

The Propensity to Hospitalize Patients as a Tool to Assess the Quality of Care in ED

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Key points



- Mission of the Emergency Medicine Physician
- Role of EP in the patient's flow
- The importance of boarding on ED crowding
- Correlation between boarding and quality fo care in ED
- Determinants of hospital admission

Mission della medicina d'urgenza



- Primo e rapido inquadramento diagnostico orientato all'identificazione delle condizioni che mettono a rischio la vita o la funzione di un organo
- Stabilizzazione pazienti a rischio
- Attivazione percorsi assistenziali intraospedalieri o di rete per le situazioni di emergenza
- Selezione dei pazienti che necessitano il ricovero con scelta del livello di intensita' assistenziale
- Rinvio a domicilio con le indicazioni per le eventuali successive fasi assistenziali



Role of the EP on the patient “flow”

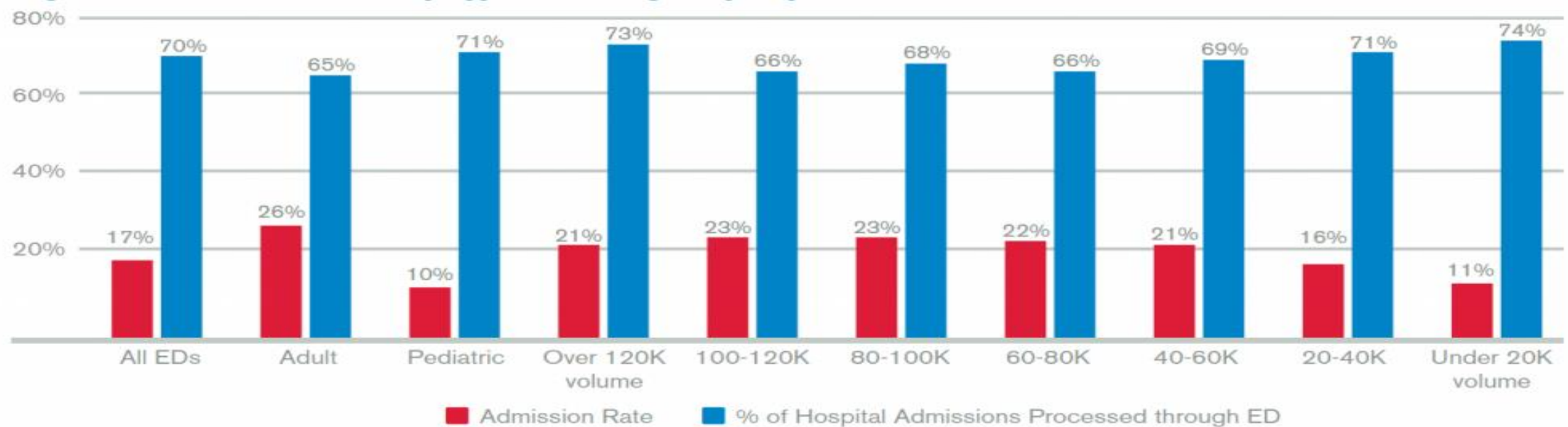
- A core competence of emergency medicine practice is determining which patients would benefit from inpatient care and which can be safely managed as outpatients.
- A complex mix of factors determines the safety of outpatient care for a patient undergoing evaluation in the emergency department.

Role of the EP on the patient “flow”



- The disposition decision to admit or discharge a patient is one of the most important decisions made by an emergency physician.
- Admitting a patient who does not need to be admitted exposes them to **unnecessary medical testing, treatments, and expenses**.
- However, an overly optimistic assessment of a patient’s condition and subsequent discharge **can lead to negative clinical outcomes** and law suits

Admission Rate by Type of Emergency Department



Role of the EP on the patient “flow”



- Emergency physicians deliver **great value to the health system** by making those determinations in about three hours from the time a patient arrives in the emergency department.
- Trend data indicate the medical community entrusts emergency physicians to determine which patients will benefit from inpatient care after the patient receives diagnostic workup and initial treatment in the emergency department. Indeed, the use of emergency departments as a processing center for hospital admissions has increased over the last 14 years, from 58 percent to about 70 percent

Correlation between ED crowding and quality



- Many of the studies targeting quality of service in the emergency departments have identified crowding as a great reason of concern
- systematic reviews show how **emergency department crowding positively correlates with mortality** both among patients admitted to the hospital and discharged home; an association is also reported with higher rates of patients leaving the emergency room without being seen.

