ORIGINAL ARTICLE

Timeliness of Interhospital Patient Transfer (IHT) within Hospital Kluster Perak Utara, Malaysia.

Mohammad Miqdam Abdul Aziz[1], Narwani Hussin[2], Chng Xiao Yuan[1], Osman Ali[3].

[1]Hospital Taiping, Ministry of Health Malaysia.
[2]Clinical Research Centre Taiping, Ministry of Health Malaysia.
[3]Department of Community based, Faculty of Medicine, Royal College of Medicine Perak, Universiti Kuala Lumpur, Ipoh, Perak, Malaysia.

Corresponding Author
Prof. Dr Osman Ali
Department of Community based, Faculty of Medicine, Royal College of Medicine Perak, Universiti Kuala Lumpur, Ipoh, Perak, Malaysia.
Email: osmanali@unikl.edu.my.

Submitted: 05/08/2022. Revised edition: 15/09/2022. Accepted: 16/09/2022. Published online: 01/11/2022

Abstract

Background: Interhospital transfer of patients is one of the strategic integrated healthcare delivery systems and involves a series of essential preparation and coordination from both facilities. Research has shown that the emergency department as the gatekeeper to the hospital required continuous quality improvement activities to enhance workflow processes to overcome the ongoing congestion issue.
Methods: This study aims to analyse the timeliness of step-up care interfacility patient transfer within Hospital Kluster Perak Utara. A cross-sectional study using data of October, 2019 was used, and a timeline to represent the journey of step-up care of interhospital transfer in the emergency department of Hospital Taiping was analysed.
Results: Analysis of the data demonstrated that duration of review time (RTR) (median 70, IQR 70) accounted for a large proportion of time-consuming workflow (59.5%). Factors that increase the overall Interhospital transfer process are multidisciplinary referrals and the requirement to do the emergency department procedure. Total Bed Waiting Time (TBWT) is more extended for the medical ward (median 30, IQR 28).
Conclusion: The result indicates that there are potential time-reducing strategies that can be applied and benefited both facilities. Further research is needed to test the quality improvement program that could enhance interhospital patient transfer.

Keywords: *Interhospital patient transfer, Total Bed Waiting Time (TBWT), timeliness of step-up care.*

Introduction

The interhospital patient transfer process is a highly complex workflow involving many interdependent procedures, critical steps, and a degree of unpredictability [1] and exposes critical errors and adverse patient safety. It is strongly recommended that patient safety should be the number one priority in healthcare design [2]. Healthcare service needs to be safe, effective, patient-centred, timely, efficient, and equitable. In Malaysia, Interhospital transfer between government healthcare facilities is an essential service to ensure the continuity of treatment and provide optimal care for patients. Three types of referrals happened in government hospitals in Malaysia, step-up care (a non-specialist hospital to a minor or a major specialist hospital), the same level of care or step-down care (a specialist hospital to non-specialist hospital). The flow of care for interhospital patient transfer is based on the guideline on Referral and Interhospital Patient Transfer Within Facility of the Ministry of Health [3].

The Hospital Cluster Service is one way to provide a better outcome in the healthcare system as shown in the Province of Ontario, Canada [4]. The main aims of the service are to improve access to safe and quality care for the patient, maximize the human resource and existing assets, and improve the hospital network's integration [5]. To optimize patient safety and clinical outcomes in this service, detailed knowledge of the factors that may influence interhospital patient transfer workflow are a necessity. Many studies have been conducted elsewhere to investigate factors that affect the timeliness of IHT [6][7][8]. Some factors identified include sociodemographic, communication between sending hospital and receiving hospital (handover), coordination of the transfer process, standard operating procedures (SOP) and bed availability.

In Malaysia, the cluster hospital concept was introduced by the Ministry of Health (MOH) in 2010. Although there were numerous studies on patient safety during interhospital transfer, only a few of them mention the timeliness aspect of patient transfer. Timeliness is referring to reducing waiting time and sometimes harmful delays for those who receive and those who give care. Optimizing patient flow in a clinical setting and currently extending to interhospital transfer through the lean project's initiatives has since become the focus since 2014 in Malaysia. The scarcity of information in terms of timely interhospital transfer in Malaysia and no study done so far in Hospital Kluster Perak Utara on this aspect led to this study. This study will analyse the timely aspect of interhospital transfer services and recommend the appropriate changes to improve the service.

Materials and methods

This is a cross-sectional study in Hospital Kluster Perak Utara using retrospective data from 1st October 2019 to 31st October 2019. All referrals during this period and step-up care cases from Hospital Kuala Kangsar (HKK), Hospital Parit Buntar,(HPB) Hospital Selama (HS) and Hospital Gerik (HG) to Emergency Department Hospital Taiping were studied. The travel distance and travel time taken to reach Taiping Hospital from four non-lead hospitals in Northern Perak are shown in figure 1. The unstable patient who require resuscitation and lifesaving procedure, the unstable patient who is taken over by the ED Hospital Taiping and no longer require an accompanying team from the district hospital, the patient who requires more than three multidisciplinary team assessment during interhospital patient transfer and the patient who returns to their respective hospital due to no further management is needed in the specialist hospital and can be treated in the district hospital were excluded from the study. Samples from 'sending back patient to the district' were excluded due to the incomplete process of the IHT, where the patient was not admitted to the ward and could be managed in the district hospital. Unstable patients were excluded because the case was taken over completely by the emergency

department of Hospital Taiping and no longer require accompanying team from the district hospital.

