

Length of stay and its associated factors among adult patients who visit Emergency Department of University Hospital, Eastern Ethiopia

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Abstract

Objectives: This study was aimed to assess the length of stay and its associated factors among adult patients who visited Emergency Department of Hiwot Fana Specialized University Hospital, Eastern Ethiopia.

Method: A hospital-based cross-sectional study was conducted among 400 adult patients who visit the Emergency Department. Systematic random sampling technique and an interviewer-administered data collection method was used. Data analyses were done using STATA version 16. Bivariable and multivariable logistic regression analysis was used to control the potential confounders. The analysis outputs were presented using an odds ratio with a corresponding 95% confidence interval (CI). Independent variables were defined as statistically significant at p -values <0.05 in the final model.

Result: A total of 169 [42.25% (95% CI: 37.5%–47.0%)] patients stayed longer than 24 h in the Emergency Department. We identified factors significantly associated with length of stay in ED include: patients treated at orange triage type (adjusted odds ratio (AOR)=0.267; 95% CI: 0.13–0.53), laboratory request (AOR: 3.05; 95% CI: 1.49–6.23), radiological requests (AOR: 1.80; 95% CI: 1.05–3.07), and diagnosed with medical condition (AOR: 2.27; 95% CI: 1.21–4.26).

Conclusion: A significant number of patients stay longer in the Emergency Department. Evaluation of the clinical diagnosis, diagnostic investigations, and organizational factors is essential to reduce the length of stay in the Emergency Department.

Keywords

Length of stay, Emergency Department, Ethiopia

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Introduction

Length of stay (LOS) in an Emergency Department (ED) indicates how well the department is performing and is a vital key performance indicator of healthcare services.¹ ED is a unit that serves an unscheduled patient population with anticipated needs for emergency care.² For many patients, it represents the “front door” of health system and accounts for about three-fifths of inpatient hospital admissions.³

Globally, the percentage of patients who visit the ED rose by 65% between 2001 and 2011, leading to exaggerated waiting times, prolonged stays, overcrowding, and delayed admissions.^{4,5} Prolonged stay in ED can adversely affect patient outcomes, leading to increased length of hospital admission, higher inpatient cost, and mortality.⁶ Moreover, Singer et al.⁷ suggested that the mortality rate increased

from 2.5% to 4.5% with increasing LOS for more than 12 h or more.

According to the Ethiopian Hospital Services Transformation Guidelines, 2016: the LOS for patients in the ED should not exceed one day.⁸ When beds in the ED are

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occupied by patients for more than 24h, the ED becomes overcrowded.⁹ In addition, a shorter hospital stay minimizes the risk of infections and drug side effects, reduces unnecessary medical expenses, and increases the bed turnover rate, which helps increase the facilities' profit margin, and improve the quality of treatment.¹⁰ Studies revealed that health professionals' inability to perfectly triage and patients' characteristics determine the LOS in ED.^{3,11} However, there is a variability based on the settings.¹² Despite this, understanding the factors that contribute to the delays in an ED is a critical step in improving the patient care efficiency, which is rarely studied in the Ethiopian context.¹¹ Therefore, this study aimed to assess the proportion of patients who stay longer than the recommended time in ED and to identify the contributing factors among adult patients who visit the ED of Hiwot Fana Specialized University Hospital, Eastern Ethiopia.

Methods

Study setting and study period

The study was conducted in Hiwot Fana Specialized University Hospital. The hospital is one of the two government hospitals affiliated to Haramaya University with a total of 210 beds and more than 250 health professionals. Emergency medicine and critical care department gives both emergency medical and surgical care services as a main gateway of the hospital. The study was conducted from 1st to 30th March, 2021.

Study design and population

Institutional-based cross-sectional study was conducted. All adult patients attending the emergency medicine and critical care units during the study period were eligible to be included in the study. However, patients who were unable to give their consent due to an inability to speak or altered mental status and who did not have an accompanying person were excluded.

