



Original Article

Risk factors of admission in 72-h return visits to emergency department

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ABSTRACT

Objective: Return visit to emergency department (ED) is a common phenomenon and has been a clinical indicator of quality of care in ED. Most of previous articles focused on the characteristics of the patients returning within 72 h after ED discharge, while those on subsequent admission are numbered. This study's purpose is to identify risk factors for admission among 72-h return visit in the ED adult population. **Materials and Methods:** This retrospective cohort study was conducted at a medical center in Eastern Taiwan. The study period was from January 1, 2013, to December 31, 2013. We excluded patients who left against medical advice or without being seen, who was admitted or transferred at the index ED visit, whose medical records were incomplete, and whose age was below 18 years old. Significant variables were selected based on univariate analysis and later entered into multivariate logistic regression analysis to identify risk factors for 72-h return admission. **Results:** We identified 1575 eligible visits, and there were 1,119 visits entering into the final analysis. Male gender (odds ratio [OR] = 1.44), ambulance-transport at return visit (OR = 3.68), senior staff (OR = 1.52), work-up (OR = 3.03), and longer length of stay (LOS) were associated with higher risks of admission among ED 72-h return visits. Age, comorbidity, mode of transport at index visit, consultation, triage, type of illness, outpatient department visit between ED visits, and interval between index and return visits were not significantly associated with return admission. **Conclusion:** Gender, mode of transportation, staff experience, check-up, and LOS are associated with ED return admission.

KEYWORDS: Admission, Emergency department, Return visit

INTRODUCTION

When patients revisit the emergency department (ED) shortly after being discharged from ED, it is assumed that they received inadequate management during their prior visits. Unplanned return visits to ED are defined as the representations to ED with the same chief complaints in a short period of time, usually within 72 h. The rates of 72-h-return-visit ranged from 2.7% to 8.7% in previous researches of various data sources, including single-center and multi-center [1-5]. Previous studies reported that male gender, older age, arrival by ambulance, urgent triage level, chief complaint of abdominal pain, and left-against-medical-advise were risk factors of 72-h ED return visit (EDRV) [1,2,4,6].

Monitoring of unplanned return visits is a common method to examine the quality of emergency care; 72-h EDRV rate is a widely-used indicator for patient safety and quality of care. However, Pham *et al.* and Alberto Jiménez-Puente *et al.* found that 72-h EDRV may not be a valid indicator for emergency care quality [7,8]. Therefore, some researchers aimed at the differences between ED return visits with admission (EDRVA)

and ED return visits with no admission (EDRVNA). Their studies suggested that some clinical conditions in the index visits may be related to 72-h return admission [3,9-11].

The purpose of this study was to compare the demographic information and clinical characteristics of 72-h EDRVA and 72-h EDRVNA and explore the risk factors for admission in 72-h EDRV.

MATERIALS AND METHODS

Study design

This observational study involved a retrospective medical record review of all patients who made return visits to the ED between January 1, 2013 and December 31, 2013. The study was conducted at the ED of a tertiary referral hospital in Eastern Taiwan. The ED of this 843-bed academic teaching

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hospital has an annual volume of approximately 53,000 visits. The department consists of a treatment area with 20 beds and an observational unit with 36 beds. The admission rate of ED patients is 19%. Forty-three percent of the inpatients are admitted via ED. The ED is staffed by full-time board-certified emergency physicians, residents trained for emergency medicine, and rotating residents from other departments. ED patients may be assessed and treated by residents or emergency physicians initially, and later, the disposition was decided by attending physicians in the emergency room or observation unit. Patients may be discharged directly from the emergency room or moved into the observation unit for short treatment or boarding. The observation unit is staffed by senior emergency physicians. The electronic medical records of all adult patients who revisited ED after the initial discharge from ED were extracted from our ED administrative database. We collected patient demographics, process-of-care characteristics, health-care provider features, and patient outcomes.

Ethics

The study was a retrospective review of the medical records from our hospital database, and all patients were de-identified after data collection. Therefore, the Institutional Review Board of our institution waived the need for informed consent (IRB 104-71-B).