This study uses the data collected from a Lean Healthcare Hospital Kluster Perak Utara: Study on Timeliness of Interhospital Patient Transfer within Hospital Kluster Perak Utara. The time recorded in the IHPT (interhospital transfer) form was used to calculate the event interval. Data collection was done by the accompanying or transporting team from district hospitals via google forms. This form was made in a google format to ensure the easy submission of data using a mobile phone. Before the study started, a briefing and training session were done for all the supervisors of the accompanying team. A pilot study for one week (in September) was done to ensure the reliable data collection procedures, calculate the sample size needed and conduct the troubleshooting process. The total of 39 patients were recruited and the time taken to complete the IHT was 123.7 $\pm$ 63.9 minutes, The transporting team was responsible for filling up the form, either by the accompanying medical officer, nurse, or medical assistant. The data collection was modified for those who have difficulty submitting the data using the mobile phones. They must fill up a standard form in a hard copy while accompanying the patient and submit the data later when they have access to the computer.

The time recorded include the time of arrival in Hospital Taiping, time of primary team reviewed the cases, the time medical procedure was conducted in A&E by the primary team, time of resuscitation started by A&E, time of completed review of the case, time of decision made to admit patient or sent back to the referral hospital, the time when the respective ward accepted the case, time of patient arrival at the ward and time of departure of transporting team going back to the district hospital. The time intervals calculated were calling primary team (time of arrival at Hospital Taiping to the time when the transporting team called the primary team), arrival duration of the primary team (the time when the transporting team call the primary team to the time when the primary team arrive to review the patient), duration of review time (time of arrival until the time all the department completely review the patient), bed ready time (BRT) (time taken by the lead hospital to arrange the bed to the time taken patient admitted in the ward), register to ward arrival (REG)(the moment ward accepted the case to the time patient's arrival at ward), total bed waiting time (TBWT)(time decision made for patient admission to the time patient admitted to the ward), patient length of stay (PLOS) (time of arrival at Taiping Hospital to the time patient admitted to the ward) and staff length of stay (SLOS)(time of arrival at Taiping Hospital to time transporting team leave). Value management stream will be drawn for the analysis.

Sample size estimation was calculated using the population mean formulae [9]. Prior data based on the pilot survey indicate that the mean was 123.7 minutes (standard deviation = 63.9) and the population size is 1500. If the Type I error probability and precision are 0.05 and 0.05, we will need to study 323 samples. With an additional 10% dropout rate, the sample size is 359 samples. Since the number of IHT patients during this period was 355 then all patients were selected.

Statistical Analysis

The analysis was done using SPSS version 25[10]. Descriptive data expressed as mean ± standard, median and IQR for non-normally distributed data. The Mann-Whitney U test was used to test whether the mean time taken between those with procedures and those without referral was equal. Kruskal-Walli's test was used to test statistical differences between two or more independent groups.

Ethical approval

Ethical approval for this study was obtained from the Medical Research and Ethics Committee (MREC), Ministry of Health Malaysia and Royal College of Perak Medicine Ethical Committee.

The study complied with the ethical principles outlined in the Declaration of Helsinki and Malaysian Good Clinical Practice Guideline. The investigator declares no conflict of interest.

Results

Profiles of the samples

From 1st October 2019 to 31st October 2019, there were a total of 355 cases submitted via google forms. However, 122 cases were excluded based on the exclusion criteria and only 233 cases were analysed (65.6%) (Table 1). 104 cases (44.6%) came from Hospital Kuala Kangsar (HKK) followed by Hospital Parit Buntar (HPB) (30.9%) and Hospital Selama (HS) (16.3%) and Hospital Gerik (HG) (8.2%).

Frequency of department referral to Hospital Taiping

Single departmental referral from non-lead hospitals is the highest with 174 (74.7%) referrals to Hospital Taiping, followed by two department 52(22.3%) and three departmental 7(3%).

Baseline of the time interval for the various workflow of step-up care interhospital patient transfer (IHT).

Table 2 showed the minimum, maximum, median, and mean for each time interval workflow. From the data, apart from PLOS and SLOS, the RTR is the most time-consuming workflow during IHT. It accounted for 59.5% of the overall workflow process. The least time-consuming workflow is called up the primary team on arrival with a mean of 9 minutes (sd 13.9) and followed by BRT with mean of 15.6 minutes (sd 19.2). The longest time taken for staff to stay in Hospital Taiping during the IHT is 375 minutes (6 hours and 15 minutes). All the time intervals were not normally distributed (using Kolmogorov-Smirnov test of normality).