Sample size determination

The sample size was calculated by using single population proportion considering the following assumptions: where n is the required sample size, $Z_{\alpha/2}=1.96$ at 95% confidence interval, p is the proportion of patients that stayed longer than the recommended time, 38.4%,³ and d is the assumed marginal error (5%); by adding 15% nonresponse rate, it yields 417 participants that was considered for the final study.

Sampling procedure

Systematic random sampling technique was used to select the study participants. According to the patient's registration record, on average about 880 patients visit the ED every month (which was calculated by taking the data of three

consecutive months and dividing by 3). We have included every other patient according to their order of visit to ED.

Study variables

Variables included were sociodemographic characteristics including age, sex, marital status, educational status, occupation, religion, monthly income, and residence. Concerning the organizational and other related factors: mode of payment for health services, mode of presentation, means of transportation, date of presentation, time of presentation, triage type, first contact of health professionals, and shift change of healthcare workers. In addition, factors related to diagnostic investigations include: laboratory requests and their types and radiology service order and its types. Under the clinical characteristics of patients: vital sign, Modified Early Warning Score (MEWS), mental status, treatment given before arrival, frequency of presentation to ED, previous history of admission to hospital, history of comorbidity, previous medical conditions, current patient's diagnosis, final outcome, and medication ordered were included. The outcome variable, LOS in ED was measured in hours and categorized as greater than and equal to 24h and less than 24h according to the Ethiopian Hospital Service Transformation Guidelines.¹³

Data collection tools and methods

Data were collected by using the stop watch, structured checklist, and questionnaire. The stopwatch was used to measure the time duration of patients in the ED from the time of presentation to discharge and particular duration of stay in each service unit were filled on the structured checklists. In addition, the interviewer-administered questionnaire was used to address the variables including sociodemographic characteristics, organizational factors, diagnostic investigations, and clinical characteristics of patients that were developed through an extensive review of relevant literatures.^{11,14,18}

Data collection procedures

The data collection procedure is illustrated as follows: first, the data collectors identified eligible patients in the triage room upon arrival. Therefore, the time and other presentation-related characteristics were recorded at the triage room. Further, information such as sociodemographic characteristics was obtained by interviewing the patients at different treatment points or after the patient stabilized otherwise. Finally, information such as diagnostic investigations and clinical data were recorded from medical records. Overall LOS at the department and final disposition was recorded right before the patient was discharged from the ED. Six data collectors with bachelor degrees were deployed daily. Thereby, two data collectors worked 8-hour shifts to collect data. Consequently, data collection started early in the

morning from 8:00 am and continued over the next 24 h such that the first group collected the data from 8:00 am to 4:00 pm, the second group from 4:00 pm to midnight, and the third group takes over from midnight to 8:00 am.

Data quality control

For quality assurance, 2 days' training was given for the data collectors on the tool contents, data collection technique, and ethical considerations. The interviewer's manual was developed, which explains clearly all the standard steps and procedures for the study and addresses potential problems and questions to be raised. The questionnaire was prepared in English and translated into local language (*Afaan Oromo* and *Amharic*). The final versions of the questionnaire were pretested on 10% (47) of the sample at the Jugol Hospital 1 week prior to the actual data collection and necessary modifications were made accordingly. On-site supervision was performed to ensure the integrity and consistency of the completed questionnaire on a daily basis. In addition, data completeness was ensured throughout the data entry and data cleansing process.

Statistical analysis

The data was entered into Epidata version 2, and was exported into and analyzed by STATA version 16. Descriptive analysis: proportions, frequency, and summary of statistics and binary logistic regression analysis was done to identify factors associated with LOS in ED. Accordingly, variables yielding p -values <0.05 at bivariable logistic regression analysis were considered for multivariable logistic regression analysis. Factors significantly associated with outcome variable was identified at p -value <0.05 and adjusted odds ratios at 95% CI.

