A Time and Motion Study of Patients Presenting at the Accident and Emergency Department at Advanced Paediatric Centre of Pgimer, Chandigarh

Ranjana Singh[1], Yatin Talwar[2*] and Ashok Kumar[1]

[1]Department of Hospital Administration, PGIMER, Chandigarh, India

[2]Department of Hospital Administrator, AIIMS, Odisha, India

*Corresponding author: Yatin Talwar, Department of Hospital Administrator, AIIMS, Odisha, India, Tel: 9911246989; E-mail: drtalwaryatin@gmail.com

Citation: Singh R, Talwar Y, Kumar A. (2019) A Time and Motion Study of Patients Presenting at the Accident and Emergency Department at Advanced Paediatric Centre of Pgimer, Chandigarh. Health Sci J Vol.13.No.1:635.

Abstract

The quality and efficacy of treatment at the emergency departments can be critically evaluated by the patients' outcomes and their waiting time. The length of stay in the emergency department is an indicator of performance for assessing the emergency room services.

To investigate time motion of patients and to compare the outcomes with the patient flow guidelines from the western countries. Also, the significantly contributing parameters in this time motion were predicted. 134 patients were randomly screened at the ER of Advanced paediatric center of a premiere tertiary care teaching hospital of North India. In this blinded study, researchers were recruited at the ER with a digital stopwatch. The time monitoring of the patients starts as they enter into the building till the time their treatment starts. The duration calculated demonstrated significant areas where more stress could be given for eventual process improvement.

Keywords: Operational excellence; TAT Triage; Emergency; Patient care

Introduction

Postgraduate Institute of Medical Education and Research (PGIMER) is a premiere tertiary care teaching hospital in North India. It caters the health of people from distant states including but not limiting to Himachal Pradesh, Jammu and Kashmir, Rajasthan, Haryana and Punjab.

The institute has separate emergency departments for general emergency, gynaecology emergency, trauma centre, cardiac emergency, eye emergency and paediatric emergency. The paediatric emergency is located in the Advanced Paediatric Centre (APC), of PGIMER Chandigarh. The daily OPD load of PGIMER is around 3500 patients, out of which 500 patients are seen in paediatrics emergency itself.

The quality and efficacy of treatment at the emergency departments can be critically evaluated by the patients' outcomes and their waiting time. Prolonged waiting time has a significant association with patients' dissatisfaction also [1]. Partly, waiting time is associated with the patient turn over but the hospital management must be geared to tackle any such obvious situation and try all measures to reduce the waiting times. With longer waiting time, patients look for alternate health facility and in the process end up spending even more time in chaos and meanwhile loose the window of opportunity for their better outcome. Timely treatment at the emergency room (ER) improves patients' outcomes and may save precious lives [2].

Many developed countries have formulated guidelines for acceptable waiting time of patients in the emergency room of the hospital and hospital premises (Ref, US, UK). In its growing economy and health facilities, India is still to come up with any such guidelines. However, understanding the timely treatment initiation and a check on service delivery has been carried out from time to time in various hospitals across the country.

The emergency department of APC includes triage area, resuscitation area, Phototherapy rooms with incubators and ventilators for emergency care of neonates and an emergency X-ray facility and waiting areas for the relatives. The ED is headed by consultants and a team of Residents.

The usual patient flow at the ER starts with the patient examination at the triage area. In the triage area, after assessment of patients, patients are categorized into any of the three-triage categories: life threatening/urgent (Red), urgent (yellow) and non-urgent patients (Green). The patients with green triage category are the ones that may not need emergency services and can consult the physicians in the outpatient department. After evaluation, patients are categorized in triage categories and the management as per the set protocol of the institute is started. If patients are suffering from associated gynaecological, ophthalmic and ear,

nose or surgical complains, cross reference are also sought after.

Systematic planned studies evaluating time motion of patients in the ER of hospitals are lacking in India. The present time motion study investigates the average time spent by the patients at the paediatric emergency room.