Procedures done during IHT

Of 233 cases, slightly more than half, 120 (51.5%) performed procedures in the emergency department (ED) of Hospital Taiping. The highest number of procedures done during IHT is 44 cases (36.6%) for blood sampling, followed by the CT scan 41(34.1%), X-Ray 11(9.1%) and bedside procedures 5(4.1%).

Referral received during IHT

The medical department received the highest number of referrals, with 113 cases (48.5%), followed by the surgical department 94(40.3%) and the Orthopaedic department 14(6%).

Comparison of time intervals taken of various IHT between the three major departments.

Kruskal Wallis's test was done to test whether there are differences between the time interval of various IHT and three major departments referred in ED Hospital Taiping. The arrival duration of primary team time interval was significant between Medical, Surgical and Orthopaedic Department (p-value ≤ 0.05). The surgical team has the lowest median (14.5 minutes) and orthopaedic has the highest median (39 minutes). There was a significant difference of BWT between the three departments. The orthopaedic team has the lowest median (20 minutes) and medical team has the highest median of 30 minutes.

Comparison of time interval taken of various IHT workflow between non-lead hospitals.

Kruskal Wallis test was done to test whether there are differences between the time interval of various IHT workflow and four referring hospitals. There was no significant difference between various IHT workflows and non-lead hospitals except register to ward arrival time (REG). REG was found to have a significant difference between four non-lead hospitals ($p \leq 0.05$). HKK had the highest median of 15 minutes. The other hospitals had the same median of 10 minutes.

Comparison of time interval taken of various IHT workflow between number of departments referred.

Mann Whitney U test was used to test the significant difference between the time interval of various IHT between the number of departments referred (either only one department or more). Out of 8-time intervals tested, there were four performance matrices with significant differences in the number of departments referred. They are RTR, REG, PLOS and SLOS with P-value ≤0.05. For RTR, more than one department referral was 45 minutes higher (median 105 minutes) than one department (median 60). For REG, with >1 department 3 minutes lower (median 10 minutes) than one department (median 13 minutes). For PLOS, with >1 department 50 points higher (median 150 minutes) than one department (median 100 minutes). For SLOS, with >1 department 50 points higher (median 165 minutes) than >1 one department (median 115 minutes).

Comparison of time interval taken of various IHT workflow between procedures done during IHT.

Mann Whitney U test was used to test the significant difference between the time interval of various IHT between procedures done during IHT (Yes or No). A three-performance matrix has a significant difference between cases doing the procedure(s) or not doing any procedure in ED Hospital Taiping. For RTR, with procedure 34.8 minutes higher (median 91.4 minutes) than no procedure (median 56.5 minutes). For PLOS, with procedure 32.5 minutes (median 125 minutes) than no procedure (median 92.5 minutes). For SLOS, with procedure 30 minutes higher (median 135 minutes) than no procedure (median 105 minutes).

Discussion

The total number of cases referred from non-lead hospitals in the month of October 2019 looked small (n = 355) compared to the number of outpatients who visit ED Hospital Taiping in the same month. The data taken from Medical Record Unit Hospital Taiping showed ED Hospital Taiping received a total of 9081 cases in October 2019. Many cases were referred by other medical facilities in the state because the referring medical facilities do not have the appropriate expertise, equipment or diagnostic tools and facilities to accommodate them in the non-specialist hospital care [11]. The critical elements of safe transfer involve a decision to transfer and communication, pre-transfer stabilization and preparation, choosing the appropriate mode of transfer, and finally, the patient's documentation and handover at the receiving facility [12]. Thus, it is significant to facilitate a better workflow and increase the efficiency in the receiving specialist hospital since Cluster Hospital Service is the way forward in promoting health equity under one organization as intended by the guideline on referral and Interhospital Patient Transfer within facilities of Ministry of Health, 2009 [3].

Interhospital transfer of the patient is one of the most complicated and high-risk patient transfer care procedures in coordination and patient safety. It is a critical step in the healthcare delivery system to ensure continuity of patient care [13]. In most of the hospital setting, the emergency department in the referred facility is the central transitional place to cater to all the interhospital transfer process before the patient admitted and accepted to the ward. Congestion in the Emergency Department as the gatekeeper to the hospital is considered a challenging issue worldwide [14].

In this study, it was noted that the highest referral came from HKK (44.6%). This result was expected due to the geographical location of all the non-lead hospitals. HPB is closed to Hospital Kulim, a minor specialist hospital only 34 minutes away. Meanwhile, HG is located far away in a rural area with much less population density. However, the results indicated that 23.7% (84/355) of cases referred, could be managed, and treated in the respective district hospital. Probably, the referring hospital sending the patients to the Hospital Taiping for diagnostic purposes or the

primary team in the specialist hospital found the condition of the patients did not require admission. This situation implied that the team in non-lead hospital could reduce unnecessary referrals by getting further training and experiential learning.