Correlation between ED crowding and boarding



Asplin *et al* introduced a conceptual model of ED crowding, visualising the factors associated with crowding. These factors can be divided into

- input,
- throughput
- output factors.

It is thought that mainly output, that is, an inadequate disposition of patients, contributes to crowding, which subsequently leads to limited patient flow at the ED

The main contributor to ED crowding is the inability to transfer patients to inpatient units once they are admitted



- The primary cause of overcrowding is boarding: the practice of holding patients in the emergency department after they have been admitted to the hospital, because no inpatient or observation beds are available.
- The time at which boarding starts, or the time-zero, is the time at which the decision has been made to admit or place the patient into observation status.

Determinants of decision for hospital admission



- Rates of inpatient hospital admission from the emergency department (ED) vary substantially across hospitals and regions even after controlling for patient comorbidities and hospital case mix
- Variation in admission rates also exists for a wide spectrum of conditions across physicians within the same institution when variation in patient characteristics across physicians is minimal

Appropriate and inappropriate admission



Original Article

Evaluation of Appropriate and Inappropriate Admission and Hospitalization Days According to Appropriateness Evaluation Protocol (AEP)

Abstract

Background: Inappropriate admission and hospitalization days are the factors that impose more costs to hospitals. By considering current condition of hospitals, it is vital to have an insight into the data on inappropriate admission and hospitalization days in order to eliminate obstacles to the proper and appropriate hospitalization.

Methods: In this study, 198 patients who were admitted to receive surgical or non-surgical treatment in Sina public hospital were selected. An appropriateness Evaluation Protocol (AEP) was used for data collection. The validity of AEP is well established by the preceding studies. In order to achieve the study objectives, binary logistic regression test was used.

Results: According to our findings, 39.4% of hospitalization days and 16.2% of admissions are inappropriate. In this study, inappropriate admission was observed among married patients eight times more than among single ones. Inappropriate hospitalization days were 12 times more prevalent among patients from provinces than among those from Tehran. With increasing age of the patient the probability of inappropriate admission decreases slightly, i.e. the probability of inappropriate admission decreases 10% as the age increases one year. The number of hospitalization days was significantly correlated to the following parameters: type of admission, patient's city of residence, type of treatment, and length of stay ($P < 0.05$).

Conclusion: Regarding the results of this study, a large number of admissions and specially hospitalization days are inappropriate. According to other studies, suitable programming many inappropriate admissions and hospitalization days are preventable.



Influence of crowding on the decision for hospital admission

Abir et al. *International Journal of Emergency Medicine* (2019) 12:4
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ORIGINAL RESEARCH

Open Access

Evaluating the impact of emergency department crowding on disposition patterns and outcomes of discharged patients



Abstract

Background: Crowding is a major challenge faced by EDs and is associated with poor outcomes.

Objectives: Determine the effect of high ED occupancy on disposition decisions, return ED visits, and hospitalizations.

Methods: We conducted a retrospective analysis of electronic health records of patients evaluated at an adult, urban, and academic ED over 20 months between the years 2012 and 2014. Using a logistic regression model predicting admission, we obtained estimates of the effect of high occupancy on admission disposition, adjusted for key covariates. We then stratified the analysis based on the presence or absence of high boarder patient counts.

Results: Disposition decisions during a high occupancy hour decreased the odds of admission (OR = 0.93, 95% CI: [0.89, 0.98]). Among those who were not admitted, high occupancy was not associated with increased odds of return in the combined (OR = 0.94, 95% CI: [0.87, 1.02]), with-boarders (OR = 0.96, 95% CI: [0.86, 1.09]), and no-boarders samples (OR = 0.93, 95% CI: [0.83, 1.04]). Among those who were not admitted and who did return within 14 days, disposition during a high occupancy hour on the initial ED visit was not associated with a significant increased odds of hospitalization in the combined (OR = 1.04, 95% CI: [0.87, 1.24]), the with-boarders (OR = 1.12, 95% CI: [0.87, 1.44]), and the no-boarders samples (OR = 0.98, 95% CI: [0.77, 1.24]).

Conclusion: ED crowding was associated with reduced likelihood of hospitalization without increased likelihood of 2-week return ED visit or hospitalization. Furthermore, high occupancy disposition hours with high boarder patient counts were associated with decreased likelihood of hospitalization.

