

Emergency Room Physician Staffing to Patient Ratio

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ABSTRACT

OBJECTIVE

To determine the physician staffing to patient ratio at Emergency Department (ED)

METHODS

This is a cross-sectional study including 363 patients who visited at ED of Khon Kaen Hospital, Thailand in the period of April 2015. Period of time for each patient in ED was assessed to calculate the physician to patient ratio per hour.

RESULTS

ED stay times in patients with critical conditions (Level 1), patients with emergency illness (Level 2) and patients with acute illness were (Level 3) were 54, 74 and 97.5 minutes, respectively. By calculation we found that 1.9, 3.2, and 4.0 patients in Level 1, Level 2 and Level 3 were treated by one physician per hour. There were 121 patients (33.3%) who had an ED visit time of more than 2 hours and two factors which were found to be statistically significant associated with this were being in Level 3 (adjusted odds ratio (AOR), 3.14; 95% confidence interval (CI), 1.01 to 9.74) and being laboratory investigated (AOR, 4.50; 95% CI, 2.41 to 8.43).

CONCLUSION

Emergency room physician staffing to patient ratios in Level 1, 2 and 3 patients were 1.9, 3.2 and 4 patients per hour, respectively.

INTRODUCTION

Emergency department overcrowding means there are too many patients excessively the capability or resources available in the emergency department, hospital or both.¹ The emergency department overcrowding is a problem gradually encountering more and more and it arises rapidly when there are more patients coincidentally with the administration within the emergency department has not adequately and sufficiently managed.^{2,3} This results in disadvantage to patients' sickness conditions such as delay treatment.⁴⁻¹² Moreover, It is also found to be related to the occurrence of cardiac emergency in patients admitted in the hospital more and more and the mortal rate increased.^{13,16}

The emergency department overcrowding could be caused from three processes, namely, before entering into an emergency room, within emergency room and after discharge from emergency room.¹⁷ The process before entering into an emergency room means there are a great number of patients requiring to use emergency rooms while the process within emergency room includes patients screening, evaluation and procedure of diagnosis affecting to the duration the patient has to stay in an emergency room but the process after discharge from emergency room would crucially regard to the time the patient was carried out of the emergency room.¹⁷ Whereof the emergency room with high potentiality would have longer period of in-emergency room process but it would not allow the emergency department overcrowding.¹⁸ There had been studies, it was found that the emergency department overcrowding was arisen from increasing numbers of severe sick and critical patients.¹⁹

The important personnel herein the emergency room are physicians, they

should be provided in adequate number to be able to give treatment for patients in severe and critical conditions and to provide for the treatment movement continuing efficiently in standard management, to reduce risk and dissatisfaction of all parties, patient, relatives and medical operators. It was found that the adequate ratio should be 1.8–2 patients to physician per hour.²⁰ The cause enabling the lower rate of physician's examination and treatment than this always came from a great number of severe sick patients, high rate of in-patient admission, insufficiently experienced physicians and waiting duration for forwarding patients to a ward took a long time.²⁰ The American Academy of Emergency Medicine had stated that the physician to patients proportion depends upon the patient service acceptable rate which should not over 2.5 patients to physician per hour in group of patients with moderately emergency condition.²¹ Even though at present, there are widely studies on causes of emergency department overcrowding but there were limited studies on the adequate number of physicians necessary for giving treatment to emergent and critical patients. Besides, the study results had not reflect to the condition of Thailand which has a different public health system. This study therefore emphasized on the study of the number of physicians to the number of emergent and critical patients in general hospitals' context and on factors affecting patients retained in emergency rooms for a long time.

METHODS

This was a cross sectional research to find the adequate proportion or ratio of physician to a number of critical, emergent and urgent patients visited for treatment during 1-30 April 2015.

The study was carried out at the Emergency Department, Khon Kaen Hospital, Thailand. It is a tertiary care hospital with 876 patient beds availability. Emergency patients were about 100,000 cases per year and the rate of in-patient admission from the Emergency Department was approximately 36.1 percent in 2015.²² The physicians practicing in emergency rooms were divided into four groups as follows: The first group are physician staff consisting of emergency physician (EP), various specialist, such as internal medicine, surgeon and pediatrician who are circulated to work on duty as out-official time physician. The second group are emergency medicine resident and intern. The third group are specific expert physicians alerted at the Emergency Department consisting of surgeons and orthopedic surgeons and the final group are the specific expert physicians called for to look after a patient (on call) such as, ophthalmologist, otolaryngologist and obstetrician and gynecologist.

