The Correlation of Transport Time and Boarding Time to Unexpected Events During Transport of Emergency Patients to Critical Care Unit

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Abstract

Background: Transport of emergency patients requires special attention because it has unexpected event risks. The vulnerable emergency department situation with complex cases, limited resources and multi-discipline makes the transfer risky. The emergency department patients that are worth to be transferred to inpatient rooms sometimes must wait until the referred rooms and their equipment are ready. Critical patients are vulnerable to any worsening condition due to acceleration or deceleration of movements. This research aims to find out the correlations among the nurses' experiences, hemodynamics monitoring and equipment preparation with unexpected things during transport of Emergency Patients to the Critical Care Unit.

Method: This quantitative study uses perspective-observational design. The sample consisted of 151 emergency patient transfer processes (the Emergency Department patients) that were transported to the Critical Care Unit. The ages of the sample are older than 16-year-old. The exclusion criteria are patients passing away in the Emergency Department or referred to other hospitals. The numerical data were analyzed by the Eta test while the categorical data were analyzed by Cramer's V test.

Results: From 151 observed patients, 119 patients experienced unexpected events. The bivariate analysis shows correlation between transport time and unexpected event ($F = 10.8$, F table $= 2.67$, $r = 0.425$). However, there is no correlation between boarding time in the Emergency Department to unexpected events ($p = 0.087$, $r = 0.208$).

Conclusion: Longer transport time leads to a higher risk of unexpected event occurrence. The companion officers should be able to prepare the patients properly, to ensure the routes of transport to be free, to promote strict monitoring during the transport process.

Keywords: *Unexpected events, transport, time, emergency, patients*

Introduction

The critical patient transports from Emergency Department require special attention[(1)]. The transport in an emergency and unstable condition has risks of complication occurrence and unexpected events of the patients' health[(2)(3)]. High patient volume entailed by complex severity level, a fast-working environmental characteristic that races against time and lots of interruption from various health worker types are causes of unexpected events in the Emergency Department[(4)].

The unexpected events during transports cover physiology and non-physiology[(5)]. *Moderate* unexpected events affect the treatment time[(6)].

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Studies mention the unexpected events prevalence of 254 observed-critical patients during the transports to diagnostic units are such as 134 unexpected events in 64 patients. They are oxygen disconnection with 38 cases (27.33%), ECG displacement with 27 cases (19.42%), 15 O_2 saturation decrease cases for more than 5% of the beginning (10.79%), 22 various blood pressure cases for more than 20% from the baseline (15.82%), 5 mental status change cases (3.59%) and 6 arrhythmia cases (4.31%)[7]. Other studies mention from 143 observed-critical patients, 86 adverse events occurred. 44.1% of the cases dealt with physiological function worsening. 23.5% of the cases dealt with equipment failures. 19.7% of the cases dealt with team failures. 12.7% of the cases dealt with lateness[6].

The literature studies show that boarding time in the Emergency Department causes patient-condition worsening, adverse event and mortality[8]. This research aims to find out the correlations among transport time and boarding time with unexpected events during transport of emergency patients to Critical Care Unit.

Material and Method

This quantitative study uses an analytic observational prospective design. There were 151 critical-patient transfer processes at levels 2 and 3 at a Central Java hospital. This study was conducted from January 5 until January 31, 2020. The applied sampling technique was consecutive sampling. The inclusion criteria included emergency patients aged older than 16-year-old and eligibility to be transferred to the Critical Care Unit levels 2 and 3. The exclusion criteria are passing-away patients and referred to other hospitals before being transferred.

The transport time was counted in minutes, stared from when the patients were transported from the Emergency Department until arriving at the Critical Care Unit. The boarding time in the Emergency Department was counted when the patients were determined by the Emergency Department physician to be eligible to transport until the patients were transported from the Emergency Department (in minutes). This research instrument is an observation sheet. It was undergone an expert judgment.

The data were processed by the assistance of SPSS version 16. The descriptive data are presented in frequency and percentage. The numerical data were analyzed by the Eta test while the categorical data were analyzed by Cramer's V test. The parameters of AEs during the transports were based on the model developed by Jones *et al* (2016). Table 1 was validated by 3 clinicians or experts in the field of emergency.