Study population

During the study period, all adult patients aged 18 years or older fitting the criteria of EDRVs within 72 h were considered eligible subjects into the current study. We excluded patients who left against medical advice or without being seen, who were admitted or transferred at the index ED visit, whose medical records were incomplete, whose causes of revisit were unrelated to the index ED visit, and whose age was below 18 years old. The rationale to exclude unrelated return visits was that they seldom presented quality issue. Return visits with previous discharge against medical advice were also excluded because these patients differ substantially from those discharged otherwise [12].

Definitions

Patients were categorized into ambulance, car driven by others (lay persons), and self-presentation in terms of modes of transport. Adult patients were defined as the elderly if they were 65 years old or older. Comorbidities were determined after thorough review of patients' medical record and summarized into Charlson Comorbidity Index (CCI). Emergency physicians were grouped as senior if they were board-certified more than 5 years. Level of patient acuity was categorized high if the Taiwan Triage and Acuity Scale being 1 or 2. Workups were defined as yes if patients underwent blood tests, urine exams, electrocardiograms, or radiology exams in their index visits. Consultations were defined as yes if patients obtained consultation in their index visits.

Statistical analysis

We used descriptive statistics to present all the outcomes. Continuous variables are reported using means with standard deviation or medians with interquartile range, depending whether the data were normally distributed or not. Categorical variables are expressed in the frequencies and ratios. Statistical

tests were conducted using independent *t*-test for normally distributed continuous variables, Mann–Whitney U-tests for non-normally distributed continuous variables, and Chi-square tests for categorical variables. Significant variables were selected based on the univariate analysis and later entered into multivariate logistic regression analysis to identify the risk factors for 72-h return admission. Data were analyzed with statistical software IBM SPSS Statistics for Windows, version 19 (IBM Corp., Armonk, NY, USA) and two-sided $P < 0.05$ was considered statistically significant.

RESULTS

Return visit rate and return visit admission rate

Over a 1-year study period, there were 49,610 visits to ED totally. The mean age of ED patients is 46.8 years old; 49.6% were female; 29.2% were elderly (>65 years old). After excluding pediatric visits ($n = 7231$), there remained 42,379 visits. Of these, there were 1,575 return visits within 72 h. The 72-h return visit rate was 3.7% (1575/42,379). Among the 1575 return visit patients, we excluded those with incomplete data ($n = 58$), those with causes unrelated to initial visits ($n = 206$), those not discharged normally in the initial visits ($n = 179$), and those with age below 18 years old ($n = 13$). Thus, there were 1119 return visits into final analysis, including 185 return visits with admission and 934 return visits without admission. Admission rate was 16.5% among return visits [Figure 1].

Characteristics of the return-visit-admission and return-visit-no-admission groups

Patients' characteristics were compared between the return visit admission (RVA) and the return visit no

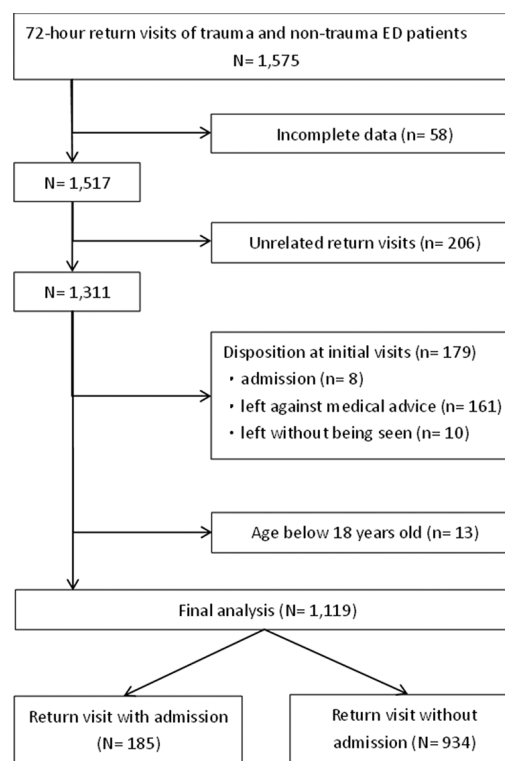


Figure 1: Flow chart for patient selection

Table 1: Characteristics of the return visit admission and return visit with no admission groups

