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Original Article

Impact of implementing simulation on idle and service time at emergency room

Sima Ajami[1], Saeedeh Ketabi[2]

ABSTRACT

The aim of this research was to determine impact of implementing scenarios' simulation on idle and service time at Emergency Room (ER) after one year. Participants in the study included the patients who received services in emergency department (ED). The arrival and service times in different stations were collected for 1092 patients during 17 days. For data analysis, SPSS and simulation technique were used. Results showed service time in the Ear Nose Throat (ENT) and Neurosurgery dramatically reduced as well as other services. Health care managers, in the ER are usually physicians who are not familiar with principals of management.

KEY WORDS: Emergency Department, Idle and Service Time, Simulation, Scenario.

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INTRODUCTION

Emergency Room (ER) provides urgent clinical and Para-clinical care for patients that are injured in accidents and incidents. The injured patients need urgent treatment according to their situation.[1] The results of different studies showed that patient waiting time is one of the impressive factors on patient satisfaction. In a research that titled "reasons of patient dissatisfaction at ER", finding showed main reasons of dissatisfaction were waiting time 67% and absence of effective relationship with patients by medical care staff 19%.[2] In recent years, patient waiting time in the emergency process has had a great increase, for instance, in England waiting time was increased to 4 hours and in Canada it took two hours.[3]

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Several studies in recent years have revealed that the number of people that visit ER has grown as in Canada to 14 million per year and in Britain to beyond 15 million in a year.[4-6] Simulations help the management to optimize many factors such as work expenditure, patient waiting time and number of personnel in ER.[7] Ayatolahkashani Hospital, which is affiliated to Isfahan Medical Sciences University (IMSU) in Iran, had 10 wards, 196 active beds, an average length of stay of 2.41 days, bed occupancy of 70% and a turnover of 1.1 days. In addition, it had 30 beds in its ER with 74 medical staff (26 nurses, 6 general practitioners, 2 anesthesiologists, and one secretary) in 2009.

The annual numbers of admissions to the ER in 2006-9 were 29446, 31735, 32445 and 34336 respectively. The average daily admissions during the last four years were 81, 87, 89 and 94 respectively. Regarding the particular situation of the hospital, due to the high rate of emergency patients and their needs to be admitted urgently, delay in service not only increases dissatisfaction of patients, but also causes delay in response of new patients. On one hand, it results in overcrowding and limitation of space for medical personnel in its ER and on other hand, the long waiting time for the patient in the ER which is frustrating. In view of the importance of Emergency Services and to ensure minimum

cost with maxim resources productivity, it was felt necessary to study idle and service time in its Emergnecy Room services.

The aim of this study was to determine idle and service time at its ER and secondly to compare idle and service time in the ER in 2008 (phase one) with 2009 (phase two), which was the impact of implementing scenarios.

METHODOLOGY

This was a comparative and analytical study in which data has been collected by forms and observations. Isfahan city with a population of approximately 4,800,000 has 22 hospitals. However, Alzahra Hospital and Ayatolahkashani Hospitals are the biggest teaching and governmental hospitals which admit emergency patients in the Isfahan province. Researchers chose this hospital to propose some solutions to improve the ER sersvies. Study population included the patients who received services in the ER of general and teaching Ayatolahkashani Hospital for 1092 patients in May 2009.

Hospital administrators asked the researchers to do this study. They encouraged personnel for cooperation to do this research in it's the ER. Then, research team interviewed managers and medical personnel to know number of stations, number of personnel that work in different stations, start and end time of personnel work in all stations in ER along with diagnostic departments (e.g. Laboratory, Radiology, Ultrasonography, and C-T Scan). Then, research team has drawn the flow work of treatment process. For measuring wait and service time, research team settled down in all stations related to ER's treatment process along with diagnostic departments during 17 days in the spring 2009.

The waiting time spent in all services and stations in the ER measured from the time the patient arrives in to the time the patient is provided service. Patients were tracked by patient wristband number which were worn after entering in the ER door and research team recorded wait and service time to measure their information in each station. Data included; current processes, patient wristband number, name of station, service duration, time of arrival to stations, and time of departure to stations in the Ayatolahkashani Hospital ER. For data analysis, we used SPSS, and simulation model. Data was entered to SPSS software in order to design of patients' arrival distribution of service time in different work stations.

In phase-one in May 2008, distribution of patients' arrival time and patients' service times along with related parameters for each station were fitted by using SPSS. By simul8, for the ER processes, a simulation model has been planned with their scenarios. Then, in May 2009, researchers compared distribution of patients' arrival time and patients' service time along with related parameters for each station with before implanting solutions in 2008 in the Ayatolahkashani Hospital ER.

RESULTS

After modifications, in phase-two, in majority of the stations service time manpower-percentage has decreased (Table-I). It means that faster service is provided to customers.

Table-I: Idle and Service Time Manpower-Percentage in Service's Stations.

