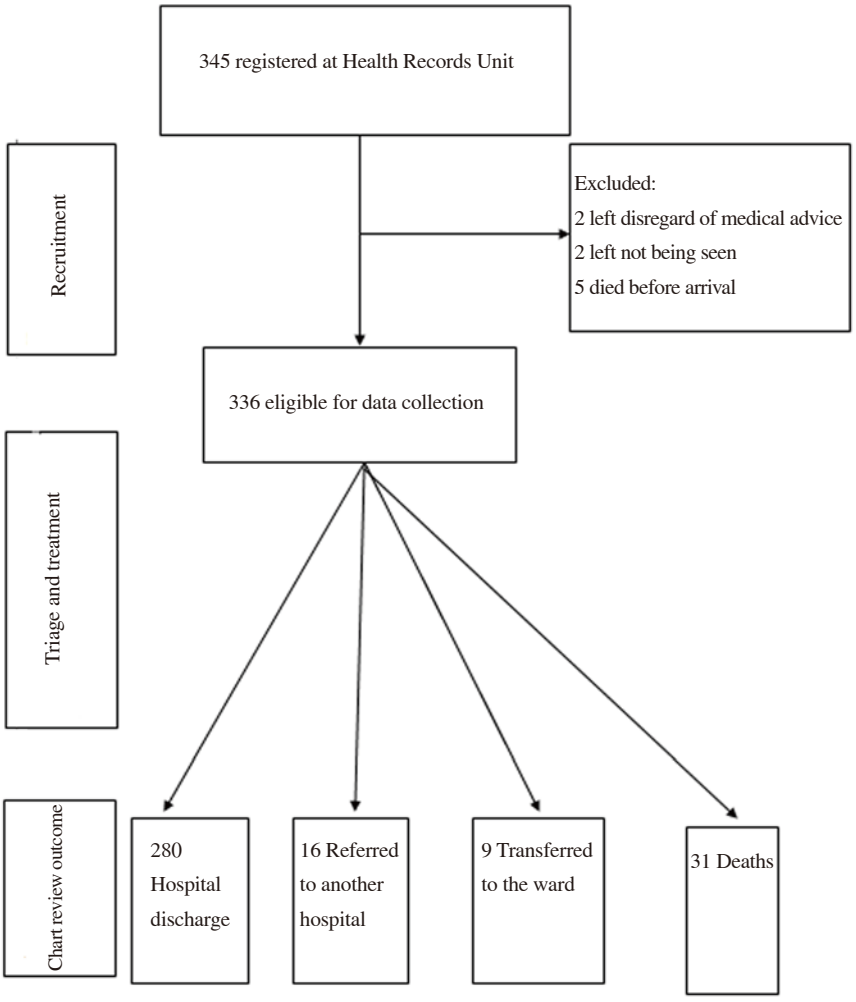

Figure 1. Flow diagram of patient selection.

2.5. Statistical analysis

Data were entered and analyzed using Epi Info 7.1.1.14 (2012) (CDC, Atlanta GA, USA). Continuous variables were presented in mean±SD or median (upper and lower quartiles). Categorical variables were presented in frequency. *Chi*-square test was used to analyze the association between variables and mortality. Logistic regression analysis was used to analyze predictors of mortality. *P* value of less than 0.05 was considered statistically significant.

2.6. Ethical approval

The Research Ethics Committee of FMC Birnin Kudu approved the study protocol and waived the need for informed consent for study enrollment, prospective data collection and subsequent chart review after the ED visit (HREC/014/2016).

3. Results

3.1. Sociodemographic characteristics

A total of 336 patients were analyzed. They were predominantly male (209, 62.2%) with a male-to-female ratio of 1.6:1 (Table 1). The mean age was (36.0±19.0) years [range: (0.25-90.00) years]. Patients aged (20-39) years (146, 43.4%) visited most frequently. More ED visits occurred in September (165, 49.1%). The median symptom duration was 24 h [interquartile range (IQR): 4.0, 72.0] and most patients had symptom duration as 24 h to 72 h (156, 46.4%) (Table 1).