Patients coming to get services at the Emergency Department will be screened and selected by experienced nurses according to the Emergency Severity Index (ESI)²³ Guideline which divides patients into 5 levels according to the disease severity, namely, Level 1, the critical patient; Level 2, emergency patient; Level 3, urgent patient; Level 4, less urgent patient and Level 5, general patient whereas Level 1-3 are regarded as the patients in emergency condition and Level 4-5 are regarded as non-severe sick people. All patients in emergency condition would be brought into the study. From the data of Emergency Department in 2014, it was found that the average duration patients in emergency room who had been and not had been performed urgent treatment, laboratory examination, radiological examination and consultation with specific expert physicians were 63 and 95 minutes respectively. Hence, if any patient spent period in emergency room for over 2 hours (120 minutes), that patient would be deemed over the acceptable criteria.

The data were collected by reviewing the retroactively medical registration from the database of Emergency Room Registry to get the following information; characteristic of patients, time of presenting, type of presenting, patient triage category, type of illness, waiting time for physician's examination, duration of emergency physician's examination, duration the patient staying in emergency room, emergency procedure, radiological examination, laboratory examination, specialist consultation, result of treatment at emergency room and health insurance. When patients had been screened and separated, they would be brought into the examination room, waiting to meet a physician according to their level of urgency. Patients would be examined by the physician, get treatment, forwarded for additional examination and sent to consult specialist as appropriate in each case whereas the duration the patient was in the emergency room was deemed the duration the patient was under the physician's care-taking. The treatment result was divided into admission for hospitalization, going home, refer to another hospital, forwarding to out-patient department and deceased at the emergency room. The sample size was calculated from the previous study made at the Emergency Department, Khon Kaen Hospital, it was found that it required sample size for 345 cases to be in 95 % confidence interval and 80 % testing power. The sampling was carried out in simple means with expectation that there might be 10% of data lost. Hence, in this study, 380 cases had been sampled and the data were presented in form of means, standard deviation, median and quartile range. The data were analyzed by to calculate for the crude odds ratio (COR) of factors delaying patients to be in an emergency room for longer time than 2 hours. All factors with $P < 0.05$ would be analyzed by binary logistic regression to calculate for the adjusted odds ratio (AOR) and its 95% confidence interval (CI). All data were analyzed using STATA Program, Version 11.0.

RESULTS

There were 8,117 patients visited at the Emergency Department during the studying interval. They were Level 1-3 emergency patients, totally 5,367 cases (66.1 %) and they were selected by random sampling for the study to a number of 380 cases (7.2 %). 17 patients (4.7%) were cut out because their data were incomplete. Therefore, there were total 363 patients brought into the analysis. They were found to be male 199 cases (54.8%), average age : 46.5 years, they came to the hospital by themselves to the number of 217 cases (59.8%), 144 (39.8%) and 142 (39.2%) patients came to get services at the time interval of 08.01 – 16.00 hours and 16.01 – 24.00 hours respectively. 170 patients (46.8%) were mostly found to be the patients of Level 2 emergency whereas 99 cases (27.3%) were injured, 203 cases (55.9%) were admitted as in-patients and 220 cases (60.6%) were universal coverage health insurance, as shown in Table 1.

It was found the waiting time for physician's examination were 0, 8 and 14 minutes for patients of Level 1,2 and 3 respectively. Duration for examination of each patient of Level 1, 2 and 3 were 31, 19 and 15 minutes, respectively. From the analysis of physician's examination period, it could be calculated that a physician could examine and give treatment to patients of Level 1, 2 and 3 to amount of 1.9, 3.2 and 4.0 patients per hour respectively or approximately 2, 3 and 4 cases per hour respectively. The duration a patient staying in emergency room (length of stay-LOS) for patients of Level 1,2 and 3 were 54, 74 and 97.5 minutes respectively. The Level 1 patients had mostly been done emergency procedure for 23 cases (51.1 %) and 42 cases (93.3%) were hospitalized as in patients. One third of analyzed patient number were in emergency room for longer than 2 hours, especially Level 3 patients of 64 cases (43.2%) as shown in Table 2.

Table 1. Characteristics of the Patients.