Results

Sociodemographic Characteristics

A total of 400 patients were enrolled in the study, with a 97% response rate. The mean age of the participants was 38 years, ranging from 18 to 80 years. The majority of patients 323 (80.75%) were married, 209 (52.25%) had no formal education, and 138 (34.5%) were farmers by occupation (Table 1).

Organizational and others related factors

Nearly one-fourth, 103 (25.75%) of patients presented with their visit on Friday, 181 (45.25%) patients were treated at orange or very urgent triage type, 366 (91.5%) patients were first seen by nurses, and 305 (76.75%) patients paid the medical expenses out of pocket. The mode of arrival for 218 (54.5%) patients was public transport, and the mean distance of patient's home from health facility was 37 km (40.5 SD) (Table 2).

Table 1. Sociodemographic characteristics of patients treated at the ED, 2021.

Variable	Frequency	Percent
Age	Mean 38 ± 15.76	
Sex		
Male	245	61.25
Female	155	38.75
Marital status		
Married	323	80.75
Divorced	11	2.75
Single	60	15.00
Widowed	6	1.50
Educational status		
No formal education	209	52.25
Primary	106	26.50
Secondary	37	9.25
College	48	12.00
Occupation		
Farmer	138	34.50
Merchant	46	11.50
Housewife	41	10.25
Daily laborer	79	19.75
Student	23	5.75
Government employee	40	10.00
Unemployed	33	8.25
Religion		
Muslim	294	73.50
Orthodox	76	19.00
Protestant	26	6.50
Others	4	1.00
Monthly income	Mean 64USD	
Residence		
Urban	196	49.00
Rural	204	51.00

Diagnostic investigations

Laboratory services were ordered for 328 (82%) patients. The types of laboratory service ordered were complete blood count for the majority of patients 309 (94.21%). Moreover, radiology service was ordered for 153 (25%) patients (Table 3).

Clinical characteristics

The mean blood pressure of participants was 115 mmHg (± 22.7 SD). The majority of patients, 290 (72.5%) presented at the ED for the first time, 81 (20.25%) had at least one comorbidity, and 158 (39.5%) patients improved and were discharged from the hospital. Any types of medications were ordered for 266 (66.5%) patients (Table 4).

Length of stay

A total of 169 (42.25% (95% CI: 37.5%–47.0%)) patients stayed longer than 24 h in the ED. Among those who stayed

Table 2. Organizational and related factors at the ED, 2021.

Variable	Frequency	Percent
Date of presentation		
Monday	73	18.25
Tuesday	77	19.25
Wednesday	28	7.00
Thursday	66	16.50
Friday	103	25.75
Saturday	53	13.25
Time of presentation		
Morning	152	38.00
Afternoon	133	33.25
Evening	115	28.75
Triage type		
Red/immediate	109	27.25
Orange/very urgent	181	45.25
Green/standard	110	27.50
First seen by healthcare worker		
Nurse	366	91.50
General practitioner	34	8.50
Shift change of healthcare workers		
Yes	40	10
No	360	90
Mode of payment for health service		
Out of pocket	307	76.75
Health insurance	41	10.25
Free/exempted	52	13.00
Mode of presentation		
Alone	55	13.75
With spouse	286	71.50
With friends	42	10.50
With siblings	17	4.25
Mode of arrival/means of transportation		
Private	110	27.50
Public	218	54.50
Ambulance	55	13.75
By foot	17	4.25

Table 3. Diagnostic investigations conducted for the patient treated at the ED, 2021.

Variables	Frequency	Percent
Laboratory request ordered		
Yes	328	82
No	72	18
Types of laboratory service ordered		
Complete blood count	309	94.21
Stool examination	6	1.83
Urine analysis	9	2.74
Serum	1	0.30
Organ function test	2	0.61
COVID-19 test	1	0.30
Radiology service ordered		
Yes	153	38.25
No	247	61.75
Types of radiology ordered		
X-ray	117	76.47
Ultrasound	30	19.61
Electrocardiography	6	3.92

Table 4. Clinical characteristics of patients treated at the ED, 2021.