The timeline model created in this study was based on the measurable performance metrics analysed via Value Stream Mapping (VSM), which is a commonly used method in Lean Healthcare. It is a quality improvement tools to enhance critical healthcare workflow, improving patient safety and eventually raising the healthcare quality standard [15]. The aim was to identify the point of handover processes in between workflow. However, the actual workflow is more complex and unpredictable. The healthcare delivery system's timeliness aspect in the step-up care of the interhospital transfer process is important in reducing operational cost and manpower planning. However, there were limitations in collecting the data accurately since it requires cooperation from the accompanying team, who need to handle the patient simultaneously. In this study, all the time intervals for the study were not normally distributed and were positively skewed. From the data analysis, RTR (median 70 minutes) was the most time-consuming workflow during IHT, followed by TBWT (median 25 minutes). Another study had shown that RTR might be reduced by assigning a senior doctor from the speciality to assess the referred patient in the ED and make clinical judgement and treatment plan [16]. This point should be discussed in the multidisciplinary meeting for quality improvement. The study showed the longest accompanying team's overall duration in the Hospital Taiping is 375 minutes (6 hours and 15 minutes). The difference between PLOS (median 108 minutes) and SLOS (median 125 minutes) was 17 minutes (duration of the accompanying team depart after admitting the patient). The handover process to the accepting ward needs to be carefully done to avoid adverse patient safety. No comparison could be made to other studies due to the differences in clinical settings and health systems.

There is no fixed performance matrix in the time interval in the emergency department (ED) used worldwide. There is still a lack of consensus on which performance measures are most accurate, extensive, precise, and evidence-based [17][18]. Time interval is one of the quality aspects taken into consideration to reflect the healthcare quality in the ED[19][20] where most of the performance matrix is distinctive and had its application to the local healthcare delivery settings. The review identified 55 ED performance measures and found out time intervals were the most recommended performance measures. In this study, most of the cases (74.7%) were referred to a single department in the ED of Taiping Hospital. RTR is higher in multidisciplinary referral (median 105 minutes) compared to a single department referral (median 60), mostly due to the nature of multiple medical examinations and diagnostic procedures done at the bedside by different doctors and specialty. RTR was the key to improving the overall workflow because it accounted for 59.5% of the overall workflow process. Both SLOS and PLOS were higher with the multidisciplinary referral. Interestingly, the orthopaedic team took longer period (median 39 minutes) to see the referral cases, whereas surgical team has the lowest time taken to see patients in the ED. The difference in the response was possibly due to the urgency of the cases referred.

TBWT also had significant differences between the three departments. The orthopaedic team had the lowest median 20 minutes whereas medical team had the highest (median of 30 minutes). The medical ward was known to be the busiest in the specialist Hospital and preparing the bed for incoming patients might take a while. In the current practice, the step-up care IHT workflow is known to go through the ED. Thus, it is suggested that eliminating the step and admitting the patient of specific criteria straight to the ward may save a lot of time.

More than half (51.5%) of cases coming through ED Taiping Hospital require procedures before being admitted to the ward. One study proposed a comprehensive bed manager model to reduce waiting times in ED. Patients were admitted directly to the ward and all procedures were requested from the ward [21]. CT scan procedure was the most time-consuming procedure compared to the blood samples procedure, X-Ray, or ultrasound. In Taiping Hospital, all patients from a referring hospital would be lodged in ED before being called by the CT scan room. This step was one of the wastes that can be eliminated by bypassing ED and going straight to the CT scan's waiting area. The finding was different from a study which show that the waiting time 51-63 % of the total patient turnaround time in the Emergency Department was due to x-ray examination, waiting time for the first physician's examination and waiting time for blood work procedures [22]. However, in that study, the population was among patients who were seen through ED, not those from the interhospital transfer.

There were few significant differences between various IHT workflow and procedures done during IHT. RTR with procedure score 34.8 points higher (median 91.4 minutes) than no procedure (median 56.5 minutes), PLOS with procedure 32.5 points higher (median 125 minutes) than no procedure (median 92.5 minutes) and For SLOS with procedure 30 points higher (median 135 minutes) than no procedure (median 105 minutes). These results indicated that more improvement was needed to cut waste during the IHT workflow procedure, such as pre-arranging CT scan slot, especially during night-time before the patient arrives at ED or pre-ordering blood samples in the referring hospital itself. Action should be taken also to reduce SLOS such as taking over the referred patients by the primary team or ED team if the IHT time took too long especially with multidisciplinary referrals.

HKK had a significant difference in the duration for Register to Ward Time Arrival (median of 15 minutes) compared to the other hospitals (median of 10 minutes). The reasons for the accompanying team from HKK taking a longer time to send patients to the ward as compared to other hospitals require further investigation and verification.

Many efforts and interventions had been documented to improve the patient flow and congestion in ED over the year, however, the systematic reviews published between 2000 and 2017, showed that the evidence supporting the interventions to improve patient flow is weak [23]. More study is required to understand the flow of patients in ED using the current technology to improve its performance.

