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FACTORS CORRELATED WITH THE LENGTH OF STAY OF PATIENTS IN THE EMERGENCY DEPARTMENT OF HOSPITAL A, EAST JAVA

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ABSTRAK

Masalah IGD yang penuh atau ED Crowding belum dapat diselesaikan di Indonesia disebabkan oleh pemanjangan dari lama tinggal pasien di IGD (ED LOS), sehingga mengakibatkan keterlambatan dalam memberikan pelayanan, dan meningkatkan angka kematian. Tujuan penelitian ini adalah untuk mencari faktor yang dominan berkorelasi dengan ED LOS pasien di RS yang diteliti, untuk dapat dilakukan perbaikan secara sistematis. Desain penelitian menggunakan observasional analitik dengan pendekatan kohort prospektif dengan jumlah sampel 62 pasien. Triase, lama waktu pemeriksaan penunjang selesai, jumlah pasien di IGD, Boarding Time dan rasio perawat dibandingkan jumlah pasien saat pasien datang dihubungkan dengan lama pasien di IGD dalam hitungan menit menggunakan uji Pearson bila distribusinya normal dan uji Spearman bila tidak, lalu dilakukan penilaian terhadap kuatnya hubungan melalui koefisien korelasi (r), dilanjutkan dengan uji regresi linier untuk melihat faktor mana yang paling dominan untuk variabel dengan nilai p<0,25. Hasil penelitian didapatkan bahwa Triase (p=0,120), lama pemeriksaan penunjang (p=0,597), Jumlah pasien yang ada di IGD saat pasien datang (p=0,632), dan rasio perawat-pasien(p=0,313) tidak memiliki korelasi yang bermakna secara terhadap ED LOS. Terdapat korelasi yang bermakna antara Boarding Time dengan ED LOS (p<0,001) dengan kekuatan korelasi kuat (0,77). Kesimpulan penelitian ini adalah terdapat korelasi linear positif antara *Boarding Time* dengan lama pasien berada di IGD RS A dengan kekuatan korelasi kuat.

ABSTRACT

Factors Correlated with The Length of Stay of Patients in The Emergency Department of Hospital A, East Java. The issue of overcrowding in the Emergency Department (ED) has not been resolved in Indonesia, which can be caused by prolonged Length of Stay (LOS) of patients in the ED, resulting in delayed service time and increased mortality rates in the ED. The research design used observational analytics with a prospective cohort approach with a sample size of 62 patients. Research Findings: Triage, length of diagnostic testing, the number of patients in the ED at the time the patient arrives, and the nurse-to-patient ratio do not have a significant correlation with ED LOS. There is a significant correlation between Boarding Time and ED LOS (p<0.001) with strong correlation strength (0.77). There is a strong positive linear correlation between Boarding Time and the length of time patients stay in the ED (p<0.001) with strong correlation strength (0.77) and is a dominant factor with a capacity of 58.6% to explain patient's ED LOS.

INTRODUCTION

Health services in the world are still developing, and of course, many problems are arising. The increase in the number of world population and the increase in the life expectancy of the world population have resulted in new problems, especially in the field of health services. Various Degenerative diseases, autoimmune diseases, trauma incidence rates, and changes in the time of human activities from morning to dawn into 24-hour activity, increase the possibility of trauma and immediate medical treatment.[1]

The Emergency Department (ED) is the front face of a hospital and is one of the main entrances for patients to be treated in the hospital. The emergency room is one of the sections within a hospital that provides initial emergency care for patients suffering from serious illnesses and injuries, which can threaten their survival.[2]

ED Crowding is a global problem in all hospitals around the world, and efforts to solve this problem are still not yielding maximum results. ED Crowding can be caused by the prolongation of the patient's LOS in the emergency room, resulting in the accumulation of patients in ED. ED Crowding can result in time delays in providing services, resulting in an increase in the mortality rate in the emergency room.[3,4,5,6,7] LOS of patients more than 12 hours in the emergency room increased the mortality rate by 31.9% in moderate cases, 22.9% in difficult cases, and 10.4% in extreme cases.[8]

Emergency Department Length of Stay or ED LOS is the total time required by a patient, from the time the patient comes to the ER, the time required for registration, the time required to receive medical treatment and diagnostic processes, the time required for expert consultation, and the time required for to transfer the patient from the ER to the inpatient bed in the hospital.[9]

In Indonesia, the length of stay of patients in the emergency room is set at a maximum of 8 hours (480 minutes) [10], where the patient must be transferred to the inpatient room or intervention room (operating room, catheter lab, etc.) before the LOS in the emergency room reaches 8 hours (480 minutes).

METHOD

Quantitative research using primary data in the form of observation of the patient's timeline in the ER. The research design used in this study is observational analysis with a prospective cohort approach. The sampling technique used in this study is a purposive sampling technique where the sample is a patient that the researcher handles while on duty with a sample of 62 patients.