	RVA	RVNA	P
Gender			
Female	76 (41.1)	492 (52.7)	0.004
Male	109 (58.9)	442 (47.3)	
Age (years)			
≥65	79 (42.7)	213 (22.8)	<0.001
<65	106 (57.3)	721 (77.2)	
CCI			
≥2	87 (47.0)	317 (33.9)	0.001
<2	98 (53.0)	617 (66.1)	
Index visits metrics			
Mode of arrival			
Self	35 (18.9)	262 (28.1)	0.002
Ambulance	22 (11.9)	58 (6.2)	
Lay person	128 (69.2)	614 (65.7)	
Type of illness			
Nontrauma	171 (92.4)	861 (92.2)	0.908
Trauma	14 (7.6)	73 (7.8)	
Triage			
Level 1-2	45 (24.3)	184 (19.7)	0.154
Level 3-5	140 (75.7)	750 (80.3)	
Staff seniority			
Junior	47 (25.4)	360 (38.5)	0.001
Senior	138 (74.6)	574 (61.5)	
Work-up			
Yes	160 (86.5)	466 (49.9)	<0.001
No	25 (13.5)	468 (50.1)	
Consultation			
Yes	23 (12.4)	50 (5.4)	<0.001
No	162 (87.6)	884 (94.6)	
ED LOS (h)			
0-1	18 (9.7)	382 (40.9)	<0.001
1-6	101 (54.6)	391 (41.9)	
>6	66 (35.7)	161 (17.2)	
Return visits metrics			
Mode of arrival			
Self	24 (13.0)	248 (26.6)	<0.001
Ambulance	19 (10.3)	27 (2.9)	
Lay person	142 (76.8)	659 (70.6)	
Type of illness			
Nontrauma	172 (93.0)	889 (95.2)	0.216
Trauma	13 (7.0)	45 (4.8)	
Triage			
Level 1-2	51 (27.6)	177 (19.0)	0.008
Level 3-5	134 (72.4)	757 (81.0)	
Time to return (h)			
0-24	91 (49.2)	385 (41.2)	0.045
24-72	94 (50.8)	549 (58.8)	
Outpatient visit before EDRV			
Yes	32 (17.3)	167 (17.9)	0.850
No	153 (82.7)	776 (82.1)	

RVA: Return visit admission, RVNA: Return visit with no admission, CCI: Charlson comorbidity index, LOS: Length of stay, EDRV: Emergency department return visit, ED: Emergency department

admission (RVNA) groups [Table 1]. There were significant differences between RVA and RVNA groups with regard to gender, age, comorbidities, index visits metrics (modes

of arrival, staff seniority, work-up, consultation, length of stay [LOS], and return visits metrics [mode of arrival, triage, time to return]).

Risk factors of admission in 72-h emergency department return visit patients

Presented in Table 2 are the results of the multivariable regression adjusted for gender, age, comorbidities, mode of arrival, triage level, staff seniority, work-up, consultation, LOS, and time to return. The risk factors for admission in return patients include male gender (odds ratio [OR] 1.44, 95% confidence interval [CI] 1.01–2.04), senior staff seniority at index visit (OR 1.52, 95% CI 1.04–2.23), and work-up at index visit (OR 3.03, 95% CI 1.82–5.05). Longer LOS of index visit and mode of arrival other than self-transport are also associated with higher risk of RVA. Age, comorbidities, mode of arrival at index visits, consultation at index visit, triage level, type of illness, and outpatients visit before return to ED are not significantly associated with return admission.

DISCUSSION

In this study, we found that patients who returned to the ED within 72 h of their initial visits had increased likelihood of admission if they were male, were seen by senior staff at initial visits, received work-ups at initial visits, stayed longer at initial visits, or were transported by lay persons/ambulance at return visits.

Previous studies have suggested that male gender might be associated with higher risk for return visit [2,4]. However, Wang *et al.* and Hu *et al.* did not find association between genders and return admission, in contrast to the finding of our study. It could result from the statistical method or insufficient case numbers in their studies [11,13].

Multiple studies have shown inconsistent results of association between age and return admission [3,11,13]. Analysis of our study revealed that older age (≥65 years) was not associated with greater risk for return admission. This controversy over whether elderly patients are at greater risk of return admission might occur for different reasons. First, age is usually categorized into groups during data analysis, and age groups are defined by cutoff values. More the numbers of the age groups, more likely to find increased risk in the old age group compared to the young age group (reference group). Second, even if the age group definitions are the same, difference between study populations should be taken into account. For example, Hu *et al.* found increased the risk of return admission in patients aged 65 years or older while our study did not. Of notice is that the mean age of the patients in their study was older than that in ours (53.2 years old vs. 46.8 years old), which might enhance the effect of “old age” and therefore discrepancy between age groups.