Table 1. Unexpected events during transfer of critically ill in hospital

Classification	Notes
Physiological	Early-systolic-blood decrease or increase > 20%, systolic <90 mmHg, O_2 saturation <90%, bleeding, RR < 8 or > 30, x/ min, HR <40 or> 130 x/min, new onset arrhythmias, agitation, seizures, decreased awareness (GCS), nausea/vomiting, increased pain score (CPOT), falling, Cardiopulmonary arrest (PEA, asystole), patients died.
Non-physiological	Oxygen supply depleted, ventilator unprepared, equipment falling, the low battery used, alarm, loose vein access device, non-current, change in ETT location, change in drain position, change in NGT/OGT position, dislocation of urine catheter, delay in destination > 5 minutes, the patient required travel restrain, discontinuation of therapy, medication errors, incomplete document.

Adapted with modification from (9)

Findings/Results

Table 2. The Frequency Distribution of the Respondents based on the Unexpected Events

Variable	F	%
Unexpected events during transfer		
Null	32	21.2
Occurrence unexpected events	119	78.8
Types of unexpected events		
Non-physiological	54	45.5
Physiological	33	27.7
Combined	32	26.8

The table shows from 151 respondents, 119 of them (78.8%) experienced unexpected events. Most occurring unexpected events were non-physiological unexpected events.

Table 3. Transport Time

Variable	Mean	Median	F	F table	R
Transport Time	14.99	14(4-50)	10.8*	2.67	0.425

It is significant if F> F table

Table 3, based on the Eta test, it is obtained an F score (10.8) > F table (2.67). Thus, there is a significant correlation between transport time to the unexpected events during transport of emergency patients to the Critical Care Unit.

Table 4. Boarding Time in the Emergency Department

Boarding time	F (%)	Unexpected events during transfer				r & p
		1	2	3	4	
> 120 minutes	66(43.7)	19(28.8)	15(22.7)	23(47.3)	9(13.6)	p=0.087
≤ 120 minutes	85(56.3)	13(15.3)	17(20.0)	32(37.6)	23(27.1)	r=0.208

1: Combined, 2: Physiology, 3:Non-Physiology, 4: Null

Table 4 shows most respondents had boarding time lower than 120 minutes. There is no correlation between boarding time in the Emergency Department to unexpected events during transport of emergency patients to the Critical Care Unit with a p score (0,087) > α (0,05).

Discussion

Correlation between transport time and unexpected events during transport of emergency patients to the Critical Care Unit: The length of the transport time was counted since the patients left the Emergency Department until they arrived in the Critical Care Unit. The observation results show significant correlations between equipment preparation and the incidents during emergency patients to the Critical Care Unit with a positive correlation direction. Longer transport time leads to a higher unexpected events occurrence. There are correlations between the transport time to unexpected events during critical patient transport from the Critical Care Unit heading to diagnostic and therapeutic units with transfer time median 45 minutes (10-255 minutes)[9].

This research has a median score of 14 minutes with a minimum score of 4 minutes and a maximum score of 50 minutes. The minimum and maximum thresholds of the transport duration in this research are categorized as lengthy. It was due to the respondents were not grouped based on their transport routes. The level-3 transport patients had radiology checkups in the room. Meanwhile, the level-2 transport patients stayed in the Radiology Unit to have X-ray or CT-Scan checkups. It made the transport time of the level-2 patients longer than level-3 patients.

Most respondents in this research had transport time less than 36.5 minutes. Transport time is the required time to transport a patient from one place to another place. During the transport, nurses require various transport time in the hospital with an average time of 42 minutes[10][11]. The unexpected events, especially physiology and non-physiological events, would occur in patients who had transport duration longer than 36.5 minutes under the external setting of Intensive Care Unit[12]. Other studies mention the duration of critical-patient transport inside of hospitals for less than 60 minutes would have cardiac-arrest risk[3]. The observation results show there is one of 151 respondents (0.006%) suffering *cardiac arrest* with 32 minutes-transport length time.

Other strong influential factors during the transport are the team's ability in organizing the patients during the transport and the standard operational procedure (the hospital protocol) that has been tested[12]. The route and the time when the patients must be communicated among the transport companion teams, the referred rooms and the security officers when it is deemed necessary[13][14]. A safe-transport system application that is combined by prospective-nursing intervention would be effective to improve transport time efficiency and to avoid unexpected events during critical patient transport in hospitals[15]. Longer transport time led to higher vital-sign instabilities, especially systemic blood pressure. However, if it was correlated to the whole unexpected events, there was no correlation between transport time variables to unexpected events of critical patients during transport[16]. This research is not in line with the previous studies telling that there is a significant correlation between the length of transport time to unexpected events during critical-patient transport in hospitals[17][9][18][19]. The research shows there is no

correlation between transport duration to unexpected events during critical patient transport[20]. The transport duration factor is extremely influenced by location and transfer system owned by each hospital. The estimation of the required total transport time should have been prepared properly by the transport companion staff.