The number of samples obtained with the formula below, the minimum number of samples is 62 samples.[11]

$$n = \left\{ \frac{(Z\alpha + Z\beta)}{0{,}5 \ln \left(\frac{1+r}{1-r} \right)} \right\}^2 + 3 = \left\{ \frac{(1{,}96 + 1{,}28)}{0{,}5 \ln \frac{1+0{,}4}{1-0{,}4}} \right\}^2 + 3 =$$

note:
n = Minimum sample count
Zα = Fixed alfa derivatives [error type 1 = 5% (1,96)
Zβ = Fixed beta derivatives [error type 2 = 10% (1,28)]
r = minimal correlation considered meaningful

In this case, to analyze the dominant factors that correlate with the Length of Stay (LOS) of patients in the ED of RS A. The sample inclusion criteria are all patients who come to the emergency room, both patients who come alone and those who go through the referral process from April 2024 to May 2024 where examinations are carried out, either from the laboratory or radiology, or both.

Sample exclusion criteria are patients who come with the mechanism of preparation for surgery, patients with the outcome of death, discharged from the emergency room, leaving against medical advice, or patients with a nationally established timeline treatment algorithms such as the ACS response time algorithm for the cardiology cases and the response time algorithm for cesarean section for the obstetric cases.

Triage (categorical, P1 or P2), The length of time needed for supporting examinations from the time of sample collection to the completion of the results (numerical, minutes), number of patients in the emergency room when the patient arrives (numerical), Boarding Time (numerical, minutes) and Nurse-to-patient ratio when the patient arrives (numerical), correlated with the length of the patient (LOS) in the emergency room (numerical, minutes), using the Pearson test if the distribution is normal while if it is abnormal using the Spearman test, then an assessment of the strength and direction of the relationship through the correlation coefficient (r) is carried out, followed by a linear regression test to see which factor is the most dominant for the variable with a value of $p<0.25$. All statistics were analyzed using a 95% confidence degree, $\alpha = 0.05$, significant if $p < 0.05$. All statistical tests were analyzed using Statistical Product and Service Solution (SPSS) software 25.

RESULTS

In this study, patients' length of stay in the ED was collected by observing and recording the timeline prospectively from April to May 2024. The registry data was taken by purposive sampling of patients who came to the emergency room while the researcher was on duty in the ED, taking into account the inclusion and exclusion criteria of the researcher until the 62 samples needed for this study were reached.[11]

From prospective data collected from April 2024 to May 2024, the number of male patients sampled was 40 patients (64.5%) and female patients 22 patients (35.5%). The number of admitted patients with priority 1 was 21 patients (33.9%) and priority 2 patients were 41 patients (66.1%). The number of patients disposed to the Internal medicine department was 26 patients (41.93%), Surgery department 10 patients (16.3%), Neurology department 9 patients (14.51%), Pulmonary department and Orthopedic department 4 patients each (6.45%), Urology department and obstetrics department 2 patients each (3.22%), Ophthalmology department and pediatric department 1 patient each (1.61%). Patients admitted from the emergency room to the Operating room were 6 patients (9.67%), 37 patients (59.67%) were admitted to the low care unit, 12 patients (19.35%) were admitted to the High Care Unit (19.35%), and 7 patients were admitted to the Intensive Care Unit (11.29%). Patients with *emergency room LOS* more than 360 minutes (6 hours) were 51 patients (82.25%), while with *ED-LOS* less than 360 minutes (6 hours) as many as 11 patients (17.74%). Descriptive Table of Factors studied, Numerical data is presented in the form of central values of tendencies (mean, SD, median, minimum and maximum).

Table 1. Descriptive Table of studied Variables

Variable	Average ± SD	Median	Min	Max
ED LOS (Minutes)	524.62 ± 185,33	517	158	1092
Length Of Diagnostic Testing (Minutes)	125,19 ± 86,67	95	39	488
The Number of Patients in The ED at The Time The Patient Arrives	17,33 ± 5,97	16	4	35
Boarding Time	266,01 ± 143,66	248	43	737
Nurse to Patient Ratio	0,47 ± 0,22	0.46	0.2	1.75

Table 2 Bivariate Table of studied Variables

Variable	N	Mean/median (95% IK/min-max)	SD/IQR	Normality test (2-way p-value)	Linearity deviation test (2-way p-value)	Mann Whitney spearman / Pearson test (2-way p-value)	Correlation coefficient
Triage 1 – ED LOS	21	Median 584,29 (490,39-678,18)	206,27	0,018	-	-	Not Done Because P>0.05
Triage 2 – ED LOS	41	Mean 495,00 (158,00-869,00)	215,00	0,200	-	-	Not Done Because P>0.05
Length of Diagnostic Testing	62	95.00 (39.00-488.00)	88.50	<0.001	0.889	0.336	Not Done Because P>0.05
The Number of Patients in The ED at The Time The Patient Arrives	62	17,34	5,98	0,088	0,907	0,632	Not Done Because P>0.05
Boarding Time	62	266,02	143,67	0,078	0,567	<0,001	0,770
Nurse to Patient Ratio	62	0,4667 (0,20-1,75)	88.50	<0,001	0,663	0.313	Not Done Because P>0.05