Variable	Frequency/mean (SD)	Percent
Vital sign		
Blood pressure	115.26 ± 22.7	
Pulse	100.76 ± 22	
Temperature	36.44 ± 1	
Respiratory rate	22 ± 5.1	
Modified early warning score		
1–4	259	64.80
5–6	98	24.50
>7	43	10.80
Mental status during the presentation		
Alert	180	45.00
Comatose	41	10.25
Confused	179	44.75
Any treatment given before arrival		
Yes	62	15.50
No	338	84.50
Frequency of presentation to ED		
For the first time	290	72.50
Previously presented	110	27.50
Previous history admission to the hospital		
Yes	44	11.00
No	356	356.00
History of comorbidity		
Yes	81	20.25
No	319	79.75
Previous medical condition		
Diabetes	21	25.93
Asthma	28	34.57
Pneumonia	7	8.64
Tuberculosis	2	2.47
Cardiovascular disorder	17	20.99
Others	6	7.41
Current patient's diagnosis		
Trauma	110	27.50
Medical	197	49.25
Infectious	28	7.00
Surgical	65	16.25
Final outcome		
Improved and discharged	158	39.50
Admitted	128	32.00
Referred to isolation center of the hospital	99	24.75
Died	15	3.75
Medication ordered		
Yes	266	66.50
No	134	33.50

Others: intestinal obstruction, acute appendicitis, and urinary tract infection.

longer than the recommended hours in the ED 116 (68.63%) were males, 101 (59.76%) have no formal education, 70 (41.42%) were rural residents, and 103 (61%) have MEWS of 1–4 (Figure 1).

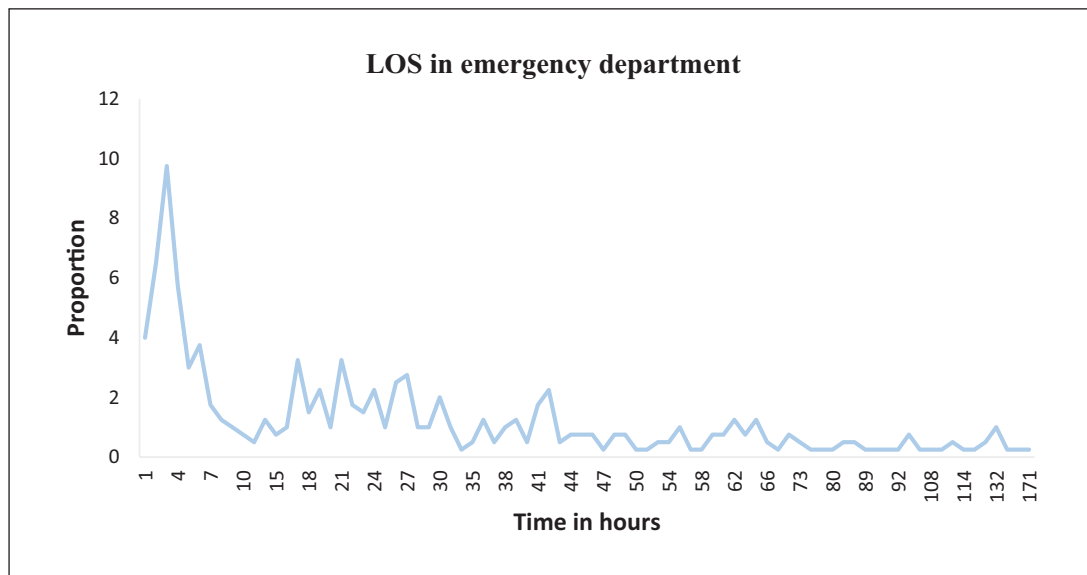


Figure 1. LOS in the ED of Hiwot Fana Specialized University Hospital, Eastern Ethiopia, 2021.

