Note of the editors: Note of the editors: This is a BOWMAN-generated English translation of the officially indexed Spanish-language article, which should be cited as Emergencias 2026;38:330-338. In this translated version, the editors have supervised the process; however, it cannot be ruled out that some errors resulting from the artificial intelligence translation process may have gone unnoticed.

ORIGINAL ARTICLE

Impact of overnight boarding in the emergency department on in-hospital mortality and length of hospital stay among older patients

Agustín Fernández-Cisnal[1], Òscar Miró[2], Carla Boixeda[2], Christian Luis Di Paolo[2], Carolina Rangel[2], Luisa F. Villate Robles[3], Laura Fernández Gutiérrez[3], Ernest Bragulat[2]

Objective. To evaluate the association between overnight boarding in the emergency department after the decision to admit and in-hospital mortality and total episode duration among older patients admitted through the emergency department of a minimally overcrowded hospital in Boston (Massachusetts, United States).

Methods. A retrospective cohort study was conducted using MIMIC-IV data from 2011 through 2019. Patients aged 65 years or older who were admitted through the emergency department and had a documented admission order were included; patients admitted to intensive care were excluded. Overnight boarding was defined as remaining in the emergency department until 8:00 AM, whereas controls were defined as patients who left the emergency department before midnight. Five sensitivity analyses were performed, with adjustment for age, sex, and comorbidity.

Results. A total of 2,806 patients were included: 2,471 controls and 335 patients who experienced overnight boarding. Although time to the admission decision did not differ between groups, the wait for an inpatient bed was substantially longer among patients who experienced overnight boarding (1.2 vs 20.1 hours). The in-hospital mortality rate was 2.0% (49/2,471) in the control group and 2.4% (8/335) in the overnight-boarding group, with an adjusted OR of 1.21 (95% CI, 0.56-2.60). Moreover, total episode duration was similar between the groups (+0.21 days; 95% CI, –0.14 to 0.57). Sensitivity analyses yielded consistent findings for mortality, with ORs of 1.31, 1.27, and 1.64, and showed a longer episode duration only in the medical cohort (+0.61 days). When a documented admission order was not required, the OR was 0.68 (95% CI, 0.48-0.97). Age did not modify the results.

Conclusions. In this selected low-risk cohort, overnight boarding was not associated with in-hospital mortality or total episode duration. However, the small number of events and the potential for selection bias preclude ruling out a harmful effect.

Keywords: Overnight boarding. Emergency department. Inpatient bed wait. In-hospital mortality. Length of stay. Older adults.

Author Affiliations:
[1]Servicio de Cardiología, Parc Sanitari Sant Joan de Déu, Sant Boi de Llobregat, Barcelona, Spain.
[2]Servicio de Urgencias, Hospital Clínic, IDIBAPS, Universitat de Barcelona, Barcelona, Spain.
[3]Servicio de Urgencias, Parc Sanitari Sant Joan de Déu, Barcelona, Spain.

Author Contributions:
All authors have confirmed their authorship in the author's responsibilities document, publication agreement, and assignment of rights to EMERGENCIAS.

Corresponding Author:
Agustín Fernández-Cisnal
Parc Sanitari Sant Joan de Déu. Hospital Sant Boi, Servicio de Cardiología.
Carrer del Dr. Antoni Pujadas, 42, 08830 Sant Boi de Llobregat, Barcelona, Spain.

Email:
fecia82@gmail.com

Article Information:
Received: 18-6-2026
Accepted: 20-7-2026
Online: 27-08-2026

Editor in Charge:
Agustín Julián-Jiménez

Impacto de la pernoctación en urgencias sobre la mortalidad intrahospitalaria y la duración de la hospitalización en pacientes mayores

Objetivo. Evaluar la asociación entre pernoctar en urgencias tras decidirse el ingreso y la mortalidad intrahospitalaria y la duración total del episodio en pacientes mayores ingresados desde urgencias en un hospital de Boston (EE.UU.) poco saturado.

Método. Estudio de cohortes retrospectivo (MIMIC-IV, 2011-2019) en pacientes de 65 o más años ingresados desde urgencias con orden de ingreso documentada, excluidos los cuidados intensivos. Se definió pernoctación como permanecer en urgencias hasta las 08:00 y control como salir de urgencias antes de la medianoche. Se realizaron cinco análisis de sensibilidad, ajustados por edad, sexo y comorbilidad.