This study was subjected to a lot of limitations such short duration of data collection, recorded time was not done on time, the details of workflow such as time interval for the procedure, each multidisciplinary team's review time and travel time from referring hospital to Hospital Taiping were not recorded. Other internal and external factors such as the number of staff, staff skills and efficiency, mechanical problems of transport and equipment, the time of year or season have not been considered in this study as such the results have a limited inference to other hospital clusters or health services in general.

Conclusion

This study can only reflect the IHT of Hospital Kluster Perak Utara as the management of IHT is different from each cluster hospital in Malaysia. Based on the quantitative analysis of timeliness of step-up care of IHT workflow, few areas of possible improvement can be done to improve the IHT. Through the process of elimination in the workflow, direct admission into the ward for stable patients from NLH and bypassing ED is a plausible solution to improve the timeliness of IHT. However, correct assessment and decision need to be made as to which patients are suitable for direct admission without compromising their safety. Empowering a bed manager and a good bed monitoring system may improve coordination between the different teams in bed management

to reduce TBWT. The results may help the hospital administrator to start implementing quality improvement initiatives enhance overall healthcare services. Further studies are needed to investigate the effects of IHT on human resource of referring hospital, staff satisfaction and patient safety.

Acknowledgements
The authors would like to thank the Director General of Health Malaysia for permission to publish this paper.

Declarations
Ethical approvals of the study were obtained from the Medical Research Ethics Committee (MREC), Ministry of Health Malaysia (NMMR-20-1400-55101)

Competing interests
The authors declare that they have no competing interests.

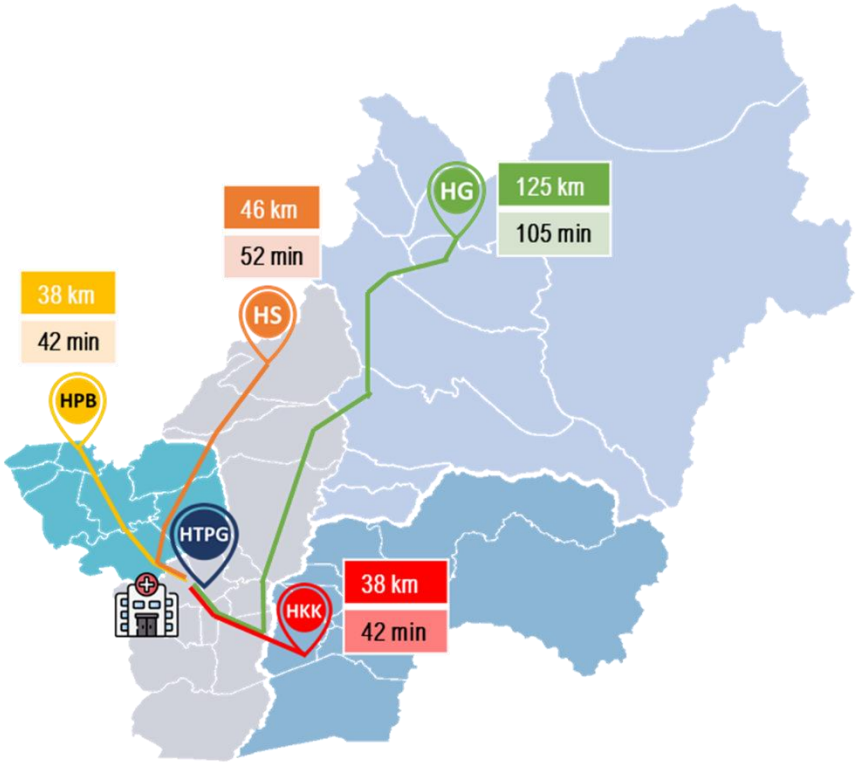

Figure 1. Travel distance and travel time taken to reach Taiping Hospital from four non-lead hospitals in Northern Perak.