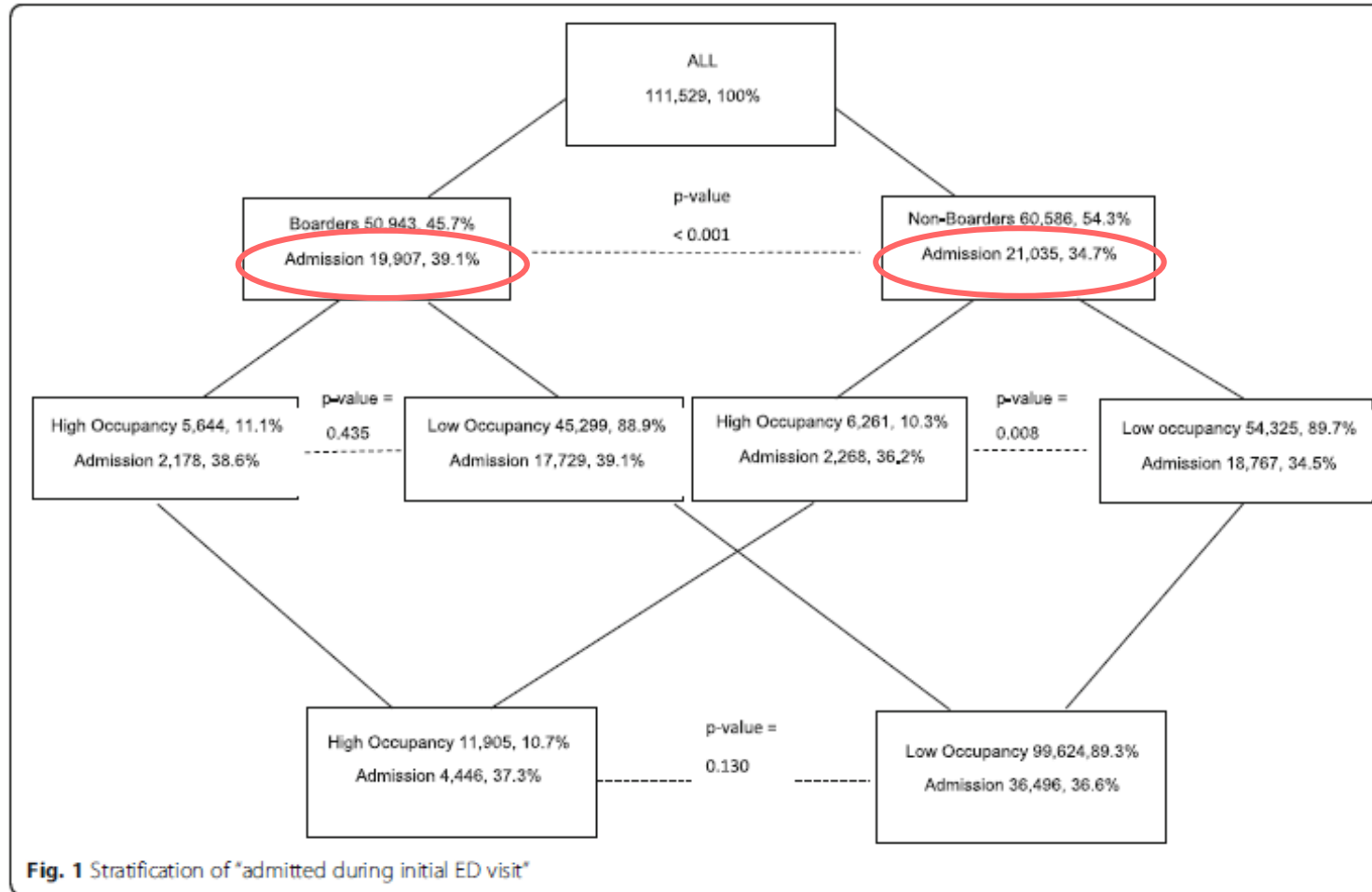
Keywords: Emergency department crowding, Outcomes, Disposition decision-making

ORIGINAL RESEARCH

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Evaluating the impact of emergency department crowding on disposition patterns and outcomes of discharged patients



Determinants for hospital admission



Predicting in-hospital admission at the emergency department: a systematic review

Anniek Brink ,¹ Jelmer Alsma ,¹ Lodewijk AAM van Attekum,¹
Wichor M Bramer,² Robert Zietse,¹ Hester Lingsma,³ Stephanie CE Schuit¹