Service's Stations	*Idle Timephase-1*	*Idle Time phase-2*	*Service Time phase-1*	*Service Timephase-2*
Admission	63.84	66.9	36.16	33.1
Screen Physician	60.48	68.81	39.52	31.19
First Nurse	54.54	40.37	45.46	59.63
Orthopedics' Intern	45.16	53.65	54.84	46.35
Orthopedics' Resident	42.66	53.04	57.34	46.96
Neurosurgical Intern	50.5	60.16	49.5	39.84
Neurosurgical Resident	45.66	50.05	54.34	49.95
ENT Intern	46.94	55 .46	53.06	44.54
ENT Resident	48.28	60.02	51.72	39.98
Second nurses	42.73	47.93	56.27	52.07
CT-Scan	79.98	77.47	20.02	22.53
Ultrasonography	87.19	88.46	12.81	11.54
Radiology	64.51	39.58	33.49	60.42
Lab	38.22	49.49	61.78	50.51
Third Nurses	33.24	26.92	66.26	73.08

As shown in Table-II, after a couple modifications, mean of service time in admission, screen physician, first nurses service, second nurses service, Orthopedics' Intern, Orthopedics' Resident, ENT Intern, ENT Resident, Neurosurgical Intern, and Neurosurgical Resident departments from 4.73 to 2.47, 2.88 to 2.63, 3.39 to 3.03, 2.48 to 1.72, 12.13 to 12.69, 16.19 to 14.52, 38.89 to 6.03, 49.60 to 11.22, 13.21 to 8.31, and 16.31 to 5.39 minutes decreased respectively. But mean of service time in CT-Scan, Radiology, Ultrasonography, and Lab departments from 9.43, 12.31, 13.62, and 22.15 to 9.61, 15.43, 18.17 and 48.86 minutes increased respectively.

Table-II also shows that majority of stations the p-value were less than the 0.05, it means the null hypothesis is rejected, the result is said to be statistically significant and there were significant differences between service time before and after modifications.

DISCUSSIONS

According to Leora results, the median ER length of visit was 4.3 hours (IQR 3.3, 5.6) for admitted patients and 2.3 hours (IQR 1.9, 2.9) for discharged patients.[8] While in this study, the median ER length of visit compare to Leora results is much less.

Patients requiring laboratory and imaging investigations had a prolonged length of stay, which varied depending on specific tests ordered. Specialty consultation was associated with longer waiting times. A major bottleneck identified was waiting times for inpatient admission.[9] On an average, patients spend nearly five hours in the ER with about one-half of the visit devoted to waiting for the next required service to take place.[10]

It is often difficult to make a differential diagnosis in patients admitted to the emergency department with the complaint of shortness of breath. Echocardiography is still the gold standard diagnostic method of heart failure, al- though its use in emergency departments is limited in terms of both cost and accessibility. Therefore, B-type natriuretic peptide (BNP) and N-terminal pro-brain natriuretic peptide [(NT)-proBNP] have become routine tests in emergency departments in recent years because they are reliable, easy to use

Table-II: Analytical statistics of service time in stations before (B) and after (A) modifications in ER.

Stations		*No. of sample*	*Standard deviation*	*Mean*	*P value (t-test)*
Admission	B	635	2.45	4.73	0.021
	A	1091	1.73	2.47	
Screen Physician	B	663	2.26	2.88	0.059
	A	906	2.41	2.63	
First Nurses	B	293	1.89	3.39	0.15
	A	309	3.93	3.03	
Second nurses	B	293	2.48	5.77	0.012
	A	56	1.72	2.48	
Orthopedic Intern	B	291	11.04	12.13	0.054
	A	550	15.02	12.69	
Orthopedic Resident	B	269	13.12	16.19	0.108
	A	392	15.32	14.52	
ENT Intern	B	62	7.96	38.89	0.001
	A	104	5.52	6.03	
ENT Resident	B	35	9.3	49.60	0.067
	A	40	8.1	11.22	
Neurosurgical Intern	B	227	11.43	13.21	0.071
	A	215	14.21	8.31	
Neurosurgical Resident	B	157	14.11	16.31	0.046
	A	72	6.44	5.39	
CT-Scan	B	1221	4.33	9.43	0.058
	A	319	7.06	9.61	
Radiology	B	972	10.56	12.31	0.009
	A	756	12.58	15.43	
Ultrasonography	B	589	6.92	13.62	0.062
	A	168	12.85	18.17	
Lab	B	2905	13.33	22.15	0.048
	A	428	35.58	48.86	

and low-cost laboratory tests. American College of Emergency Physicians and European Society of Cardiology recommended the clinical use of natriuretic peptide measurements as an aid in the diagnosis or exclusion of acute heart failure.[11]

Shaker et al. findings showed that comparing three shift works, the highest patient doctor relationship questionnaire (PDRQ) score was for morning (27.1 ± 5.5) and the lowest value was for afternoon shift (23.8 ± 5.3). PDRQ score for night shift was 25.1 ± 6.9 ($p = 0.002$). The results of this study showed that patients' satisfaction of relationship with doctors was the lowest in the afternoon and it may be better to implement some strategies to reduce residents' workloads and increase quality of works in the afternoon shifts.[12]

Findings of Yarmohammadian et al[13] showed that their study were categorized into three general categories including requirements (organizational and sub-organizational), barriers (internal and external) of Hospital Emergency Incident Command System (HEICS) establishment, and providing short, mid and long term strategies. These categories are explained in details in the main text.

Regarding the existing barriers in establishment of HEICS, it is recommended that responsible authorities in different levels of health care system prepare necessary conditions for implementing such system as soon as possible via encouraging and supporting systems. This study may help health policy makers to get reasonable framework and have comprehensive view for establishing HEICS in hospitals. It is necessary to consider requirements and viewpoints of stakeholders before any health policy making or planning.[13]

CONCLUSIONS

Managers should access to data dashboard and monitor ER situation. Then they should learn scientific and simple methods to control and planning their organization better. They should set up meetings to review and edit flow works in ER at regular period. In order to decrease idle time in ER and Para-clinical services, they should get their information to manage problems with current human and material resources.

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