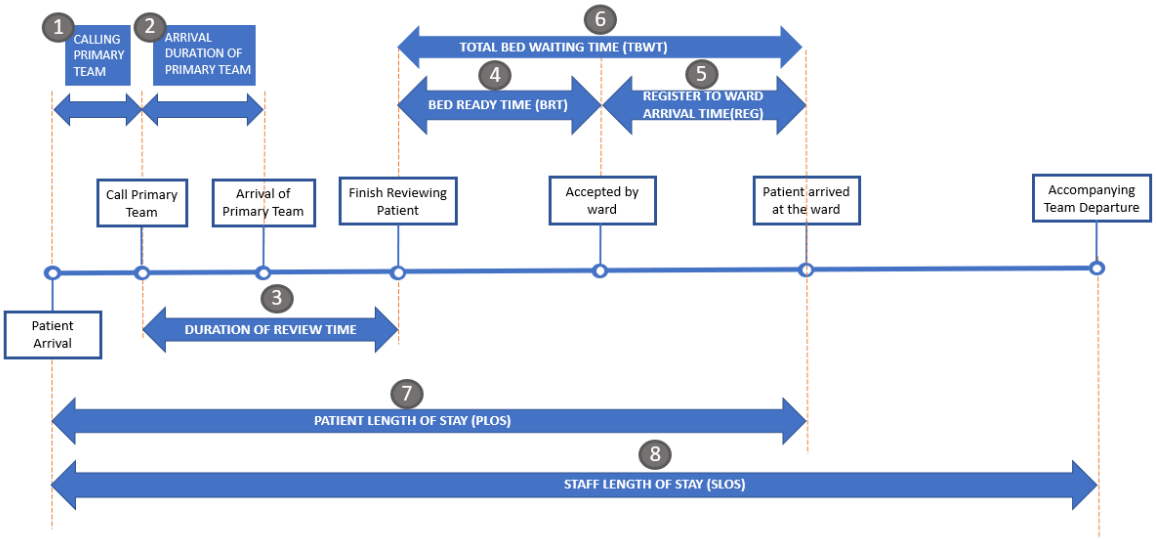

Figure 2. The value management stream of IHT from the point of patient arrival in ED Hospital Taiping until the departure of the accompanying team from referring hospital.

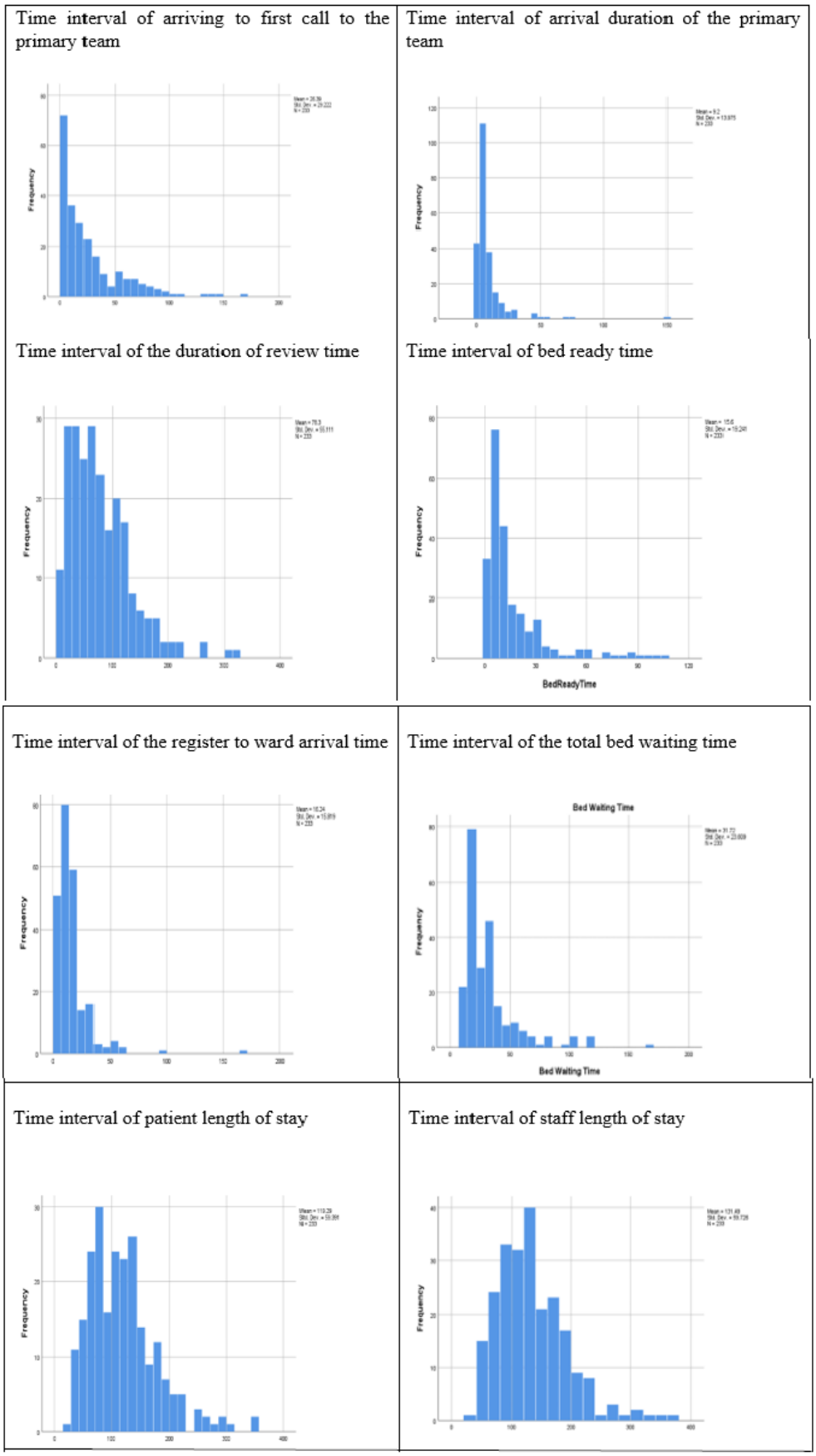

Figure 1. Histogram of the time interval for various workflow for step-up care interhospital patient transfer (IHT)

Table 1. Samples exclusion

Exclusion criteria	**n = 122**
Send back to the district hospital*	84(68.8%)
Unstable patient	28(22.9%)
Duplication of data	7(5.7%)
Required more than 3 multidisciplinary assessments	3(2.4%)

* 23.7% (84/355) of total referral cases.

