Indonesian Journal of Global Health Research
Volume 8 Number 1, February 2026
e-ISSN 2715-1972; p-ISSN 2714-9749
http://jurnal.globalhealthsciencegroup.com/index.php/IJGHR

A PREDICTIVE MODEL OF PATIENT TRANSFER WAITING TIME FROM THE EMERGENCY INSTALLATION (ER) TO THE INPATIENT ROOM

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ABSTRACT
The waiting time for patient transfer from the Emergency Department (ER) to the inpatient ward is an important indicator in hospital health services. This process reflects the efficiency and effectiveness of the service flow, and can affect patient satisfaction, safety, and overall service quality. Delays in patient transfer are often a problem that has the potential to increase the risk of medical complications, prolong the length of stay, and increase the workload of health workers. This study aims to determine the predictive factors for patient transfer time from the ER to the inpatient (a case study in the ER Room of Dr. M. Djamil Padang General Hospital. This study uses an observational analytical quantitative research design with a cross-sectional approach. The sampling technique in this study is proportional random sampling. The sample consisted of all 283 patients transferred from the Emergency Department (ER) to the ward at Dr. M. Djamil Padang General Hospital, with specified inclusion and exclusion criteria. Data were collected through interviews and observations. Bivariate data analysis used Smart PLS to determine predictive factors for patient transfer waiting time from the ER to the ward. The results showed that ER factors significantly influenced System Factors and Room Factors, but did not directly influence patient transfer time.

Keywords: ER factors; system factors; waiting time

How to cite (in APA style)
Irwan, I., Fatmawati, F., Rusmanwadi, R., Alti, A. W., & Syafni, M. (2026). A Predictive Model of Patient Transfer Waiting Time from the Emergency Installation (ER) to the Inpatient Room. *Indonesian Journal of Global Health Research*, *8*(1), 633–640. https://doi.org/10.37287/ijghr.v8i1.1192.

INTRODUCTION

The waiting time for patient transfers from the Emergency Department (ER) to the inpatient ward is a critical indicator of hospital healthcare services. This process reflects the efficiency and effectiveness of the service flow and can impact patient satisfaction, safety, and overall service quality. Delays in patient transfers are often problematic, potentially increasing the risk of medical complications, prolonging hospital stays, and increasing the workload of healthcare workers.

Based on internal data, several patient complaints relate to suboptimal waiting times for patient transfers from the Emergency Department (ER) to the inpatient ward. This indicates the need to evaluate predictive factors that influence patient transfer wait times from the Emergency Department (ER) to the inpatient ward. This study aims to identify factors associated with patient transfer wait times from the Emergency Department (ER) to the inpatient ward at Dr. M. Djamil Padang General Hospital.

The output of this study is a local data-based predictive model for estimating patient transfer waiting times from the ER to the inpatient ward. Policy recommendations or an internal referral system to expedite the patient transfer process. Scientific publications in Sinta 3-accredited nursing journals. This research serves as evaluation and policy-making material for the management of Dr. M. Djamil Padang General Hospital (RSUP) to improve the quality of ER and inpatient services. The objective of this study is to determine the predictive factors for patient transfer time from the ER to the inpatient ward (a case study in the ER Room of Dr. M. Djamil Padang General Hospital).

METHOD

This study uses an observational analytical quantitative research design with a retrospective and cross-sectional approach. This study aims to build a predictive model based on historical data of emergency room patients transferred to inpatient rooms. The sampling technique in this study was proportional random sampling. The sample was all patients who moved from the emergency room to the inpatient room of Dr. M. Djamil Padang General Hospital, totaling 283 people, with specified inclusion and exclusion criteria. Data were collected from observations and interviews, and bivariate data analysis used Smart PLS which was used to determine the predictive factors of patient transfer waiting time from the emergency room to the inpatient room. The measuring instrument used was an observation sheet. IGD factors are the condition of readiness and

Service performance in the Emergency Room which includes HR, triage, service flow, and documentation. Measurement results with a Likert scale. The measurement tool uses observation and checklist based on the Emergency Room SOP, System factors are hospital system support in the patient transfer process including administration, information systems, and supporting data. Measurement results with a Likert scale, The measurement tool uses document review and service flow observation, Room factors are the readiness of the inpatient room to receive transfer patients from the Emergency Room, Measurement results with a Likert scale, The measurement tool uses an observation sheet for inpatient room factors. Etical Clearance from Dr. M Djamil General Hospital Number: DP.04.03 / D.XVI.10.1 / 295/2025.