Resultados. Se incluyeron 2.806 pacientes (2.471 control; 335 pernoctación). El tiempo hasta la decisión no difirió, pero la espera de cama fue mucho mayor en el grupo pernotación (1,2 frente a 20,1 horas). La mortalidad intrahospitalaria fue 2,0% (49/2.471) frente a 2,4% (8/335) con OR ajustada de 1,21 (IC 95%: 0,56-2,60) y la duración total del episodio similar (+0,21 días; IC 95%: –0,14 a 0,57). Los análisis de sensibilidad fueron concordantes para la mortalidad (OR de 1,31, 1,27 y 1,64) y mostraron mayor duración del episodio solo en la cohorte médica (+0,61 días). En el análisis de sensibilidad que no exigía orden de ingreso, la OR fue 0,68 (IC 95%: 0,48-0,97). La edad no modificó los resultados.

Conclusiones. En esta cohorte seleccionada de bajo riesgo no se halló asociación entre pernoctación y mortalidad intrahospitalaria ni duración del episodio, aunque la escasez de eventos y el sesgo de selección impiden descartar completamente un efecto perjudicial de la pernoctación en urgencias en los pacientes que precisan hospitalización.

Palabras clave: Pernoctación. Servicio de urgencias. Espera de cama hospitalaria. Mortalidad hospitalaria. Estancia hospitalaria. Anciano.

Introduction

Overcrowding in emergency departments (EDs) is a chronic worldwide problem,[1] resulting from an imbalance between increasing patient inflow and reduced outflow because of a shortage of hospital beds, which forces many patients awaiting admission to remain in the ED after completion of the emergency care process while waiting for an inpatient bed.[2-4] Many of them spend the night in the ED, despite the fact that the daily need for hospital beds is highly predictable.[5] Several retrospective studies[6-8] have associated ED overcrowding and prolonged ED stays with increased mortality and longer hospitalisation. The underlying mechanisms are multiple: in addition to insufficient staffing to care for patients who are no longer under the responsibility of the ED team,[9] delays in medication and indicated treatments, less intensive monitoring, and delayed assessment by the inpatient team also contribute.

These risks do not affect all patients equally. Older patients account for approximately one quarter of the total population treated in EDs in Western countries,[10-12] and, owing to their greater frailty and high burden of comorbidities, they constitute the group most exposed to adverse events and death when they remain in the ED for prolonged periods, in an environment that disrupts sleep, delays medication, and promotes delirium.[13-17]

Although spending the night in the ED after the decision to admit has been made may be particularly harmful, it has been poorly studied. Three European studies in patients aged 75 years or older (France, Spain, and Italy, settings in which overcrowding and overnight stays are common) have shown divergent results: the French study found a clear increase in in-hospital mortality (adjusted OR, 1.50; 95% CI, 1.09-2.06),[18] which was not confirmed in the Spanish study (OR, 1.12; 95% CI, 0.80-1.58)[19] or in the Italian study, which even suggested a possible protective effect approaching statistical significance (OR, 0.90; 95% CI, 0.81-1.01).[20] The objective of the present study was to assess, in a setting different from Europe—a Boston hospital in the United States with a lower frequency of overnight ED stays—whether spending the first night after the admission decision in the ED is associated with increased in-hospital mortality and longer hospital stay. The hypothesis was that its impact in a less overcrowded setting would be limited.

Methods

Study design and data source

We conducted a retrospective cohort study using the MIMIC-IV (Medical Information Mart for Intensive Care IV) database, a controlled-access registry containing electronic health record data from patients treated at Beth Israel Deaconess Medical Center, a tertiary academic hospital in Boston (Massachusetts, United States), and available through PhysioNet.[21] The hospital and emergency department modules were used in combination. Data correspond to the 2011-2019 period and, for confidentiality reasons, dates are deidentified and randomly shifted. The study was designed and reported in accordance with the STROBE recommendations for observational studies.[22] MIMIC-IV is a controlled-access database whose use is approved by the institutional review boards of Beth Israel Deaconess Medical Center and the Massachusetts Institute of Technology; the data are anonymised, and one of the investigators (AFC) accessed them as a credentialled researcher after completing the required training. Therefore, the study was exempt from additional approval by a local ethics committee.