Table 2. Baseline of time interval (in minutes) for various workflow of IHT.

No	**Time interval**	**Min**	**Max**	**Median (IQR)**	**Mean (sd)**
1	Calling primary team on arrival	0	150	5(5)	9.2(13.9)
2	Arrival duration of primary team	0	170	15(30)	26.3(29.2)
3	Duration of review time (RTR)	0	328	70(70)	78.3(55.1)
4	Bed ready time (BRT)	1	105	10(15)	15.6(19.2)
5	Register to ward arrival time	2	169	10(10)	16.2(15.8)
6	Total bed waiting time (TBWT)	10	170	25(20)	31.7(23.6)
7	Patient length of stay	20	345	108(75)	119.2(59.3)
8	Staff length of stay	25	375	125(80)	131.4(59.7)

Table 3. Time interval of various IHT workflow in relation with three major departments

	Medical n = 113	Surgical n = 94	Orthopaedic n =14	P Value*
Arrive to First Call				
Median IQR)	5(7)	5(5)	5(5)	0.587
Arrival Duration of Primary Team				
Median IQR)	19(34)	14.5(20)	39(46)	0.040
Duration of Review Time (RTR)				
Median IQR)	63(73)	69.5(60)	115(99)	0.110
Bed Ready Time				
Median IQR)	10(20)	8(10)	5(6)	0.990
Register to Ward Arrival Time				
Median IQR)	13(10)	10(10)	10(9)	0.620
Bed Waiting Time				
Median IQR)	30(28)	24(15)	20(15)	0.040
Patient length of Stay				
Median IQR)	110(80)	105(65)	142(86)	0.078
Staff length of Stay				
Median IQR)	125(75)	120(65)	157(91)	0.086

*Kruskal Wallis Test

Table 4. Time Interval of Various IHT in relation to Non-Lead Hospital

	HKK n = 104	HPB n = 72	HS n = 38	HG n = 19	P Value*
Arrive to First Call					
Median (IQR)	5(7)	5(5)	5(7)	10(10)	0.058
Arrival Duration of Primary Team					
Median (IQR)	15(30)	17.5(34)	25(30)	5(27)	0.261
Duration of Review Time (RTR)					
Median (IQR)	65(70)	85(74)	61.5(61)	70(61)	0.567
Bed Ready Time					
Median (IQR)	10(10)	7.5(10)	10(21)	10(20)	0.508
Register to Ward Arrival Time					
Median (IQR)	15(10)	10(15)	10(11)	10(14)	0.018
Bed Waiting Time					
Median (IQR)	25(17)	23.5(20)	28.5(30)	30(27)	0.690
Patient length of Stay					
Median (IQR)	102(80)	117.5(71)	110(78)	103(62)	0.766
Staff length of Stay					
Median (IQR)	122.5(85)	132.5(75)	119.5(75)	120(58)	0.896

*Kruskal Wallis Test

Table 5. Time Interval of Various IHT in Relation with Number of Department Referred

	>1 Dept n = 51	**One Dept n = 182**	**P Value***
Arrive at First Call			
Median (IQR)	5(5)	5(5)	0.629
Arrival Duration of Primary Team			
Median (IQR)	10(34)	19.5(30)	0.484
Duration of Review Time (RTR)			
Median (IQR)	105(81)	60(65)	0.000
Bed Ready Time			
Median (IQR)	10(15)	10((10)	0.289
Register to Ward Arrival Time			
Median (IQR)	10(10)	13(10)	0.020
Bed Waiting Time			
Median (IQR)	25(20)	25(21)	0.611
Patient length of Stay			
Median (IQR)	150(72)	100(65)	0.000
Staff length of Stay			
Median (IQR)	165(65)	115(69)	0.000

*Mann Whitney U

Table 6. Time Interval of Various IHT in Relation with Procedures

	Procedure n = 120	No procedure n = 113	P Value*
Arrive to First Call			
Median (IQR)	5(5)	6.9(7)	0.127
Arrival Duration of Primary Team			
Median (IQR)	15(25)	15(40)	0.326
Duration of Review Time (RTR)			
Median (IQR)	91.4(74)	56.5(55)	0.000
Bed Ready Time			
Median (IQR)	10(15)	10(10)	0.270
Register to Ward Arrival Time			
Median (IQR)	10(12)	11(10)	0.451
Bed Waiting Time			
Median (IQR)	25(23)	25(19)	0.421
Patient length of Stay			
Median (IQR)	125(64.4)	92.5(60)	0.000
Staff length of Stay			
Median (IQR)	135(83)	105(61)	0.000

*Mann Whitney U

References

1. Luster, J, Yanagawa FS, Bendas C L, Ramirez C, Cipolla J, Stawicki SP. Interhospital Transfers: Managing Competing Priorities while Ensuring Patient Safety. In: Firstenberg, M. S. , Stawicki, S. P. , editors. Vignettes in Patient Safety - Volume 2 [Internet]. London: IntechOpen; 2017 [cited 2022 May 12]. Available from: https://www.intechopen.com/chapters/57973 doi: 10.5772/intechopen.72022.