RESULT

Table 1.
Respondent characteristics based on gender, age, and triage (n = 283)

Characteristics	f	%
Gender		
Male	142	50,2
Female	141	49,8
Age (years)		
Infant	19	6,7
Child	9	3,2
Adolescent	34	12
Adult	52	18,4
Elderly	169	59,7
Triage		
Red	126	44,5
Yellow	134	47,3
Green	23	8,1

Table 1 shows that the majority of respondents were male (50.2%), while the average age of ER patients was elderly (59.7%), while almost half were in the yellow triage area (47.3%).

Table 2 summarizes the measurement model assessment for the System Factor, the Igd Factor, and the Room Factor. Not all standardized factor loadings exceeded 0.70, indicating that the items did not adequately represent their respective constructs. The System Factor loadings ranged from 0.285 to 0.909, the Room Factor (R) from 0.434 to 0.901, and the Igd Factor (I) from 0.129 to 0.923.

Table 3 shows that the AVE values for IGD (0.879), System (0.904), and Room (0.904) exceed their respective squared correlations. For example, the squared correlation between and PND is 0.290, and between PND and MIBS is 0.064. The results of the discriminant validity test using the Fornell–Larcker criterion show that the AVE root value for each construct is still lower than the correlation between the other constructs. This indicates that discriminant validity has not been fully met, so that the IGD, System, and Room constructs have a high level of similarity in explaining the latent variables.

Table 2
Measurement Model Assessment for System Factors, ER Factors, and Room Factors

Constructs/Factors	Standarized Factor Loading
Transfer Time	(p=1,000; CR=1,000; AVE=1,000)
Sistem	
S1	
S2	
S3	
S4	
S5	
S6	
Room	
R1	
R2	
R3	
R4	
R5	
R6	
R7	
R8	
IGD	
I1	
I2	
I3	
I4	
I5	
I6	
I7	
I8	
I9	

Table 3
Construct Discriminant Validity Analysis

No	Construts	1	2	3
1	IGD	0,879		
2	System	0,958	0,904	
3	Room	0,956	0,932	0,904

Table 4
Path analysis results for emergency department factors, system factors, and room factors on transfer time in the emergency department

Patch Specified	Coefficient (β)	T Value	P Value	Result
IGD Factor->System Factor	0,119	8.533	<0,01	Accepted
IGD Factor->Room Factor	0,007	137.790	<0,001	Accepted
Factor IGD->Transfer Time	0,267	0.469	0,639	Non Accepted
System Factor->Transter Time	0,200	1.817	0,070	Non Accepted
Room Factor->System Factor	0,130	0.575	0,565	Non Accepted
Room Factor->Transfer Time	0,141	6.875	<0,001	Accepted

Table 4 and Figure 1 present the hypothesized relationships among these constructs. Positive relationships were identified between the IGD factor and the System factor ($\beta = 0.119$, T-value = 8.533, $P < 0.001$), the IGD factor and the Room factor ($\beta = 0.007$, T-value = 137.790, $P < 0.001$), and the Room factor and Transfer Time ($\beta = 0.141$, T-value = 6.875, $P < 0.001$).

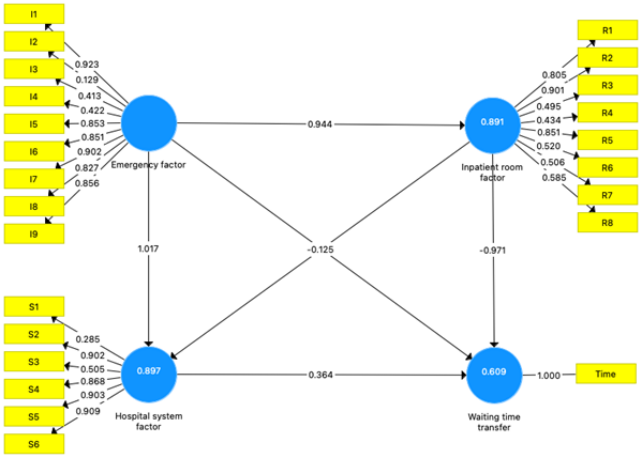

Figure 1. Model structure of the relationship between the IGD factor, the System factor, and the Room factor with Transfer Time.

The results of the analysis using Partial Least Squares–Structural Equation Modeling (PLS-SEM) showed that ED factors significantly influenced system and room factors. However, ED and system factors did not directly influence patient transfer times. Conversely, room factors were shown to significantly influence transfer times. These findings suggest that delays in patient transfer from the ED are more influenced by the readiness and availability of treatment rooms than by the initial processes in the ED or the hospital administration system.