Factors associated with LOS

Under the bivariable logistic regression model, age, sex, educational status, residence, distance of patient's home from health facility in kilometer, time of arrival, triage type, laboratory request, radiological request, MEWS, and type of diagnoses were significantly associated with the outcome variable.

The output of multivariable logistic regression indicates patients treated at orange triage type were 74% less likely (AOR: 0.26; 95% CI: 0.13–53) to stay in ED compared to patients treated at green triage type. Moreover, patients who have received an order for laboratory investigation were three times (AOR: 3.05; 95% CI: 1.49–6.23) more likely to stay in ED and patients who received a radiological service stays 1.8 times (AOR: 1.80; 95% CI: 1.05–3.07) more likely in ED, than patients who did not have laboratory investigation and radiological investigation respectively. Compared to patients with trauma cases, the LOS for patients with a medical case were 2.27 times more likely (AOR: 2.27; 95% CI: 1.21–4.26) (Table 5).

Discussion

In the current study, 42.25% (95% CI: 37.5%–47.0%) of patients stay longer than 24 h in the ED. According to the Ethiopian Hospital Service Transformation Guidelines,¹³ the LOS in the ED should not be prolonged for more than 24 h. The current finding shows the proportion of patients who stayed longer than the recommended hours is higher than the result of the study conducted in the Netherlands,¹⁴ Switzerland, France, and the United States. The variation could be attributed to differences in sample size and quality of healthcare services.^{3,14–18}

Patients treated at orange triage type were less likely to stay in ED compared to patients treated at the green triage type. Similarly, the previously conducted studies identified

the association of the triage type with the LOS in ED but with different description and number of triage categories.^{14,19,20} Moreover, the diagnostic investigation was significantly associated with the LOS. Patients without laboratory and radiological evaluations spend less time in an ED compared to their counterparts. Consistent with this finding, previously published data show that there is a correlation between the LOS in ED and diagnostic examinations.^{3,17} This could be due to the fact that the time required for diagnostic work-up increases the stay in the ED.

The current study result shows that patients with medical conditions stay longer in an ED as compared to patients who present with trauma. Previous study results indicated that the LOS in an ED is associated with the patient's diagnosis, and severity of illness.¹⁷ It is evidenced that the clinical severity has a direct association with the LOS.²¹ Similarly, Sir et al.¹⁶ signified those types of presenting complaint and diagnosis that have a significant association with LOS in ED. Moreover, different types of presenting complaints may need different clinical approaches, and diagnostic investigation, which could contribute to the difference in LOS at ED.

Strength and limitations

The current study has used the pretested tools to measure the LOS in ED and to identify the associated factors. In addition, we collected the data prospectively through patient interview and observation, which could be the strength of the study. However, it was not without limitation. The cross-sectional nature of the study may deceive the cause–effect relationship. In addition, variables like bed occupancy rate, quality of emergency care services, standard level of ED, and communication gap between the patients and healthcare providers have not been included under the current study, which may impair the generalizability of the study.

Table 5. Factors contributing to the LOS among patients treated at the ED, 2021.