The results of the analysis of the Triage with LOS of patients in the ED show that the data were normally distributed for patients with a priority scale of 2 (p=0.200) and not normally distributed for patients with a priority scale of 1 (p=0.018). With the Mann-Whitney test, the results were obtained that there was no significant relationship between the patient's priority scale and the patient's LOS in the ED (p=0.120). The results of the length of time needed for diagnostic testing with the patient's LOS in the ED showed that the data was not normally distributed (p<0.001) but was distributed linearly with a meaningless linearity deviation (p=0.336). After the Spearman correlation test was carried out, the results were obtained that there was no significant correlation between the length of time needed for the diagnostic testing and the patient's LOS in the emergency room (p=0.597)

The results of the analysis of the number of patients with LOS in the ED showed that the data was normally distributed (p=0.088) with a linear distribution with a meaningless linearity deviation (p=0.907). After the Pearson correlation test was carried out, the results were obtained that there was no significant correlation between the number of patients and the length of time the patient was in the ED (p=0.632). The results of the Boarding Time analysis with LOS of patients in the ED showed that the data was normally distributed (p=0.078) and distributed linearly with no significant linearity deviation (p=0.567). After the Pearson correlation test was carried out, the results were obtained that there was a significant positive linear correlation between Boarding Time and LOS of patients in the ED (p<0.001) with a statistically strong correlation strength (r=0.770)

The results of the analysis of the nurse-patient ratio to LOS of patients in the ED showed that the data was not normally distributed (p<0.001) but was distributed linearly with no significant linearity deviation (p=0.663). After the Spearman correlation test was carried out, the results showed that there was no significant correlation between the nurse-patient ratio and the patient's LOS in the ED (p=0.313).

Table 3.1. Linear Regression Test

Model	Unstandarized Coefficients		Std. Coefficients	Sig
	B	Std. Error	Beta	
(Constant)	260.499	32.086		<0.001
Boarding	0.993	0.106	0.770	<0.001

a. Dependent variables : ED LOS

Table 3.2. Linear Regression model table

Model	R	R Square	Adjusted R Square	Deviation Std.	Test Durbin - Watson
1	0.772[a]	0.596	0.583	119.72390	1,694
2	0.770[b]	0.592	0.586	119.30210	

a. Predictor (Constant), Boarding time, Triage
b. Predictor (Constant), Boarding time
c. Dependent Variable : ED LOS

ED LOS = 260,449 + 0,993 (Boarding Time)

The equation was obtained after the elimination of the patient's triage to obtain the best correlation coefficient and adjusted R2 results. According to the following table, it appears that the model obtained has the ability of 58.6% to explain the length of time the patient is in the ED, which means that there are still 41.4% explained by the variables that were not studied in this study. The Boarding Time variable also showed a statistically strong correlation strength (r=0.770).

DISCUSSION

In this study, the results were obtained that most of the patients who came during the research period were mostly patients with the P2 triage, and from the results of the analysis, there was no significant relationship between the patient's triage and the patient's ED LOS. This can be due to many factors, such as treatment efficiency, ED capacity, and other factors that may affect a patient's ED LOS.

Triage carried out by doctors improves the final outcome for discharged ED patients by accelerating the response time of patients being treated, reducing the rate of patients returning home without being examined by medical personnel, and regulating the flow of upcoming referral patients. However, doctor triage does not affect ED LOS for admitted patients because there are factors from outside the structure of the ED, such as the administration process and availability of in-hospital beds. Patients with P2 triage, who require fewer medical resources, still need the same length of stay in the emergency room. [12,13,14,15]

In this study, the results were obtained that there was no significant correlation between the length of the diagnostic examination and the patient's ED LOS (p=0.597). This is not in accordance with a study conducted by Kaushik(16), which stated that the length of diagnostic examination was strongly positively correlated with the patient's ED LOS. However, the results of this study are consistent with previous studies [4,17,18], where patient stabilization by medical personnel in the emergency room is carried out based on clinical symptoms and emergencies along with the process of diagnostic examinations carried out, not sequentially, without having to wait for the results of the supporting examinations to come out. In other words, patients don't need to spend extra time in the emergency room waiting for lab or radiology results; This test is usually done while the patient is being evaluated and treated in the emergency room. The length of time spent in the laboratory and radiology departments is not a major determinant of the length of time a patient spends in the ED in a hospitalized patient.[4,17,18,19]

In the observation, the results were obtained that there was no significant correlation between the number of patients treated when the patient came and the patient's ED LOS (p=0.632). This is in accordance with research conducted by Savioli[20]. Input factors, throughput factors, and output factors cause crowding. In the beginning, the input factors were the most studied, but then they were found to be less relevant. This can be caused by the good Standard Operational Procedure for patient care ED in the educational hospital. The availability of diagnostic facilities that support and operate 24 hours a day can also be a reason why the number of patients who are treated medically at the same time does not affect the patient's ED LOS, especially in terms of waiting for the results of the diagnostic examination because it can be done immediately in parallel.