Methods

Patients presenting between 20th July at 0800 hours to 26th July at 0800 hrs were observed from their entry to the ER till the time the treatment started or admittaned to a ward or discharged/or referred. A total number of 400 patients attended the ER of APC during the study period. Patients referred to other departments were excluded from the study once they left the ER. Furthermore, patients who could not be traced, and those with terminal outcomes (poor prognosis) were excluded from the present study. After excluding, 134 patients were monitored for their time motion in the ER of Advanced Paediatric Centre of PGIMER, Chandigarh. A pilot study had been previously conducted on 10th July from 1000 hrs to 1800 hrs, to fine tune the data collection process with minimal interference with routine patient's management at the ER [3,4]. Designated researchers did the time keeping of patients flow from one area to the other using a digital stopwatch with point up to milliseconds. Three researchers were present at ER during peak hours. Neither ER staff nor patients were involved in the process of data collection. The present study adopts a blinded approach, as the data-collecting researcher did not know about the study. Ethical approval for the study was sought from the Institutional Ethics Committee, PGIMER, Chandigarh. The ethics committee agreed that since it was only a monitoring study without interaction with the patients, it was not required for the patients or the caregivers to give written informed consent [5].

Two time data sheets were assigned for every patient entering the ER, the first sheet was filled in the triage room and the other in the respective clinical area. The researcher noted the time as soon as the patient entered the emergency area of APC and followed it during the course of routine patient flow at the ER. Therefore, for each patient, the time keeping started with the entrance at the APC emergency gate. Time taken to reach the reception, Triage ER (emergency room), assessment at the triage area, categorization, registration, second assessment of the patients by doctors, clinical history recording followed by the time required to start the treatment was noted [6,7].

Statistics

The time points were presented as hours: minutes: seconds. Average, median and range of time points were calculated. The data points collected were segregated by time of arrival into four time groups: 0200-0800, 0800-1400, 1400-2000, 2000-0200. In addition, segregation was made into two groups: between 0800 to1600, and between 1600 to 0800 hours. Data analysis was performed using Microsoft Excel 2007. Mann Whiteny U test was used to compare time groups using statistical package for social sciences (SPSS). Wherever applicable, the difference with p value ≤ 0.05 was considered statistically significant [8].

Results

During the study period, after excluding the non-study subjects a total of 134 patients were monitored for time motion. Amongst the 134 patients who completed the patients flow at the ER, 87 (65%) were given a green card while remaining (47) was prioritized as red (35%) during triage. No patient who could be assigned a yellow card visited the emergency during these study hours.

Patients of green triage

During the study period, 87 patients were given green triage card in the ER of APC of PGIMER, Chandigarh. Average and median time were calculated and are presented in **Table 1**. The average time for the patients to reach in the ER of APC was 1 minute 12 seconds while the median time was 50 seconds. Average time for the first visit (consultation) by the doctor was 14 minutes 14 seconds (3 minutes 29 seconds median time) [9,10].

Triage card was issued in less than 4 minutes. After registration in 7 minutes, it took an average of 16 min for the second consultation by the doctor and assessment (history). However, the median time for this was just over 10 minutes. The treatment was initiated in 5 minutes with median time of just over 3 minutes. The average total duration from the entry into the APC emergency area to treatment was 47 minutes and 25 seconds. The median time duration was 38 minutes 50 seconds. The total duration ranges from as quick as 11 minutes 33 seconds and as long as 04 hours 25 minutes and 33 seconds [9].

Table 1 Comparison of waiting and interaction times or all patients receiving red and green card.

	Red=47				Green=87				
	Average	**Median**	**Min**	**Max**	**Average**	**Median**	**Min**	**Max**	**p-value**
Time taken to reach ER	01:11	00:51	00:06	03:17	01:12	00:50	00:06	05:32	NS
First visit of doctor	02:08	00:50	00:05	31:02:00	14:14	03:29	00:11	01:02:52	<0.05
Triage card issued	04:56	02:53	00:06	46:36:00	03:35	02:19	00:12	18:20	NS