2. Stichler JF. Patient Safety as the Number One Priority in Healthcare Design. Health Environments Research & Design Journal (HERD). 2011. 5(1):73-76.

3. Ministry of Health. Guideline on Referral and Interhospital Patient Transfer Within Facility of Ministry of Health, 2009.Director-General of Health Malaysia Circular Ref. 2/2009.

4. Preyra C, Pink G. Scale and scope efficiencies through hospital consolidations. J Health Econ. 2006. 25(6): 1049-1068.

5. Azevedo H, Mateus C. Cost effects of hospital mergers in Portugal. The European Journal of Health Economics: HEPAC : health economics in prevention and care. 2014. 15(9). doi:10.1007/s10198-013-0552-6.

6. Maeweather-Read R. 2019. Interhospital transfer timeliness: evaluation of a standardized transfer process. Doctorate theses of Resurrection University, USA. Chromeextensio://efaidnbmnnnibpcajpcglclefindmkaj/http://www.doctorsofnursing practice.org/wp-content/uploads/project_form/complete_071220110421.pdf

7. Dickinson, Phillip & Eynon, Andy. (2014). Improving the Timeliness of Time-Critical Transfers: Removing 'Referral and Acceptance' from the Transfer Pathway. Journal of the Intensive Care Society. 15. 104-108.

8. Churpek MM, Wendlandt B, Zadravecz FJ, Adhikari R, Winslow C, Edelson DP. Association between intensive care unit transfer delay and hospital mortality: A multicenter investigation. J Hosp Med. 2016 Nov;11(11):757-762.

9. Lwanga SK, Lemeshow, S & World Health Organization. 1991. Sample size determination in health studies: a practical manual. https://apps.who.int/iris/handle/10665/40062

10. IBM Corp. Released 2017. IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp.

11. Nallamothu BK, Bates ER, Herrin J, Wang Y, Bradley EH, Krumholz, HM et al. Times to treatment in transfer patients undergoing primary percutaneous coronary intervention in the United States: National Registry of Myocardial Infarction (NRMI)-3/4 analysis. Circulation. 2005. 111(6): 761–767.

12. Kulshrestha A, Singh J. Inter-hospital and intra-hospital patient transfer: Recent concepts. Indian journal of anaesthesia 2016. 60(7): 451-457.

13. Warren J, Fromm RE, Richard AO, Rotello LC, Warren MH. et al. Guidelines for the inter- and intrahospital transport of critically ill patients. Crit Care Med 2004. 32(1): 256-262.

14. Xie H, Chaussalet T J, Millard, PH. A model-based approach to the analysis of patterns of length of stay in institutional long-term care. IEEE transactions on information technology in biomedicine: a publication of the IEEE Engineering in Medicine and Biology Society, 2006. 10(3), 512–518.

15. Dixon-Woods M, G. P. Martin GP. Does quality improvement improve quality? Future Hospital Journal 2016. 3(3): 191.

16. Abdulwahid MA, Booth A, Kuczawski M, Mason SM. The impact of senior doctor assessment at triage on emergency department performance measures: systematic review and meta-analysis of comparative studies. Emerg Med J 2016. 33(7): 504-513.

17. Lindsay P, Schull M, Bronskill S, Anderson G. (). The development of indicators to measure the quality of clinical care in emergency departments following a modified-delphi approach. Academic emergency medicine: official journal of the Society for Academic Emergency Medicine 2002. 9(11): 1131–1139.

18. Maritz D, Hodkinson P, Wallis L. Identification of performance indicators for emergency centres in South Africa: results of a Delphi study. Int J Emerg Med 2010. 3(4): 341-349.

19. Sørup CM, Jacobsen P, Forberg JL. Evaluation of emergency department performance - a systematic review on recommended performance and quality-in-care measures. Scand J Trauma Resusc Emerg Med. 2013. 21:62.

20. Austin EE, Blakely B, Tufanaru C, Selwood A, Braithwaite J, Williams RC. Strategies to measure and improve emergency department performance: a scoping review. Scand J Trauma Resusc Emerg Med 2020 28 (1): 55.

21. Novati R, Papalia R, Peano L, Gorraz A, Artuso L, Canta MG et al. Effectiveness of an hospital bed management model: results of four years of follow-up. Ann Ig 2017 29(3): 189-196.

22. Sinreich D, Marmor Y. Ways to reduce patient turnaround time and improve service quality in emergency departments. Journal of health organization and management 2005. 19(2), 88–105.

23. Freitas LD, Goodacre S, O'Hara R, Thokala P, Hariharan S. Interventions to improve patient flow in emergency departments: an umbrella review. Emergency Medicine Journal 2018. 35(10): 626.