Table 1. Sociodemographic characteristics.

Variables	*n*	Percentage
Sex		
Male	209	62.2
Female	127	37.8
Age (years)		
⩽19	61	18.2
20-39	146	43.4
40-59	70	20.8
⩾60	59	17.6
Month		
July	33	9.8
August	79	23.5
September	165	49.1
October	36	10.7
November	14	4.2
December	9	2.7
Symptom duration (h)		
< 24	113	33.6
24-72	156	46.4
73-144	21	6.3
>144	46	13.7

Table 2. Reasons for ED visits.

Variables	*n*	Percentage
Surgical reasons (*n*=128)		
Trauma (*n*=91)		
RTA	60	17.9
Assault	18	5.3
Domestic	7	2.1
Fall from height	3	0.9
Gunshot	1	0.3
Occupational accident	2	0.6
Non-trauma (*n*=37)		
Typhoid intestinal perforation	7	2.1
Acute abdomen	5	1.5
Appendicitis	4	1.2
Acute urinary retention	4	1.2
Intestinal obstruction	2	0.6
Hernia	2	0.6
Renal stone	2	0.6
Breast abscess	2	0.6
Others*	9	2.6
Non-surgical reasons (*n*=208)		
Infectious (*n*=118)		
Malaria	80	23.8
UTI	11	3.3
Sepsis	9	2.6
Typhoid fever	6	1.8
Pneumonia	5	1.5
Meningitis	3	0.9
PTB with pleural effusion	2	0.6
Viral hemorrhagic fever	1	0.3
ASOM	1	0.3
Gastrointestinal (*n*= 44)		
Dyspepsia	11	3.3
Gastroenteritis	29	8.6
Liver failure	4	1.2
Cardiovascular (*n*=18)		
Heart failure	8	2.4
Stroke	5	1.5
Hypertensive encephalopathy	3	0.9
Acute coronary syndrome	2	0.6
Respiratory (Asthma)	5	1.5
Renal (renal failure)	4	1.2
Endocrine (*n*=4)		
HHS	3	0.9
DKA	1	0.3
Hematologic (*n*=4)		
SCA crisis	3	0.9
Severe anemia	1	0.3
Others**	11	3.3

*There was one case due to foreign body ingestion, fecal impaction, foot gangrene, prostatic enlargement with severe hematuria, Ludwig angina, pyomyositis, septic chronic wound ulcer, typhoid enteritis, and complicated uterine fibroid, respectively. **Dog bite 4 cases, drug poisoning 2 cases, chemical poisoning 1 case, hypokalemic tetany 1 case, hypoglycemia 1 case, generalized pruritus 1 case, snakebite 1 case. ASOM: acute suppurative otitis media; HHS: Hyperosmolar hyperglycemic state; DKA: Diabetic keto acidosis; SCA: sickle cell anemia.

3.2. Reasons for ED utilization

Table 2 shows that more ED visits were caused by non-surgical (208, 61.9%) than surgical reasons. Moreover, among the surgical reasons, the incidence of trauma was the highest (*n*=91), predominantly due to road traffic accidents (*n*=60); whereas non-trauma surgical reasons constituted 11.0% and was mainly due to typhoid intestinal perforation (7, 2.1%).

For non-surgical reasons, more ED visits were due to infectious diseases (118, 35.1%) predominantly malaria (80, 23.8%). However, gastroenteritis (29, 8.6%), heart failure (8, 2.4%), asthma (5, 1.5%), renal failure (4, 1.2%), sickle cell anemia crisis (4, 1.2%) and hyperosmolar hyperglycemic state (3, 0.9%) were the main gastrointestinal, cardiovascular, respiratory, renal, hematological and endocrine reasons, respectively(Table 2).