Study population

Patients aged 65 years or older who were treated in the ED and admitted from the ED to a conventional inpatient ward (emergency admission route, "EW EMER." in MIMIC-IV terminology), with valid ED timestamps and a documented admission order during their ED stay, were included. Direct admissions to intensive care units and episodes coded as observation were excluded.

The admission order is recorded only when hospitalisation is processed through a formal bed request from the ED; without it, the decision-to-admit time cannot be established and the evaluation period cannot be separated from the bed-waiting period, which was the exposure of interest. This criterion defines a selected cohort, the effect of which was evaluated in a specific sensitivity analysis (sensitivity analysis D).

Definitions and study groups

The following care time points were defined: ED arrival (edregtime), admission order (ordertime), and departure to the inpatient ward (edouttime). From these, time to admission decision, bed-waiting time (boarding in the English-language literature; from ordertime to edouttime), total ED length of stay, hospital length of stay, and total duration of the index episode, including time in the ED and inpatient ward, were calculated (Figure 1). The admission order, rather than the administrative admission time, was used as a proxy for the decision to admit.

According to the time of departure from the ED, 3 groups were defined: the control group (departure before midnight, with transfer to the ward on the same day), the intermediate group (departure between 00:00 and 07:59), and the overnight or exposed group (remaining in the ED until 08:00 or later the following day) (Figure 1). Following the approach used in former European studies,[18-20] the primary analysis compared the overnight group with the control group and excluded the intermediate group. This exclusion followed the strategy used in those former studies; inclusion of the intermediate group was assessed in a sensitivity analysis.

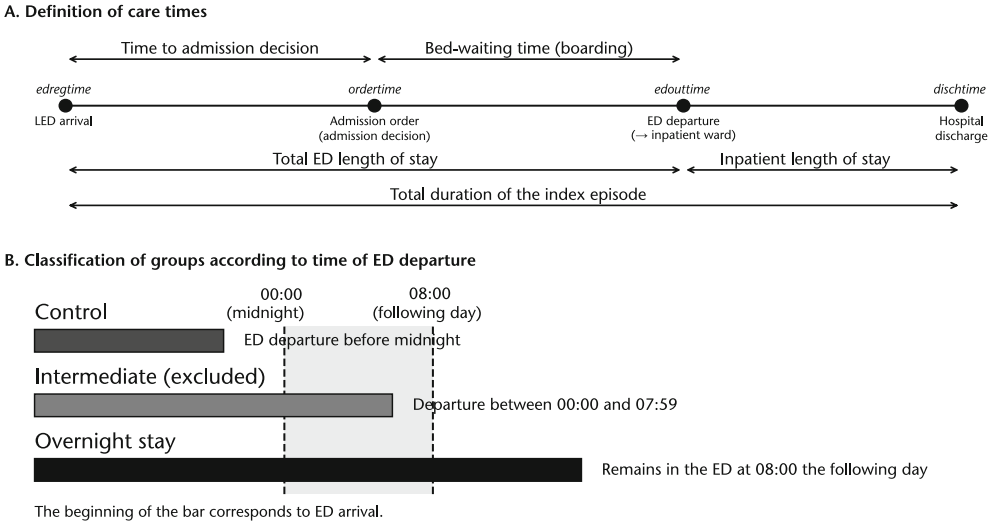


Figure 1. Definition of care times (A) and classification of groups according to the time of emegercy department (ED) departure relative to midnight and 08:00 the following day (B).

Variables and outcomes

Demographic and contextual variables were collected (age, sex, race/ethnicity, insurance type, language, marital status, day and time of arrival, and admitting hospital service), as were comorbidities, including the Charlson Comorbidity Index,[23,24] and the principal diagnosis on admission. MIMIC-IV does not provide the ED triage level or ED vital signs, and therefore no direct measure of acute severity was available. As a proxy, laboratory tests obtained within the first 6 hours were collected (abnormal parameters, lactate, blood gas analysis, troponin), but these were used only in sensitivity analyses because of differential availability.