DISCUSSION

Based on the research results, the majority of respondents in this study were male (50.2%). In terms of age, the majority of patients treated in the emergency department (ER) were elderly (59.7%). Meanwhile, based on severity level, almost half of the patients were in the yellow triage category (47.3%). This distribution of characteristics indicates that the ER patients at Dr. M. Djamil Padang General Hospital are predominantly elderly with moderate severity levels. This reflects the ER service burden, which extends beyond acute emergencies to patients with complex clinical conditions requiring supportive examinations, stabilization, and cross-unit coordination before transfer to inpatient wards. This complexity of care has the potential to contribute to long patient transfer wait times, making age characteristics and triage category important variables in developing a predictive model for transfer wait times

In the context of developing a predictive model for patient transfer waiting times from the ER to the inpatient ward, respondent characteristics are candidate independent variables, with the following considerations: because differences in clinical characteristics and disease patterns can affect the service process and transfer decisions. Advanced age has the potential to increase transfer waiting times due to: the presence of comorbidities, the need for additional examinations, higher clinical vigilance before patient transfer. Triage reflects the level of emergency and urgency of service, which directly affects: priority of treatment, length of patient stabilization, patient readiness to be transferred to the inpatient ward21.

The results showed that the Emergency Department (ED) Factor had a positive and significant effect on the System Factor ($\beta = 0.119$; $p < 0.05$). This finding indicates that the performance and management of the ED play a crucial role in supporting the operation of the hospital service system. The ED, as the main entry point for patients, significantly determines the effectiveness of workflow, inter-unit coordination, and adherence to standard operating procedures. Accurate triage, speed of clinical decision-making, and complete documentation in the ED can strengthen the overall service system 23. The significant influence of ED factors on system factors in this study aligns with research by Asplin et al., which states that the ED is a key component of the hospital service system, significantly influencing service flow and inter-unit coordination. Accurate triage, speed of

clinical decision-making, and complete documentation in the ED contribute to strengthening the overall service system.

Research by Wiler et al. also indicates that increasing process efficiency in the ED impacts the hospital's service system flow, although this does not always have a direct impact on clinical outcomes such as transfer times or length of stay. This supports the finding that the ED plays a more system-driven role than a direct determinant of patient transfer speed. 33, 35. Furthermore, the Emergency Department (ED) factor also significantly influenced the Room Factor ($\beta = 0.007$; $p < 0.05$), albeit with a relatively small coefficient. This suggests that the activity and volume of services in the ED are related to the readiness of the treatment room, such as bed availability and staff readiness in the destination unit. However, the small coefficient value indicates that this influence is not dominant and is likely influenced by other factors outside the ED, such as bed management and internal hospital policies.

The results of the study indicate a significant influence of ED Factors on Room Factors, although with a small coefficient. This finding is in line with the research of Forster et al. which stated that the surge in ED visits has an impact on increasing pressure on the availability of inpatient beds. However, the readiness of the treatment room is still strongly influenced by bed management and hospital policies, so the contribution of the ED to room readiness is indirect36. The research of Pines et al. also revealed that ED crowding is correlated with the limited availability of inpatient beds, but organizational and managerial factors have a more dominant role than operational factors of the ED7,22.

The analysis results showed that the Emergency Department (ED) factor had no significant effect on patient transfer time ($\beta = 0.267$; $p > 0.05$). This finding indicates that even if the service process in the ED runs well, it does not necessarily directly speed up the patient transfer process to the treatment room. Transfer time is more influenced by conditions after the patient is declared fit for transfer, such as room availability, facility readiness, and cross-unit coordination. Therefore, improving ED performance alone is not enough to speed up transfer time if it is not balanced by the readiness of the receiving unit.37

The finding of no significant influence of ER Factors on Transfer Time is in line with the research of Singer et al which states that patient transfer waiting time is more influenced by downstream factors, especially bed availability and the readiness of the receiving unit. Even though ER services are running optimally, patients can still experience transfer delays if inpatient rooms are not yet available 29. The research of Boudi et al also confirms that interventions that only focus on improving ER performance are not effective enough to reduce patient boarding times, without being accompanied by improvements in hospital capacity management 2,29.