Di Giuseppe *et al.* and Hu *et al.* found that comorbidities were not associated with increased likelihood of return visit or return admission among ED patients. Our findings support those of their studies. Moreover, we used CCI instead of individual chronic conditions, which might provide additional plausibility to prior works [11,14].

Table 2: Risk factors of admission in 72-h emergency department return visit^a by multivariable logistic regression models

Variables	Odds ratio (95% confidence interval)		
	Unadjusted	Adjusted [§]	Adjusted
Gender			
Female	1	1	1
Male	1.60 (1.16-2.20)	1.44 (1.01-2.04)	1.44 (1.01-2.04)
Age (years)			
<65	1	1	1
≥65	2.52 (1.82-3.51)	1.33 (0.91-1.95)	1.30 (0.89-1.90)
CCI			
<2	1	1	1
≥2	1.73 (1.26-2.38)	1.30 (0.90-1.87)	1.31 (0.92-1.89)
Index visits metrics			
Mode of arrival			
Self	1	1	1
Lay person	1.56 (1.05-2.33)	0.95 (0.58-1.56)	0.98 (0.60-1.60)
Ambulance	2.84 (1.55-5.20)	1.09 (0.52-2.27)	0.99 (0.49-2.02)
Type of illness			
Nontrauma	1	1	-
Trauma	0.97 (0.53-1.75)	0.32 (0.10-1.03)	-
Triage			
Level 3-5	1	1	-
Level 1-2	1.31 (0.90-1.90)	0.83 (0.54-1.27)	-
Staff seniority			
Junior	1	1	1
Senior	1.84 (1.29-2.63)	1.54 (1.05-2.26)	1.52 (1.04-2.23)
Workup			
No	1	1	1
Yes	6.43 (4.14-9.99)	3.23 (1.93-5.41)	3.03 (1.82-5.05)
Consultation			
No	1	1	1
Yes	2.51 (1.49-4.23)	1.81 (1.03-3.20)	1.71 (0.98-3.00)
ED LOS (h)			
0-1	1	1	1
1-6	5.48 (3.26-9.23)	2.58 (1.42-4.67)	2.60 (1.44-4.69)
>6	8.70 (5.01-15.12)	3.23 (1.68-6.21)	3.34 (1.75-6.39)
Return visits metrics			
Mode of arrival			
Self	1	1	1
Lay person	2.23 (1.41-3.52)	1.88 (1.09-3.23)	1.83 (1.07-3.14)
Ambulance	7.27 (3.54-14.96)	3.63 (1.57-8.42)	3.68 (1.60-8.48)
Type of illness			
Nontrauma	1	1	-
Trauma	1.49 (0.79-2.83)	4.30 (1.27-14.55)	-
Triage			
Level 3-5	1	1	1
Level 1-2	1.63 (1.13-2.34)	0.94 (0.62-1.43)	0.94 (0.63-1.39)
Outpatient visit before EDRV			
No	1	1	-
Yes	0.96 (0.63-1.46)	1.24 (0.77-1.99)	-
Time to return (h)			
24-72	1	1	1
0-24	1.38 (1.01-1.89)	1.41 (0.99-2.00)	1.39 (0.98-1.96)

[§]Full model: adjusted for gender, age, CCI, mode of arrival, type of illness, triage, staff seniority, work-up, consultation, ED LOS, time to return, ^{||}Final model: adjusted for gender, age, CCI, mode of arrival, triage (return visit), staff seniority, workup, consultation, ED LOS, time to return. CCI: Charlson comorbidity index, LOS: Length of stay, EDRV: Emergency department return visit, ED: Emergency department

Mode of transportation to ED is associated with resources utilization [15]. In the present study, we identified that

ambulance transportation increased the risk for return admission, which was consistent with prior researches [4,14].

Triage is a unique metric in EDs, and it represents the acuity of patients' illness. Multiple studies have showed that high-acuity ED patients might have greater changes of early return and return admission [3,4,11]. On the contrary, we were unable to find increased risk of return admission among high-acuity patients (level 1 and level 2). The explanation for this is unclear, perhaps reflecting that patients may be often over-triaged in our ED, and hence, the difference between high-and low-acuity groups in regard to true severity is blurred. It may remind our staff to re-evaluate the accuracy of triage.