- Advancing patient disposition may reduce LOS at the ED and thus consequently reduce crowding. The identification of those patients that need admission at ED arrival may help to shorten ED LOS for many patients.
- Several prediction tools exist to identify patients needing hospital admission. Implementing such a model in clinical practice may alter patient courses and lead to earlier admission

Predicting inhospital admission at the emergency department: a systematic review


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Table 3 Categorisation of parameters in the prediction models

	Model	Demographics	Vital signs	Interventions	Triage	Previous care contacts	Chief complaint	Drug use	Mobility and dependency	ED entrance	Professional assessment
Alam et al ²⁸	NEWS		X	X							
Brouns et al ²⁶	MTS	X			X						
Cameron et al ¹⁹ and Cameron et al ¹⁸	GAPS	X	X	X	X	X				X	
Cameron et al ¹⁸	VAS										X
Di Bari et al ²⁰ and Salvi et al ²¹	ISAR	X				X		X	X		
Di Bari et al ²⁰	SC	X				X		X			
Grossmann et al ²⁷	ESI				X						
Kraaijevanger et al ²⁴	Own model	X			X		X			X	
Lucke et al ²⁵	Adult model	X	X	X	X	X	X				X
Lucke et al ²⁵	Older patient model	X	X	X	X	X	X				X
Noel et al ²²	TNP										X
Noel et al ²²	Own model	X			X		X			X	
Noel et al ²²	TNP+own model	X			X		X			X	X
Salvi et al ²¹	TRST					X		X	X		X
Zlotnik et al ²³	Own model LR	X			X		X			X	
Zlotnik et al ²³	Own model ANN	X			X		X			X	



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None of the studies described implementation, and none of the models are currently implemented in the ED as a prediction tool for admission. The lack of implementation cannot be explained by the discriminative ability, which was generally good.

This systematic review identified 16 prognostic models for predicting admission in patients presenting to the ED. We suggest that the effect of these models on ED LOS and crowding reduction should be examined, given that external validation and potentially updating of the models have taken place for the specific hospital ED

Prediction of hospital admission



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Research and Applications



Research and Applications

Prediction of patient disposition: comparison of computer and human approaches and a proposed synthesis

- Emergency medicine clinicians make timesensitive diagnostic, treatment, and disposition decisions (admission to hospital vs discharge) on a daily basis.
- Often, **clinicians** rely on incomplete information and lack sufficient time to process all available information, instead relying heavily on their past experience and clinical gestalt.
- In contrast, **computer models** can easily process the entire medical record of a patient within the time allotted in the ED but are blinded to the clinical impressions of the treating clinicians, as this information is often left undocumented.



Research and Applications

Prediction of patient disposition: comparison of computer and human approaches and a proposed synthesis

- A major problem in EDs worldwide is the long-term boarding of admitted patients in the ED.
- In the current model of care, it is only toward the end of the ED encounter that a decision is made regarding patient ED disposition.
- Early identification of likely admissions has the potential to advance bedcoordination and reduce ED boarding times, improve patient flow, and reduce errors, leading to improved care, enhanced patient satisfaction, and decreased ED overcrowding.



Research and Applications

Prediction of patient disposition: comparison of computer and human approaches and a proposed synthesis

In this study, they compare the accuracy of physicians versus computers in predicting which patients in the ED will be admitted to the hospital.

The aim is to determine which elements of a physician's assessment are the most important drivers for making accurate predictions, which elements are most important for the computer model, and to compare the 2.

They hypothesize that a **hybrid model** that integrates the elements gleaned by the computer model together with human factors and the advanced cognitive clinical reasoning accessible by physicians can provide improved accuracy..



Research and Applications

Prediction of patient disposition: comparison of computer and human approaches and a proposed synthesis

Table 3. Top factors driving the physicians' predictions, alongside the sensitivity, specificity, positive predictive value, and negative predictive value of each predicting-factor