The primary endpoints were all-cause in-hospital mortality and total duration of the index episode (from ED arrival to discharge or death). Secondary endpoints were mortality at 7 and 30 days from ED arrival and inpatient length of stay after departure from the ED.

Statistical analysis

Continuous variables were expressed as median (interquartile range, IQR) and compared using the Mann-Whitney U test; categorical variables were expressed as absolute frequencies and percentages and compared using the chi-square test or Fisher exact test. For variables with more than 2 categories, the *P* value corresponded to the overall comparison of the distribution. Mortality was analysed using logistic regression, estimating odds ratios (ORs) with their 95% CI, adjusted for age, sex, and Charlson Comorbidity Index. Hospital length of stay and total duration of the index episode were analysed using median quantile regression adjusted for the same variables, owing to their skewed distribution.

The primary endpoint analysis was performed in the complete cohort. Three sensitivity analyses were predefined: (A) an analysis including only patients with medical conditions; (B) an analysis including only 1 admission per patient (the first), with robust standard errors for repeated admissions; and (C) a landmark analysis at 08:00, including only patients who were alive and admitted at that time and eliminating the immortal time bias inherent in the exposure definition. Subsequently, 2 additional analyses were added: (D) without requiring an admission order, defining groups only according to the time of ED departure, to quantify the effect of this selection criterion; and (E) the primary model with additional adjustment for acute severity.

The effect of age on the primary endpoints was explored across different subgroups of patients selected using different age thresholds ($\geq$ 65, $\geq$ 70, $\geq$ 75, $\geq$ 80, and $\geq$ 85 years). In addition, the relationship between age and the primary endpoints was modelled using age as a continuous variable (linear interaction and nonlinear interaction using restricted cubic splines).

A 2-sided *P* value < .05 was considered statistically significant. Analyses were performed using Python 3.11 (pandas 3.0, statsmodels 0.14, and SciPy 1.17).

Results

Cohort and baseline characteristics

Of the 546,028 hospital admissions recorded, a total of 379,218 had valid ED timestamps, 147,151 corresponded to patients aged 65 years or older, and 92,955 were admissions through the ED. Of these, only 14,317 (15.4%) had a documented admission order in the ED; therefore, 78,638 episodes were excluded for this reason. After excluding patients with orders recorded after midnight on the index day (n = 3,528), direct admissions to intensive care (n = 659), observation stays and nonconventional hospital admissions (n = 6,998), and

the intermediate group (n = 326), the analytical cohort consisted of 2,806 admissions: 2,471 controls and 335 overnight stays (11.9%) (Figure 2). This cohort, defined by the availability of a documented admission order, was a selected lower-risk subgroup compared with the overall population of patients aged 65 years or older admitted from the ED (Charlson index 5 vs 6 and in-hospital mortality 2.0% [57/2,806] vs 5.6% [4,580/81,418]; both $P < .001$) (Table 1).

Baseline characteristics were generally similar between the overnight and control groups (Table 2): median age was 77 years (IQR, 70-84) in controls and 76 years (IQR, 70-84) in the overnight group; 1,354 women (54.8%) vs 177 (52.8%); and identical median Charlson index (5; IQR, 4-7). Patients who remained overnight arrived later at the ED (40.0% between 16:00 and 22:59 vs 18.9%; $P < .001$), had slightly more hypertension, diabetes, ischaemic heart disease, and dementia, and differed in reasons for admission.

Care times

Time to the admission decision was nearly identical in the control and overnight groups (4.5 vs 4.7 hours), whereas bed-waiting time was 1.2 vs 20.1 hours ($P < .001$) and total ED length of stay was 6.0 vs 25.1 hours. The main difference between groups was in bed-waiting time (Figure 3).

Outcomes

In-hospital mortality in the control group was 2.0% (49/2,471) vs 2.4% (8/335) in the overnight group, with an adjusted OR of 1.21 (95% CI, 0.56-2.60). Total duration of the index episode was similar between groups (3.9 vs 4.0 days; adjusted difference +0.21 days; 95% CI, –0.14 to 0.57). Mortality at 7 and 30 days did not differ, whereas inpatient length of stay after ED departure was shorter in the overnight group (adjusted difference –0.64 days; 95% CI, –1.00 to –0.27) (Table 3).