It was unexpected to find that patients seen by senior emergency physicians at their index visits were more likely to be hospitalized at their return visits. Hu *et al.* found no difference in staff experiences between EDRVA and EDRVNA patients [11]. One plausible explanation is that the ranges of staff experiences in the two studies differed substantially (4–11 years vs. 0–16 years). The wider range of staff experience in our study might enhance the variation across junior and senior physicians. Another explanation is the staffing allocation in our ED where observation unit is staffed with senior physicians. ED patients discharged from observation unit appear to have more complicated and uncertain clinical course, which might make return admission more likely for these patients. Therefore, senior physicians in our ED are presumably associated with more return visits than junior physicians.

Diagnosis and treatment are always challenging for emergency physicians, since the nature of the acute illness is often uncertain or equivocal. Consequently it is common to order laboratory tests, radiological examinations, or consultations with specialties in ED practice. These investigations may be “skipped” for some straightforward patients, but remain essential for majority of ED patients, especially complex ones. The literature has shown that diagnostic tests and consultations are positively correlated to ED LOS [16-18]. We believe that emergency physicians tend to ordering more tests for patients with more uncertainty, which makes LOS longer. Thus it is reasonable to identify the positive relation between diagnostic tests/LOS and return admission.

Although the causes of return visits were recorded in the original dataset, we did not include them in the analysis. The reason was that each record was reviewed by one research assistant only, therefore inter-rater agreement was lacking. Nevertheless, we reported here that the causes of return visits included disease-related (721/1119, 64.4%), patient-related (339/1119, 30.3%), doctor-related (57/1119, 5.1%), and expected (2/1119, 0.2%). This result was similar to prior researches [19-21]. Doctor-related return visits were significantly different between RVA and RVNA groups (20.5 vs. 2.0%), which was in line with Hung *et al.* [22].

We collected the information by reviewing the medical charts instead of extracting administrative data, thus providing more detailed and accurate clinical conditions. The findings from the present study may contribute to the literature about 72-h return admission of ED patients by identifying the risk factors such as staff experience, mode of transportation, or LOS.

However, several limitations are also noted. First, data source was from a single hospital. Therefore, we were unable to identify the patients discharged from ED of other hospitals, nor track patients discharged from the study site. Although this limitation might be addressed by extracting information from health-care databases, it would be a study method at the expense of detailed clinical information. Second, we did not take ED crowding into account. The literature has revealed the negative impact of ED crowding on quality of care in ED, such as delay in treatment [23]. In the present study, it was the lack of the real-time information required for measuring ED crowding that prevented us from accessing its association to return admission [24]. Future investigations are needed to determine the risk of return admission with ED crowding.

CONCLUSION

In this study, we found that gender, mode of transportation, staff experience, check-up, and LOS were associated with ED return admission.

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Conflicts of interest

There are no conflicts of interest.

REFERENCES

- Huggins C, Robinson RD, Knowles H, Cizenski J, Mbugua R, Laureano-Phillips J, et al. Large observational study on risks predicting emergency department return visits and associated disposition deviations. *Clin Exp Emerg Med* 2019;6:144-51.
- Shy BD, Loo GT, Lowry T, Kim EY, Hwang U, Richardson LD, et al. Bouncing back elsewhere: Multilevel analysis of return visits to the same or a different hospital after initial emergency department presentation. *Ann Emerg Med* 2018;71:555-630.
- Hayward J, Hagtvedt R, Ma W, Gauri A, Vester M, Holroyd BR. Predictors of admission in adult unscheduled return visits to the emergency department. *West J Emerg Med* 2018;19:912-8.
- Chan AH, Ho SF, Fook-Chong SM, Lian SW, Liu N, Ong ME. Characteristics of patients who made a return visit within 72 h to the emergency department of a Singapore tertiary hospital. *Singapore Med J* 2016;57:301-6.
- Verelst S, Pierloot S, Desruelles D, Gillet JB, Bergs J. Short-term unscheduled return visits of adult patients to the emergency department. *J Emerg Med* 2014;47:131-9.
- van der Linden MC, Lindeboom R, de Haan R, van der Linden N, de Deckere ER, Lucas C, et al. Unscheduled return visits to a Dutch inner-city emergency department. *Int J Emerg Med* 2014;7:23.
- Pham JC, Kirsch TD, Hill PM, DeRuggerio K, Hoffmann B. Seventy-two-hour returns may not be a good indicator of safety in the emergency department: A national study. *Acad Emerg Med* 2011;18:390-7.
- Jiménez-Puente A, Del Río-Mata J, Arjona-Huertas JL, Mora-Ordóñez B, Martínez-Reina A, Martínez Del Campo M, et al. Which unscheduled return visits indicate a quality-of-care issue? *Emerg Med J* 2017;34:145-50.
- Martin-Gill C, Reiser RC. Risk factors for 72-hour admission to the ED. *Am J Emerg Med* 2004;22:448-53.
- Abualenain J, Frohna WJ, Smith M, Pipkin M, Webb C, Milzman D, et al. The prevalence of quality issues and adverse outcomes among 72-hour return admissions in the emergency department. *J Emerg Med* 2013;45:281-8.