During this study, the patient's medical treatment, which consists of emergency management and stabilization, observation, and diagnostic examinations, takes an average of 265 minutes and or about 4 hours. The length of time patients stay in the ED among these patients increases according to the level of need for advanced treatment rooms, where the need for rooms

with higher requirement will prolong the patient's LOS in the emergency room. This is in accordance with what is mentioned by (Lucas et al., 2009)[21]; where in the study, it was stated that the things that affect the LOS of patients in the ED are more dominantly influenced by the number of patients who will be admitted and the need for in-hospital beds, compared to the number of patients who come to the ED.

In this study, the results were obtained that there was a positive linear correlation between Boarding Time and the patient's ED LOS ($p<0.001$) with a strong correlation strength (0.77). This is in accordance with research [22] with the statement that Increasing the number of beds in the emergency room to treat patients does not reduce the patient's ED LOS; when the number of beds remains inadequate, solutions can be put in place to reduce or contain, but not solve, crowding. Without making improvements to Boarding Time, increasing the number of beds in the ED will only have a minimal impact. The main source of the increase in the length of time patients are in the ED is the waiting time for clinically stable patients to be transferred from the ED to the inpatient hospital bed.[23]

In this study, the results were obtained that there was no significant correlation between the nurse-patient ratio and the length of time the patient was in the emergency room ($p=0.313$). This is in accordance with the recommendation written by (Chapman et al., n.d.)[24], where the nurse-patient ratio in the emergency room is a maximum of 1:4 (0.25). At the time of observation, only 3 samples out of 62 samples had a nurse-patient ratio below 0.25.

In this study, there is still a possibility of bias for this factor because other medical personnel serve in the emergency room but not in the nurse formation, who provide medical care to patients, such as Residents and junior doctors.

From the multivariate analysis results, we can conclude that more than half of the patient's time in the emergency room of RS A is used for the Boarding Time process, and this can be estimated with a probability of 58.6% for each patient who comes and will be hospitalized. This is almost like previous research.[23]

In this study, the results of the model obtained have the ability of 58.6% to explain the length of time the patient is in the emergency room, which means that there are still 41.4% explained by variables that were not studied in this study. The Boarding Time variable also showed a statistically strong correlation strength ($r=0.770$).

CONCLUSIONS

The determined severity of the patient (Triage) did not have a significant correlation with the patient's ED LOS but indirectly affected the medical decision to admit the patient, which indirectly affected the patient's ED LOS. The length of the diagnostic examination does not have a significant correlation with the patient's because the patient's treatment and stabilization are carried out by medical personnel in the ED based on clinical symptoms and emergencies, in accordance with science, without having to wait for the results of the diagnostic examination to come out. So that the time for medical emergency management is often completed before the Diagnostic examination results are completed.

When the patient arrives, the number of patients in the ED does not significantly correlate with the patient's ED LOS. This can be due to proper SOP handling and sufficient nurses and other medical personnel (resident doctors and junior doctors). There was a positive linear correlation between Boarding Time and the patient's ED LOS ($p<0.001$) with a strong correlation force (0.77),

and it was the dominant factor that had the ability of 58.6% to explain the patient's ED LOS. There was no significant correlation between the nurse-patient ratio and the patient's ED LOS (p=0.313). An adequate nurse-patient ratio and the existence of other non-employee medical personnel, such as Resident doctors or junior doctors, can cause this.

The limitation of this study is in the selection of samples using the *purposive sampling method,* namely patients who are handled by researchers while on duty and observed on a timeline so that they cannot be used to generalize the findings of other studies because the nature of this research is localized

The suggestion from the researcher is that it is necessary to conduct follow-up research in the form of periodic quantitative research as an update to the previous research, the author also suggested that qualitative research be carried out to see the unanswered phenomena (by 41.4%) of the quantitative research on the variables of the most dominant factors affecting the length of stay of patients in the emergency room of Hospital A.

In the follow-up study, it can also be considered the use of an analysis method using *SmartPLS* which is based on variance to be able to answer the unanswered phenomena of this study, which factors can cause, the length of diagnostic examinations, the number of patients in the emergency room, and the nurse-patient ratio does not meet the classical assumption for regression analysis because of p>0.25.

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