3.3. Treatment duration and outcome

The median treatment duration was 24 h (IQR: 7.0, 48.0). Majority of patients (280, 83.3%) survived and were discharged. A total of 16 (4.8%) were referred to other hospital, 9 (2.7%) were transferred to the ward, and 31 (9.2%) died. Typhoid intestinal perforation (7, 2.1%) and sepsis (7, 2.1%) were responsible for 45.2% of all ED deaths (Table 3).

3.4. Risk factors of mortality

Table 4 shows that age (χ^2=16.44, *P*<0.001), symptom duration (χ^2=22.57, *P*<0.001) and visit month (Fisher exact, *P*=0.002) were significantly associated with mortality(Table 4).

3.5. Predictors of mortality

Logistic regression showed that age (⩾37 years) [Odds ratio (*OR*)=4.60, 95% confidence interval (*CI*) =1.96-10.82, *P*<0.001] and visiting months (September and October) (*OR*=4.01, 95% *CI* =1.47-10.93, *P*=0.007) were predictors of mortality (Table 5).

Table 3. Causes of mortality (*n*=31).

Variables	*n*	Percentage
Typhoid perforation	7	2.1
Sepsis	7	2.1
Heart failure	5	1.5
Stroke	4	1.2
Hyperosmolar hyperglycemic state	2	0.6
Others*	6	1.8

*Head injury, ruptured appendicitis, acute coronary syndrome, drug poisoning, hypertensive encephalopathy, and massive pleural effusion (1 case each).

Table 4. Factors associated with mortality among ED patients.

Variables	Mortality, [*n* (%)]	Statistics
Sex		
Male	21 (67.7)	χ^2=0.45
Female	10 (32.3)	*P*=0.50
Age (years)		
< 37	8 (25.8)	χ^2= 16.44
37	23 (74.2)	*P*<0.001
Visit month		
July	0 (0.0)	
August	2 (6.5)	
September	18 (58.1)	*P*=0.002*†
October	8 (25.8)	
November	3 (9.7)	
December	0 (0.0)	
Presenting symptom duration (h)		
< 24	5 (16.1)	χ^2= 22.57
24-72	10 (32.3)	*df*=3
73-144	6 (19.3)	*P*<0.001*
> 144	10 (32.3)	
Reasons for visit		
Surgical	9 (29.0)	χ^2= 1.19
Medical	22 (71.0)	*P*=0.28

*:Significance. †:Fisher exact test.

Table 5. Logistic regression analysis of predictors of mortality.

Variables	*OR*	95% *CI*	Coefficient	*P* value
Age (37/<37 years)	4.60	1.96-10.82	1.53	<0.001*
Visit month				
Sept-Oct /others	4.01	1.47-10.93	1.39	0.007*
Symptom duration				
24/<24 h	2.41	0.87-6.64	0.88	0.09
Constant	-	-	-4.80	0.00

*Significance; *OR*: Odds ratio; *CI*: Confidence interval.

4. Discussion

This preliminary prospective observational study is performed in a resource-limited setting. The mean age (36 years) in our study was similar to the investigation (40 years) in an urban hospital in Lagos (South-west, Nigeria)[20], the study (34 years) among trauma patients in Calabar (South-south, Nigeria)[21] and the result (35 years, interquartile range: 6.9-41.0) found in 59 low- and middle-income countries[2]. However, it was lower (58 years) than that obtained in an urban facility in Singapore[22]. It may be due to the recruitment of higher proportion of middle-aged and elderly ED patients (65%) in the Singaporean study. Similarly, we found a gender ratio of 1.6:1 in favor of males. This corroborates findings in low- and middle-income countries[2,21-23].

We also observed that the month of September recorded the highest incidence. This could be due to the peak of rainfall and malaria incidence in northern Nigeria (June to September)[17,24]. Our study showed that nearly a quarter (23.8%) of ED visits were due to malaria.