System factors also did not show a significant effect on transfer time ($\beta = 0.200$; $p = 0.070$). Although statistically insignificant, the p-value approaching the significance limit indicates a trend toward a relationship between the service system and transfer time. This suggests that service systems, such as administrative flows, the use of electronic medical records, and inter-unit communication mechanisms, have the potential to influence transfer time, but are not yet operating optimally to provide a significant impact. Resource limitations and the complexity of patient cases likely play a role in weakening the system's influence on transfer speed.38

System factors in this study did not show a significant effect on transfer times, although they tended to be related. This is in line with research by Khanna et al., who stated that service systems, including electronic medical records and administrative flows, will only have a significant impact if supported by adequate resource availability (13.39).

Research by Moskop et al. also stated that systemic issues such as administrative procedures and internal policies often indirectly lengthen transfer times, especially in cases of highly complex patients requiring multiple inter-unit consultations (32). The results showed that room factors did not significantly influence system factors ($\beta = 0.130$; $p > 0.05$). This finding indicates that room readiness does not directly affect the overall service system, as the system is more determined by policies, regulations, and work mechanisms established by hospital management (20).

Conversely, Room Factors were shown to have a positive and significant effect on patient transfer times ($\beta = 0.141$; $p < 0.05$). This finding indicates that room availability and readiness are key factors in expediting the patient transfer process. Limited bed availability, rooms that are not yet ready for use, and delays in preparing facilities and personnel in the receiving unit can result in patients being delayed in the ED even when their clinical condition has stabilized.

The significant effect of Room Factors on Transfer Times is a key finding of this study and is consistent with previous research. Asplin et al. stated that limited inpatient beds are a major cause of delays in patient transfers from the ED. This study emphasized that high bed occupancy rates directly correlate with increased boarding times in the ED.

Research by Chalfin et al. also found that delays in patient transfer due to limited space were associated with increased length of stay and the risk of adverse events. 40 Furthermore, Hoot and Aronsky (2008) emphasized that room availability and facility readiness were key determinants in expediting patient transfers from the ED to intermediate care units. 3, 11.

The lack of a significant effect of ED factors on transfer times aligns with research by Singer et al., which states that patient transfer waiting times are more influenced by downstream factors, particularly bed availability and the readiness of the receiving unit. Even when ED services are running optimally, patients may still experience transfer delays if inpatient rooms are not yet available. 29

Boudi et al.'s research also confirms that interventions focused solely on improving ED performance are not effective enough to reduce patient boarding times without accompanying improvements in hospital capacity management.

Overall, the results of this study strengthen empirical evidence that patient transfer times are more influenced by structural and managerial factors, particularly Room Factors, than operational factors in the ED. This finding aligns with various previous studies that emphasize the importance of a systemic approach to addressing patient transfer delays. Therefore, interventions focused on strengthening room management, bed management, and cross-unit coordination are expected to be more effective in accelerating patient transfer times than interventions focused solely on the ED.

Research Strengths: Using a comprehensive multivariate analysis approach, this study employed PLS-SEM analysis, capable of analyzing simultaneous relationships between several latent constructs, thus providing a comprehensive overview of the factors influencing patient transfer times in the ED. It systematically examined the ED service flow. The study not only assessed clinical factors but also included system and room factors, enabling the results to represent the complexity of ED services as an integrated service system. This study is relevant to hospital operational issues.

The study focused on patient transfer times, a crucial indicator of ED service quality, and therefore offers practical value for hospital management in efforts to improve efficiency and patient safety. It provides empirical evidence of the dominant factors. This study successfully identified room factors as the most influential factor influencing patient transfer times, thus providing a basis for evidence-

based management decisions. It can also inform policy and intervention development. The results can be used as evaluation material in developing bed management policies, cross-unit coordination, and improving patient transfer flows in the ED.

Research Weaknesses: The study design is cross-sectional. This study only describes conditions at a specific point in time, so it cannot explain the longitudinal causal relationship between the factors studied and patient transfer time. The variables studied are limited. This study did not include other factors that could potentially influence transfer time, such as patient severity, healthcare provider availability, nurse workload, and clinical case complexity. Reliance on Respondent Perception Data Some indicators in this study likely stem from respondents' perceptions, potentially introducing subjective bias in the assessment of ED, system, and room factors. The study's findings are limited to a single hospital. This study was conducted at a single healthcare institution, so generalizing the results to other hospitals with different characteristics requires caution. This study did not specifically analyze the mediating role of System Factors or Room Factors in the relationship between ED Factors and Transfer Time, so the mechanism of the indirect influence has not been optimally described.

CONCLUSION

The research results indicate that the Emergency Department (ED) Factor significantly influences System Factors and Room Factors, but does not directly affect patient transfer time.

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