Correlation between boarding time with unexpected events during transport of emergency patients to the Critical Care Unit: Boarding time in this research was calculated since the patients were deemed to be transferred until the patients left the Emergency Department to be transported to the Critical Care Unit. The boarding time is grouped into 2. They are ≤ 120 minutes and > 120 minutes. The findings showed the boarding time in Emergency Department was not correlated significantly to unexpected events during transport of emergency patient to the Critical Care Unit. It is in line with the previous studies by classifying the lateness in the transport process to be > 20 minutes and > 60 minutes in which physiological unexpected events were not correlated to the lateness of the transport time[17]. Other studies mention that longer boarding time, > 20 minutes in Emergency Department, is a dangerous factor to critical patient worsening conditions[21].

The boarding times of the respondents were mostly ≤ 120 minutes, experienced by 85 persons (56.3%). The standard of a boarding time in this research is 3 hours after being deemed eligible to be transported. Then, the maximum observation in the Emergency Department is 6 hours when the referred room is full. The policy is not appropriate with the consensus of *the Agency for Health Care Research and Quality.* In the performance assessment, it is mentioned that boarding time is an interval from the patients deemed to be inpatient until the patients are transported within ≤ 120 minutes[22].

Insignificant correlation between boarding time and unexpected events during transport of emergency patients to Critical Care Unit was caused by the boarding time that was still relevant, ≤ 120 and the ED officers' skills in monitoring the critical patients while waiting to be transported. The observation results show thathemodynamics monitoring administered by the transport-companion officers is respectable. Thus, although almost 66 (43,7%) respondent of emergency patients experienced lengthy boarding time to be transported, as long as the doctor and the nurse were still monitoring their conditions properly, unexpected events would not occur.

Related studies showed that patients with boarding times longer than 2 hours experienced unexpected events with a percentage of 2.5%. Meanwhile, patients with longer than 12 hours experienced unexpected events with a percentage of 4.5%[22]. Based on the research, it could be concluded that unexpected events occurred in boarding times for more than 120 minutes. Longer boarding time would lead to higher unexpected events. The average of the respondents' boarding times to be transported from the Emergency Department in this research is 107 minutes.

In this research, 66 patients (43.7%) experienced boarding times for more than 120 minutes. The speed of the patients' transports after being decided to be transported or to be inpatient depended on several factors. They were the numbers of the treated patients, the clinical conditions of the patients, the family decision for the follow-up treatment[23]. The number of inpatient patients would influence the length of service because each patient had a different treatment necessity. The roles of the families in deciding further treatment were important. Critical patients that wait for their family decision to be treated Critically sometimes occur because of the treatment costs and the absence of the family that has the highest authority upon the patients. In this research, the causal factors of long boarding time were dominated by the unavailability of beds in Critical care units. Therefore, patients should wait until the bed in the referred room was available and ready to use. Lengthy boarding time causes patients/employees unable to proceed to the next activities in the next stage[24].

Conclusion

Transport time is significantly correlated to an unexpected event. Longer transport time of Emergency Department patients to the Critical Care Unit leads to a higher unexpected event occurrence. The transport companion officers must ensure the transport route is free from obstacles, to monitor the patients that stay in the radiology unit before being transported to the room and to predict any unexpected events during the transport.

Acknowledgment: Thanks to Mr. Ahsan, Mrs. Yulian Wiji Utami and Mrs. Septi for their contribution to this study.

Conflict of Interest: The authors declare there is no conflict of interest.

Source of Funding: The research is personally funded.

Ethical Clearance: This study has received ethical clearance from the Health Research Ethics Omission at one of Regional Public Hospital in Central Java, Number. 1.418/XII/HREC/2019. The researchers reviewed the respondents' components. When the patients were fully conscious, then informed consent was done directly by the respondents. However, when the patients suffered a loss of consciousness, then the consent was done by the patients' families. Each respondent was informed about the research, starting from the purpose, objective and procedure of the research. Every respondent was anonimity. All data were kept in secrecy for the sake of the research.

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