Characteristic	Value
Male-no. (%)	199 (54.8)
Age-yr	46.5 \pm 23.2
Types of presenting-no. (%)	
On their own	217 (59.8)
Referred	125 (34.4)
Emergency Medical Service (EMS)	21 (5.8)
Time of presenting-no. (%)	
08.01-16.00	144 (39.8)
16.01-24.00	142 (39.2)
00.01-08.00	76 (21.0)
Triage categories-no. (%)	
Level 1	45 (12.4)
Level 2	170 (46.8)
Level 3	148 (40.8)
Type of illness-no. (%)	
Trauma	99 (27.3)
Non trauma	264 (72.7)
Type of discharge-no. (%)	
Admission	203 (55.9)
Home	150 (41.3)
Out patient department	8 (2.2)
Against advice	2 (0.6)
Health insurance -no. (%)	
Universal Coverage	220 (60.6)
Government insurance	43 (11.8)
Self-payment	45 (12.4)
Social insurance	42 (11.6)
Vehicle act	11 (3.0)
Others	2 (0.6)

Plus minus values are mean plus minus standard deviation.

Table 2. Treatment outcome

Characteristic	Level 1	Level 2	Level 3	All
Median door to physician-min (IQR)	0 (0-1)	8 (5-12)	14 (9-16)	9 (4-14)
Median physician examination-min (IQR)	31 (26-36)	19 (14-25)	15 (14-19)	18 (14-25)
Median length of stay in department-min (IQR)	54 (45-63)	74 (32-131)	98 (60-163)	80 (40-149)
Emergency procedure-no. (%)	23 (51.1)	2 (1.2)	0	25 (6.9)
Admission-no. (%)	42 (93.3)	101 (59.4)	60 (40.50)	203 (55.9)
Length of stay in department >2 hours-no. (%)	7 (15.6)	50 (29.4)	64 (43.2)	121 (33.3)

Table 3. Factor Associated with Length of Stay at Emergency Department More than Two Hours

Characteristic	Stay 2 hours or shorter	Stay longer than 2 hours	Crude odds ratio	Adjusted odds ratio
Age-yr	47.1±23.9	45.3±21.7	0.99 (0.98-1.01)	
Triage category-no. (%)				
Level 1	38 (15.7)	7 (5.8)	1	1
Level 2	120 (49.6)	50 (41.3)	2.26 (0.94-5.40)	1.74 (0.57-5.30)
Level 3	84 (34.7)	64 (52.9)	4.14 (1.73-9.86)	3.14 (1.01-9.74)
Type of presenting-no. (%)				
On their own	141 (58.3)	76 (62.8)	1	1
Referred	92 (38.0)	33 (27.3)	0.66 (0.41-1.08)	1.41 (0.74-2.70)
Emergency medical services	9 (3.7)	12 (9.9)	2.47 (0.99-6.13)	2.41 (0.85-6.86)
Time to presenting-no. (%)				
08.01-16.00	91 (37.6)	53 (43.8)	1	
16.01-24.00	100 (41.3)	42 (34.7)	0.72 (0.44-1.18)	
00.01-08.00	51 (21.1)	26 (21.5)	0.84 (0.47-1.51)	
Trauma-no. (%)	72 (29.7)	27 (22.3)	0.68 (0.41-1.13)	
Median door to physical time-min (IQR)	8 (3-14)	10 (5-14)	0.99 (0.98 -1.02)	
Procedural treatment-no. (%)	22 (9.1)	3 (2.5)	0.25 (0.07-0.87)	0.76 (0.16-3.54)
Laboratory investigation-no. (%)	123 (50.8)	75 (72.0)	1.58 (10.1-2.46)	4.50 (2.41-8.43)
Radiological imaging-no. (%)	139 (57.4)	59 (48.8)	0.71 (0.45-1.09)	
Consultation-no. (%)	95 (39.2)	53 (43.8)	1.21 (0.78-1.88)	
Admission-no. (%)	156 (64.5)	47 (38.8)	0.35 (0.22-0.55)	0.17 (0.88-0.34)

Plus minus values are mean plus minus standard deviation.