11. Hu KW, Lu YH, Lin HJ, Guo HR, Foo NP. Unscheduled return visits with and without admission post emergency department discharge. *J Emerg Med* 2012;43:1110-8.
12. El Sayed M, Jabbour E, Maatouk A, Bachir R, Dagher GA. Discharge against medical advice from the emergency department: Results from a Tertiary Care Hospital in Beirut, Lebanon. *Medicine (Baltimore)* 2016;95:e2788.
13. Wang HY, Chew G, Kung CT, Chung KJ, Lee WH. The use of Charlson comorbidity index for patients revisiting the emergency department within 72 h. *Chang Gung Med J* 2007;30:437-44.
14. Di Giuseppe G, Abbate R, Albano L, Marinelli P, Angelillo IF; Collaborative Research Group. Characteristics of patients returning to emergency departments in Naples, Italy. *BMC Health Serv Res* 2008;8:97.
15. Marinovich A, Afilalo J, Afilalo M, Colacone A, Unger B, Giguère C, et al. Impact of ambulance transportation on resource use in the emergency department. *Acad Emerg Med* 2004;11:312-5.
16. Brouns SH, Stassen PM, Lambooi SL, Dieleman J, Vanderfeesten IT, Haak HR. Organisational factors induce prolonged emergency department length of stay in elderly patients--A retrospective cohort study. *PLoS One* 2015;10:e0135066.
17. Li L, Georgiou A, Vecellio E, Eigenstetter A, Toouli G, Wilson R, et al. The effect of laboratory testing on emergency department length of stay: A multihospital longitudinal study applying a cross-classified random-effect modeling approach. *Acad Emerg Med* 2015;22:38-46.
18. van der Veen D, Remeijer C, Fogteloo AJ, Heringhaus C, de Groot B. Independent determinants of prolonged emergency department length of stay in a tertiary care centre: A prospective cohort study. *Scand J Trauma Resusc Emerg Med* 2018;26:81.
19. Liaw SJ, Bullard MJ, Hu PM, Chen JC, Liao HC. Rates and causes of emergency department revisits within 72 h. *J Formos Med Assoc* 1999;98:422-5.
20. Wu CL, Wang FT, Chiang YC, Chiu YF, Lin TG, Fu LF, et al. Unplanned emergency department revisits within 72 hours to a secondary teaching referral hospital in Taiwan. *J Emerg Med* 2010;38:512-7.
21. Wu CL, Wang FT, Chiang YC, Chiu YF, Lin TG, Fu LF, et al. Unplanned emergency department revisits within 24 h in a referral hospital. *J Emerg Crit Care Med* 2008;19:146-54.
22. Hung SC, Chew G, Kong CT, Hsiao CT, Liaw SJ. Unplanned emergency department revisits within 72 hours. *J Emerg Med Taiwan*. 2004;6:230-8.
23. Stang AS, Crotts J, Johnson DW, Hartling L, Guttman A. Crowding measures associated with the quality of emergency department care: A systematic review. *Acad Emerg Med* 2015;22:643-56.
24. Boyle A, Abel G, Raut P, Austin R, Dhakshinamoorthy V, Ayyamuthu R, et al. Comparison of the International Crowding Measure in Emergency Departments (ICMED) and the National Emergency Department Overcrowding Score (NEDOCS) to measure emergency department crowding: Pilot study. *Emerg Med J* 2016;33:307-12.