Factor chosen by physician	Count (n = 192)	Sensitivity	Specificity	PPV	NPV
Chief complaint	174	59% [45–72%]	89% [83–94%]	68% [54–82%]	84% [78–90%]
Patient's medical history	94	62% [45–78%]	82% [72–91%]	66% [49–82%]	79% [69–89%]
Clinical appearance (i.e., eyeball)	83	54% [34–74%]	92% [84–99%]	72% [52–93%]	83% [74–92%]
Vital signs	82	59% [35–82%]	97% [93–100%]	83% [62–100%]	90% [83–97%]
Time of day	36	33% [0–71%]	93% [84–100%]	50% [1–99%]	88% [76–99%]
Current ED attending practice style (e.g., tendency to admit or not admit)	31	22% [0–49%]	82% [66–98%]	33% [0–71%]	72% [54–90%]
Referring physician's request	23	57% [31–83%]	89% [68–100%]	89% [68–100%]	57% [31–83%]
Radiology	19	89% [68–100%]	90% [71–100%]	89% [68–100%]	90% [71–100%]
Medications given or ordered	18	75% [33–100%]	93% [79–100%]	75% [33–100%]	93% [79–100%]
Parental concern or preferences	17	43% [6–80%]	70% [42–98%]	50% [10–90%]	64% [35–92%]
Labs	11	100% [100–100%]	71% [38–100%]	67% [29–100%]	100% [100–100%]
Patient's social situation (e.g., homeless, distance travelled)	9	100% [100–100%]	71% [38–100%]	50% [1–99%]	100% [100–100%]
Other	7	67% [13–100%]	100% [100–100%]	100% [100–100%]	80% [45–100%]
Clinical scores (e.g., CHEWS, HASS, etc)	2	NA	NA	NA	NA
Hospital bed availability capacity	1	NA	NA	NA	NA
ED bed availability capacity	1	NA	NA	NA	NA

Abbreviations: ED, emergency department; NPV, negative predictive value; PPV, positive predictive value.

Table 4: Top risk factors for admission as identified by the computer model, grouped by category and sorted by odds-ratio for admission. Showing only features available for 50 or more subjects. The full list can be found in the [Supplementary Material](#)

Feature	Cases	Controls	Odds Ratio	95% CI
Chief complaint				
Abnormal lab test	78	66	5.8	[4.17–8.08]
Seizure	110	136	4.0	[3.08–5.13]
Shortness of breath	26	35	3.6	[2.19–6.07]
Triage score				
1	60	39	7.6	[5.04–11.33]
2	1619	2214	3.6	[3.33–3.87]
Miles traveled				
80–160M	79	76	5.1	[3.72–7.01]
40–80M	360	471	3.8	[3.26–4.33]
Admission ratio				
≥ 50%	324	12	132.7	[74.45–236.34]
<50% (> 0%)	133	86	7.6	[5.78–9.99]
Number of lab tests				
11+	104	24	21.3	[13.63–33.24]
6–10	354	189	9.2	[7.68–11.03]
3–5	430	453	4.7	[4.06–5.35]
Arrival Model				
Transfer	418	399	5.1	[4.46–5.94]
EMS	351	806	2.1	[1.88–2.44]
Time from arrival to first lab drawn				
Within 10m	197	115	8.4	[6.66–10.63]
10–20m	216	183	5.8	[4.74–7.09]
20–30m	221	234	4.6	[3.84–5.6]
30–60m	562	866	3.2	[2.85–3.57]
Maximal heart rate				
> +2SD for age	395	776	2.5	[2.2–2.84]



Research and Applications

Prediction of patient disposition: comparison of computer and human approaches and a proposed synthesis

CONCLUSION

Only a few studies to date have compared the predictions of machine learning models to those of clinicians for the same cohort of patients and with external validation.³⁷ In this study, using a prospective head-to-head comparison, we found that combining computer predictions with human gestalt predictions leads to the most accurate disposition predictions. These findings help establish a framework for determining which prognostic elements identified by computer models can improve upon the diagnostic experience of human experts, and vice versa. The next step would be to validate this synthesized model, prospectively, as well as to examine the impact of computer-generated predictions and automatically extracted features on clinicians' ability to predict disposition. Such studies would build on the growing vision for a future clinical practice in which the best of both human and computer predictive capabilities are combined in a complementary and synergistic fashion to provide improved patient care.



TAKE HOME MESSAGE

One of the core competences of emergency physician is the ability to decide to admit or not

This decision has a double effect:

- on the single patient
- on the global ED patients flow

Knowing the determinants of this decision could help fastening the process



TAKE HOME MESSAGE

- One of the core competences of emergency physician is the ability to decide to admit or not
- Emergency physicians deliver **great value to the health system** by making this decision
- Admission rates and propensity to hospitalization could be a measure of quality of the ED



THANK YOU
FOR YOUR
ATTENTION