Registration done	07:44	05:37	01:03	01:03:42	07:05	05:30	01:14	01:08:05	NS
Second visit of doctor	03:44	00:59	00:05	01:00:11	04:24	01:18	00:04	01:00:31	NS
History taken	12:22	08:08	01:13	01:34:17	11:47	08:58	01:09	01:05:53	NS
Treatment started	05:58	01:26	00:06	01:14:02	05:07	03:10	00:04	01:01:18	NS
Total time taken	38:02:00	28:28:00	08:39	04:56:42	47:25:00	38:50:00	11:33	04:25:33	<0.05
NS: Not Significant									

Patients of red triage

During the study period, 47 patients were given red triage card in the ER. The average time for the patients to reach ER was 1 min 11 seconds and median time was 51 seconds. This time duration of reaching the reception area was same for the patients with green triage as well. In comparison to the average time for the first visit of the doctor for green triage (14 minutes 14 seconds), the patients were red triage were attended in 2 minutes and 8 seconds. The median time was just 50 seconds and was significantly lower than the median time for the green triage patients. There was no significant difference in the time duration for the issue of triage card. The triage cards were issued in 4 minutes 56 seconds. The mean duration of registration for both the patients was comparable. The second visit of the doctor was faster for the red triage patients (average time of 3 minutes 44 seconds). Doctors in ER took 12 minutes and 22 second for assessing patients. The treatment was started in less than 6 minutes with median time of 1 minute 26 seconds [11].

Total duration from the entry into the APC area to treatment was significantly lower in patients with red triage (average: 38 minutes 2 seconds; median: 28 minutes 28 seconds) as compared to patients with green triage.

Patients in fours shifts of six hours duration

In order to understand the influence of different timings of patients' reaching the ER, patients' data were segregated first into six hours duration of 4 shifts and then to 12 hours duration of two shifts (day and night shift). The green triage patients' data in six hours shift is presented in **Table 2**. There was only one patient in the first shift of the day (0200 to 0800 hrs) during the study period. The duration from entry to the start of treatment for this patient was only 32 minutes and 36 seconds. The comparison of the other shifts reveals that the entry time to the ER was similar. The first visit of the doctor was fastest in the patients reaching between 2000 to 0200 hrs. There was no significant difference in the issue of triage cards to the patients in different shifts, though patient registration was fastest in patients visiting from 0800 to 1400 hrs as compared to patients reaching at different time of the day [12]. As with the first visit, the second visit of the doctors were fastest to the patients coming from 2000 to 0200 hrs. The time required for examining and taking history was lowest for these patients. The average maximum time required for the starting of treatment was 07 minutes 09 seconds in patients attending from 1400 to 2000 hrs. The total duration from entry in ER to treatment start was comparable in all the shifts except in patients attending in the afternoon shift. For these patients average time was 54 minutes 16 seconds and median time was 41 minutes 22 seconds **(Table 2)**.

Table 2 Waiting and interaction times (minutes: seconds) of patients in four different shifts–green.

	0200-0800 hrs (n=1)				0800-1400 hrs (n=7)				1400-2000 hrs (n=48)				2000-0200 hrs (n=30)			
	Average	Median	Min	Max	Avg	Median	Min	Max	Avg	Median	Min	Max	Avg	Median	Min	Max
Time taken to reach ER	00:29	00:29	00:29	00:29	01:45	01:40	00:17	03:09	01:14	00:50	00:06	05:32	01:01	00:40	00:08	03:10
First visit of doctor	12:23	12:23	12:23	12:23	11:30	03:07	01:21	02:52	17:35	05:16	00:14	01:02:52	09:45	02:07	00:11	01:00:13
Triage card issued	02:56	02:56	02:56	02:56	05:33	02:26	00:18	18:20	03:26	02:27	00:12	18:20	03:23	01:37	00:15	18:16
Registration done	04:19	04:19	04:19	04:19	03:51	04:22	01:28	06:02	08:11	06:12	01:14	01:08:05	06:13	05:50	02:02	15:40
Second visit of doctor	00:14	00:14	00:14	00:14	07:49	02:26	00:06	24:09:00	05:03	01:13	00:04	01:00:31	02:45	01:15	00:04	21:02