Furthermore, this study indicated that more cases were caused by non-surgical than surgical reasons, which is similar to the Lagos study[20]. Infectious diseases were the most common non-surgical reason in this study, similar to result of a 4-year medical emergency audit in Zaria, North-west Nigeria[25]. However, it is in variance with cardiovascular accident found in the Lagos study[20], and the more chronic disease cases in high-income countries[26]. More infectious disease cases found in this study may also be attributable to the high incidence of malaria in the study area similarly reported among the hospital's outpatients[27].

Our study showed that a majority (83.3%) of ED patients survived and were hospital discharged; while 9.2% of them died. This mortality rate was similar to 10.1% obtained in Lagos[20], and 9% in Zaria[25]. However, it was lower than the mortality rate of 41.3% found in a 2-year study among trauma patients in Calabar[19] but higher than the median ED mortality rate of 3.4% found among 59 sub-Sahara African countries[2]. Different study design (prospective versus retrospective), population (trauma versus general patients) and duration (6 months versus ⩾1-year) may explain the variations in the ED mortality rates.

Furthermore, cardiovascular accident caused 20% of the Lagos ED mortality[20], and typhoid intestinal perforation and sepsis together accounted for 45.2% of our ED deaths. This finding highlights the importance of infections (such as typhoid fever and its consequences) in ED especially in rural and suburban communities of Northern Nigeria[28], and further implies that interventions to decrease incidence of infectious diseases at the ED may increase life expectancy of the patients and productivity of the community[2]. Furthermore, mean symptom duration of 3.8 d suggested the late ED arrival by many patients. This finding was similar to that (3.2 d) obtained from trauma patients in Calabar[19] but it was higher than that (9 h) found among ED stroke patients in India[29]. Delay in seeking ED care is a common problem in many low-and middle-income countries[2,30]; this delay is associated with avoidable consequences such as intestinal perforations and deaths (even with hospital treatment)[28,31]. This finding also corroborates that the mortality would increase as symptom duration increased. Delays could be due to the patronage of unorthodox healers, which has been reported in many low- and middle-income countries[2]. In this study, we found higher mortality among patients ⩾37 years. This could be due to the higher proportion (64%) of ED patients aged 20 to 59-year. Similarly, more death occurred (58.1%) during September and October. This may also be due to the higher proportion of patients visiting in September. Remarkably, age ⩾37 years and ED visit in September/October are predictors of mortality in this study. There is a four-fold increase in odds of deaths among patients ⩾37 years and visiting in September and October.

Deliberate measures need to be implemented to reduce the mortality. These risk factors of mortality should be paid attention to, especially patients ⩾37 years in the study area. Diseases such as typhoid perforation and sepsis should be diagnosed and treated appropriately. More manpower and equipment are required during high-occurrence months (*e.g.* September in this study) to avert preventable deaths. Training and retraining of ED staff, employment of emergency physicians, trauma surgeons, neurosurgeons, plastic surgeons with the provision of relevant equipment such as CT/MRI scans are necessary. Community education on the prevention

of communicable diseases (such as typhoid fever and malaria) and noncommunicable diseases (like hypertension, diabetes mellitus, drug poisoning, and accidents) is also required. Emphases on appropriate healthcare-seeking behaviors (such as early presentation in hospital) to improve outcome should be intensified.

This study investigated the distribution of morbidity and mortality in the ED and factors associated with mortality in a semi-urban (resource-limited) Nigerian hospital. This information may aid in strategic planning to improve emergency care. However, we did not assess errors that may have occurred in the clinical management of the patients especially due to work overload. Work-overload has been reported to occur in heavily utilized trauma centers[32]. Additionally, an audit of a longer duration (1 year and more) may be helpful in unveiling the complete temporal changes in ED utilization.

5. Conclusion

Our study shows that most ED visits are caused by non-surgical reasons, and majority survive. Typhoid intestinal perforation and sepsis are important causes of death. Age and visiting month are main predictors of mortality. Improvements in manpower, infrastructure, and operational protocols (with attention to periods of increased utilization) along with community education may be crucial in reducing ED mortality.

Conflict of interest statement

The authors report no conflict of interest.

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