It was found there were 5 factors; patient triage categories, type of presenting to ED, emergency procedure, forwarding for laboratory examination and in-patient admission had relation to the length of stay in emergency room over 2 hours where from two fifth of factors had relation to statistical significance when analyzed by Multivariate Logistic Regression, namely, for the Level 3 sickness severity, the AOR was 3.14 (95% CI, 1.01 to 9.74) and for forwarding for laboratory examination, the AOR was 4.50 (95% CI, 2.41 to 8.43). While the in-patients admission had relation to the length of stay in emergency room less or equal to 2 hours with statistical significance, the AOR was 0.17 (95% CI, 0.08 to 0.34) as shown in Table 3.

DISCUSSION

Patients who visited at the Emergency Department were different from the patients who came to get services at Out-patient Department, namely, this group of patients, especially the severe patients required many steps of disease diagnosis, needed many emergency procedures that took longer time for treatment. Simultaneously, it needed continuous evaluation or assessment, post-treatment activity by physician such as waiting for symptom observation, meeting or specialist consultation and waiting for result coming out of laboratory. These factors resulted in accumulation of patients in emergency rooms that reduced the area to support the newly coming patients and caused the emergency department overcrowding because the department had to give concurrent services to both previous patients and new patients.

From the study, it was found that even though the study was conducted specifically among only severe patients

coming to get services at the Emergency Department but it was found that in Khon Kaen, the proportion of physicians to the number of patients was more in quantity than that in the United States of America.^{20,21} This might be due to there were more patients in Thailand and different public health system. Hence, adoption of the foreign proportion to calculate for physician personnel load in emergency room in Thailand is unsuitable or even in Thailand itself, each level of hospital has its differently internal administration system that may result in variation of physician to patients proportion. Besides, it was also found that Level 1-3 patients stayed in an emergency room 80 minutes per case but when categorized by each level, it was found that Level 3 patients stayed longest time in an emergency room and they had the patients' most proportion staying in an emergency room for longer than 2 hours which, according to the screening criteria of ESI, the Level 3 patients were the ones who had constant symptom and needed examination, diagnosis and treatment at the Emergency Department to reduce admission of unnecessary.

Level 1 and 2 patients were the ones who had non-constant symptoms and high risk who needed admission for continuous treatment in hospital so they spent less time in emergency rooms and had more proportion to be admitted in the hospital. Appurtenant with the hospital's management system, the admission of patients could immediately be done so the patients needed not to wait within the emergency rooms, they could immediately be moved in when the physician ordered admission to be in-patients. It was found another factor relating to the length of stay of a patient in an emergency room other than the severity level of sickness, namely, forwarding for laboratory examination similarly to a previous study.²⁴

Due to forwarding for a specific laboratory examination, if there were several categories, it took time for waiting for the result to come out, at least 1-2 hours, this effected to the length of stay a patient had to be in an emergency room. But for admission to be an in-patient, it was found to result in opposite way, namely, the patient admitted to be an in-patient had less length of stay in emergency room, compared with other groups of patients with statistical significance that its result was opposite to many studies which found that admission to be in-patient resulted in patient's long stay in emergency room^{19,25} because there must be management of in-patient bed preparation to be able to admit the patient that this step took a long time. But Khon Kaen Hospital which is a tertiary hospital and the mother hub to receive forwarded patients from provinces in upper Northeastern Part of Thailand so it must be prepared to support patients necessary to get a suitably specific treatment, unlimitedly and proublemlessly on in-patient bed administration so patients could immediately forwarded from the Emergency Department to in-patient ward without delay when the treatment at emergency room had been finished.

The limitation of this study were, firstly, the study had been conducted at only one hospital that its result may not be applicable with another hospital with different context of services. Secondly, due to the studying data obtained from the database of Emergency Room Registry that the time of receiving records in case the patients were admitted as in-patients would be recorded to prepare the patient's

document before movement of the patient out of emergency room, hence, the time which the patient left the emergency room would be sooner than actuality which affected to the length of stay of the patient in the emergency room. Thirdly, it was the study conducted within an interval of time which in fact, the number of patients may vary or be different in each season and the physician's potential may be different, especially in the interval when emergency medicine resident and intern with less experience were on new working that resulted in physician's examination period or length of patient's stay in an emergency room. Hence, there should be additional studies to cover every interval of all year round and in the public health service in each level in the next study so as to be benefit in organization of appropriate physician personnel list rate to give services to patients. It can be summarized that in patients of critical, emergent and urgent groups who entered to get medical treatment at the Emergency Department had the physician to number of patients proportion equal to 1 to 2, 3 and 4 patients per hours respectively.

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