History taken	12:06	12:06	12:06	12:06	18:39	12:59	04:46	01:05:53	11:38	08:17	01:09	01:05:53	10:28	10:01	01:42	29:16:00
Treatment started	00:10	00:10	00:10	00:10	01:54	01:01	00:11	04:48	07:09	04:28	00:12	01:01:18	02:53	01:22	00:04	14:19
Total time taken	32:36:00	32:36:00	32:36:00	32:36:00	51:02:00	42:03:00	24:41:00	01:22:13	54:16:00	41:22:00	16:47	04:25:33	36:28:00	29:51:00	11:33	01:28:48

Likewise, patients with red triage were also divided into four shifts of six hours duration each. The time motion data is presented in **Table 3**. As none of the patient come in the first shift, there were practically three shifts to compare the time motion of the patients. The data showed that the average duration from entry to start of treatment was fastest for the patients attending the ER from 0800 to 1400 hrs (26 minutes 16 seconds). It is evident that the time duration was maximum for the first visit of the doctor and issue of triage card. While the patients coming from 1400 to 2000 hrs took maximum time for the registration, second visit of the doctor, history and start of the treatment as compared to the patients coming either in the morning or in night shifts.

Table 3 Waiting and interaction times (minutes: seconds) of patients in four different shifts–red.

	0200-0800 hrs (n=0)				0800-1400 hrs (n=9)				1400-2000 hrs (n=22)				2000-0200 hrs (n=16)			
	Average	Median	Min	Max	Average	Median	Min	Max	Average	Median	Min	Max	Average	Median	Min	Max
Time taken to reach ER	NA	NA	NA	NA	01:06	00:42	00:14	02:42	01:19	01:04	00:08	03:04	01:03	00:40	00:06	03:17
Ist visit of doctor	NA	NA	NA	NA	01:00	00:41	00:05	04:55	01:31	01:05	00:09	05:16	03:36	00:48	00:05	31:02:00
Triage card issued	NA	NA	NA	NA	03:47	02:53	00:55	15:04	02:49	01:49	00:06	14:06	08:29	05:11	00:12	46:36:00
Registration done	NA	NA	NA	NA	04:55	05:09	02:56	07:16	10:23	07:27	01:03	01:03:42	05:40	04:52	01:24	13:27
IInd visit of doctor	NA	NA	NA	NA	02:18	00:22	00:05	16:53	05:05	01:18	00:16	01:00:11	02:40	00:53	00:06	19:47
History taken	NA	NA	NA	NA	09:39	09:36	03:54	16:41	16:11	10:51	03:05	01:34:17	08:40	05:13	01:13	41:02:00
Treatment started	NA	NA	NA	NA	03:30	01:09	00:09	18:10	07:36	02:05	00:22	01:14:02	05:05	01:26	00:06	16:29
Total time taken	NA	NA	NA	NA	26:16:00	26:20:00	11:04	35:52:00	44:54:00	32:24:00	15:54	04:56:42	35:14:00	23:58	08:39	01:34:24

Patients in two shifts of twelve hours duration

In order to understand the efficiency of the ER service delivery according to the day and night shifts, the patients' data was re-grouped into two shifts, from 0800 to 2000 hrs and from 2000 to 0800 hrs. These will be named as day and night shifts, respectively from this point onwards. There were 86 patients in the day shift (55 Green triage and 31 Red triage) and 48 patients in the night shift (32 Green triage and 16 red triage). It is evident that the patients with red triage were on fast track as compared to the patients with green triage, in both the shifts [13]. The registration time was similar in all the four categories. However, the average duration for the first visit of doctor was as low as 1 minute 22 seconds in patients with red triage coming in the day shift to as high as 16 minutes 49 seconds in patients coming in the day shift with green triage. There was no difference in the time duration of second visit of the doctor in night shifts in green and red triage patients. However, during daytime second visit of the doctor took 5 minutes 24 seconds for the patients with green triage. The other time motion data points are presented in **Tables 4 and 5**.

Table 4 Waiting and interaction times (minutes: seconds) of patients in two different shifts – Green.