Variables	LOS in ED		95% CI	
	<24 h	>24 h	COR	AOR
Age				
20–35	29	14	1	1
35–50	74	34	0.95 (0.44, 2.02)	0.73 (0.30, 1.76)
50–65	44	36	1.69 (0.78, 3.67)	1.20 (0.48, 3.00)
>65	84	85	2.09 (1.03, 4.24)	1.35 (0.58, 3.16)
Sex				
Male	129	116	1.73 (1.14, 2.62)	1.22 (0.73, 1.97)
Female	102	53	1	1
Education				
No formal education	108	101	2.05 (1.05, 4.01)	1.28 (.53, 3.08)
Primary	65	41	1.38 (0.67, 2.86)	.97 (0.40, 2.32)
Secondary	25	12	1.05 (0.42, 2.64)	1.05 (0.36, 3.03)
College and above	33	15	1	1
Residence				
Urban	126	70	1	1
Rural	105	99	1.69 (1.13, 2.53)	1.58 (0.90, 2.76)
Distance from home in kilometers				
Mean	37.81 ± 40.5		1.00 (1.56, 1.13)	1.00 (0.99, 1.09)
Time of arrival				
Morning	101	51	1	1
Afternoon	92	41	0.88 (0.53, 1.45)	0.66 (0.37, 1.16)
Evening	38	77	4.01 (2.39, 6.71)	1.82 (0.88, 3.75)
Triage type				
Red/immediate	49	60	2.22 (1.29, 3.83)	0.57 (0.29, 1.11)
Orange/very urgent	111	70	1.14 (0.70, 1.87)	0.26 (0.13, 0.53)*
Green/standard	71	39	1	1
Laboratory request				
Yes	176	152	2.79 (1.55, 5.01)	3.05 (1.49, 6.23)*
No	55	17	1	1
Radiological request				
Yes	68	85	2.42 (1.60, 3.66)	1.80 (1.05, 3.07)*
No	163	84	1	1
MEWS				
1–4	156	103	1	1
5–6	57	41	1.08 (0.67, 1.74)	0.69 (0.39, 1.24)
>7	18	25	2.10 (1.09, 4.04)	0.83 (0.35, 1.95)
Type of diagnoses				
Trauma	51	59	1	1
Medical	122	75	1.88 (1.17, 3.01)	2.27 (1.21, 4.26)*
Infection	17	11	1.05 (0.46, 2.36)	0.56 (0.22, 1.44)
Surgical	41	24	0.95 (0.53, 1.70)	0.66 (0.34, 1.29)

AOR, adjusted odds ratio; COR, crude odds ratio; ED, Emergency Department; LOS, length of stay; MEWS, Modified Early Warning Score.

*Statistical significant at p -value <0.05.

Conclusions and recommendations

The present study identified that a significant number of patients stay longer in ED than a recommended time period. Patients treated at orange triage type, requested for laboratory and radiological investigation, and with medical diagnosis, stayed longer in the ED. Accordingly, we recommend special attention should be given to the patients with investigations ordered and with

medical diagnosis to reduce the LOS. Perhaps, the slight homogenous nature of study participants in terms of marital status, occupation, and mode of payment for medical services needs cautious interpretation as regards the transferability of the findings to the settings with various heterogeneous characteristics of patients presenting to ED.

Future researchers have to incorporate factors including quality of emergency service, healthcare provider's level of

job satisfaction, bed occupancy rate, and other factors that could affect the LOS in ED.

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Author contributions

All the authors made a significant contribution to the work reported equally: conception, study design, execution, acquisition of data, analysis, and interpretation. Also, they equally took part in drafting, revising, or critically reviewing the work. Moreover, they have made a mutual agreement on the journal to which the article has been submitted for publication. Finally, they agreed to share equal responsibility to be accountable for all aspects of the work and send the final approved version for publication.

Availability of data and materials

The data set used for analysis could be shared with reasonable request from corresponding author.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethical approval

An ethical approval letter was obtained from Haramaya University Institutional Research Ethics and Review Committee (IRERC) with a reference number (IHRERC/422/2021) before the commencement of the data collection. Informed, voluntary, written, and signed consent was obtained from each participant, and hospital administrators. Clear description of the study title, procedure, duration, possible risk, and benefits of the study was explained to the participants.

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Informed consent

Written informed consent was obtained from all subjects before the study. Informed, voluntary, written, and signed consent was obtained from each participants, and hospital administrators. Clear description of the study title, procedure, duration, possible risk, and benefits of the study was explained to the participants.

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Supplemental material

Supplemental material for this article is available online.

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