	0800-2000 hrs (n=55)				2000-0800 hrs (n=32)				p-value
	Average	Median	Min	Max	Average	Median	Min	Max	
Time taken to reach ER	01:18	01:04	00:06	05:32	01:00	00:36	00:08	03:10	NS
Ist visit of doctor	16:49	04:58	00:14	01:02:52	09:50	02:07	00:11	01:00:13	p<0.05
Triage card issued	03:42	02:26	00:12	18:20	03:23	01:44	00:15	18:16	NS
Registration done	07:38	05:30	01:14	01:08:05	06:09	05:35	02:02	15:40	NS
IInd visit of doctor	05:24	01:21	00:04	01:00:31	02:40	01:12	00:04	21:02	p<0.05
History taken	12:32	08:18	01:09	01:05:53	10:31	11:02	01:42	29:16:00	NS
Treatment started	06:29	04:16	00:11	01:01:18	02:48	01:20	00:04	14:19	p<0.05
Total time taken	53:51:00	41:42:00	16:47	04:25:33	36:21:00	31:14:00	11:33	01:28:48	p<0.05

Table 5 Waiting and interaction times (minutes: seconds) of patients in two different shifts – red.

	0800-2000 hrs (n=31)				2000-0800 hrs (n=16)				p-value
	Average	Median	Min	Max	Average	Median	Min	Max	
Time taken to reach ER	01:15	00:58	00:08	03:04	01:03	00:40	00:06	03:17	NS
First visit of doctor	01:22	00:56	00:05	05:16	03:36	00:48	00:05	31:02:00	p<0.05
Triage card issued	03:05	02:01	00:06	15:04	08:29	05:11	00:12	46:36:00	p<0.05
Registration done	08:48	06:57	01:03	01:03:42	05:40	04:52	01:24	13:27	p<0.05
Second visit of doctor	04:17	01:02	00:05	01:00:11	02:40	00:53	00:06	19:47	p<0.05
History taken	14:17	10:08	03:05	01:34:17	08:40	05:13	01:13	41:02:00	p<0.05
Treatment started	06:25	01:26	00:09	01:14:02	05:05	01:26	00:06	16:29	NS
Total time taken	39:29:00	30:20:00	11:04	04:56:42	35:14:00	23:58	08:39	01:34:24	NS

Discussion

The time motion of patients attending an ER of the hospital is a crucial parameter not only for assessing the quality of service delivery to the patients but also it has a great impact on patients' outcomes. The present study is first of its type in our knowledge related with the time motion of patients in the ER in India.

There was no delay in reaching the ER once the patients enter the APC of PGIMER, Chandigarh. The patients with serious condition (Red triage) were attended quickly over the patients with green triage. This significant time gap during this first point of contact was crucial in minimizing the time duration in starting the treatment of these patients. However, the average time required to take the patients' history with red triage was marginally higher than the patients with green triage were. Though not statistically significant, this is due to the extra minute required to take the patients' history in detail in critical cases. This might also be due to the subjective nature of this parameter. A more experienced doctor will quickly judge the patients' conditions. In the present study the history was taken in as quick as 1 minute 13 seconds and as high as 1 hour 34 minutes and 17 seconds in patients with red triage. However, the maximum time taken for history in patients with green triage was 1 hour 5 minutes and 53 seconds.

Although, more time was required for the history, the overall time taken to start the treatment was significantly lower in patients with red triage. In order to study the influence of different time to reach the ER on the total time required to start the treatments, the data points were segregated in four shifts. The only patient with green triage came between 0200 to 0800 hrs reach the ER in 29 seconds as compared to 1 minute 45 seconds for the patients coming between 0800 to 1400 hrs and again the duration falls in the third and fourth shift. This is because there is common entry to both OPD area and ER and due to more number of patients in the morning shift, they took a while to reach the ER. The first visit of the doctor took maximum time in the third shift due to more number of patients (n=48) during that shift as compared to other shifts. The same is reflected in the issuance of triage

card and time required to start the treatment in these patients. Due to more number of patients, the patients had to be in a queue for their turn. These set of patients required maximum duration for the overall time from entry to start of the treatment. The maximum time required (4 hours 25 minutes) was also for one of the patient coming in this shift.

The patients with serious conditions were managed in significantly lower time duration as compared to the patients with green triage, except for the patients coming between 2000 to 0200 hrs. The average time required for 9 patients coming to the ER in the morning shift was only 26 minutes 26 seconds. This is the least time as compared with any other group of the patients in any triage. When compared head to head, the total time required to start the treatment was lower, quite understandably, for red triage patients. Within the red triage, however, the maximum time was for the patients coming between 1400 to 2000 hrs. This is associated with significantly more number of patients during this period. The analysis suggests that the patient burden is the only critical factor in the present setting in present condition. The total time motion of the patients is affected due to a crowded ER.

When divided in two shifts of 12 hours each, as expected the patients with red triage took significantly lower time to start the treatment as compared to the patients with green triage. There was no significant difference in average time required to start the treatment in day and night shifts in patients with red triage. However, a significant lower time was required to patients coming in the night shift with green triage. This is again attributed to the less number of patients during this time. The time duration was even lesser than for the serious patients coming in the day shift, though this was not statistically significant. The inter-group analysis revealed that this is due to significantly more time required to take history of the serious patients.

Conclusion

The present study firmly advocates the efficiency of the ER staff to manage their patients. The patients with red triage were most of the time fast tracked as compared to the patients with green triage category. However, time motion of the patients was dependent on number of patients at any given point in time. In addition, for serious patients, the time duration required by the doctors to take the detailed history was significantly associated with the longer overall time motion. This time duration was even better with the formal guidelines of patients' management in the western world. This study could pave the way to the development of guidelines of time duration of patients' management in Indian settings.

References

1. Capuano F, Lot AS, Sagnes-Raffy C, Ferrua M, Brun-Ney D, et al. (2015) Factors associated with the length of stay of patients discharged from emergency department in France. Eur J Emerg Med 22: 92-98.

2. Booth AJ, Harrison CJ, Gardener GJ, Gray AJ (1992) Waiting times and patient satisfaction in the accident and emergency department. Arch Emerg Med 9: 162-168.

3. Bindman AB, Grumbach K, Keane D, Rauch L, Luce JM (1991) Consequences of queuing for care at a public hospital emergency department. JAMA. 266: 1091-1096.

4. Karpiel MS (2000) Benchmarking facilitates process improvement in the emergency department. Healthc Financ Manage 54: 54-59.

5. Saurman E, Lyle D, Kirby S, Roberts R (2014) Assessing program efficiency: a time and motion study of the Mental Health Emergency Care - Rural Access Program in NSW Australia. Int J Environ Res Public Health 11: 7678-7689.

6. Chattopadhyay A, Ghosh R, Maji S, Ray TG, Lahiri SK (2012) A time motion study in the immunization clinic of a tertiary care hospital of kolkata, west bengal. Ind J Community Med 37: 30-33.

7. Herring A, Wilper A, Himmelstein DU, Woolhandler S, Espinola JA, et al. (2009) Increasing length of stay among adult visits to U.S. Emergency departments, 2001-2005. Acad Emerg Med 16: 609-616.

8. Bambi S, Ruggeri M, Sansolino S, Gabellieri M, Tellini S, et al. (2016) Emergency department triage performance timing. A regional multicenter descriptive study in Italy. Int Emerg Nurs 29: 32-37.

9. Mahmoud I, Hou XY, Chu K, Clark M (2013) Language affects length of stay in emergency departments in Queensland public hospitals. World J Emerg Med 4: 5-9.

10. Karaca Z, Wong HS, Mutter RL (2012) Duration of patients' visits to the hospital emergency department. BMC Emerg Med 12: 15.

11. Ay D, Akkas M, Sivri B (2010) Patient population and factors determining length of stay in adult ED of a Turkish University Medical Center. Am J Emerg Med 28: 325-330.

12. McCarthy ML, Zeger SL, Ding R, Levin SR, Desmond JS, et al. (2009) Crowding delays treatment and lengthens emergency department length of stay, even among high-acuity patients. Ann Emerg Med 54: 492-503.

13. Considine J, Botti M, Thomas S (2007) Do knowledge and experience have specific roles in triage decision-making? Acad Emerg Med 14: 722-726.