Sensitivity analyses

None of the 3 predefined analyses altered the conclusion regarding mortality (adjusted ORs of 1.31, 1.27, and 1.64; all nonsignificant); the landmark analysis (C) shifted the estimate towards increased risk without reaching statistical significance. Regarding duration of the index episode, only the medical cohort showed a significant increase (+0.61 days; 95% CI, 0.26-0.96) (Table 3).

In analysis D, without requiring an admission order and defining the groups only by ED departure time (36,959 controls and 1,816 overnight stays), in-hospital mortality was lower among those who stayed overnight: 1.8% [33/1,816] vs 2.7% [1,006/36,959], with an adjusted OR of 0.68 (95% CI, 0.48-0.97); the estimate reversed direction. In analysis E, adjustment for indirect indicators of acute severity shifted the estimate towards the null, with an adjusted OR of 0.97 (95% CI, 0.41-2.27) (Table 3, Figure 3B). The intermediate group

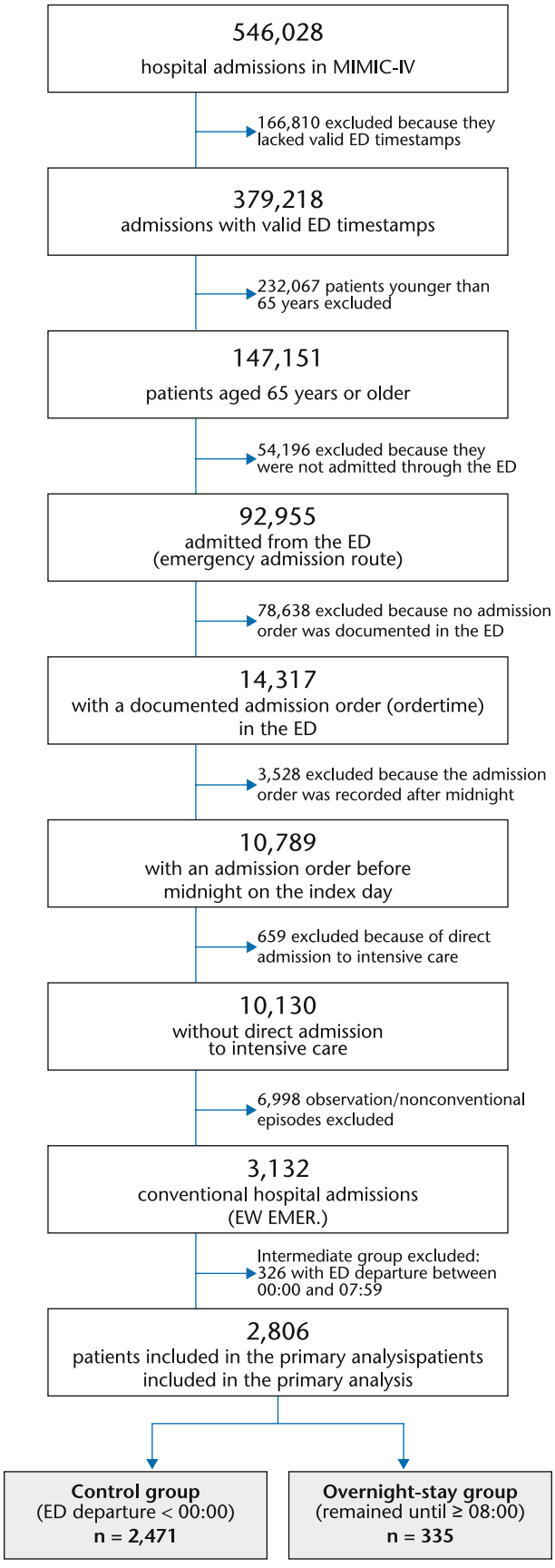


Figure 2. Patient inclusion flow diagram.

Table 1. Comparison between the analytical cohort (with a documented admission order) and the remaining patients aged 65 years or older admitted from the emergency department, to assess sample representativeness

Variable	Analytical cohort N = 2,806 n (%)	Not included in the analytical cohort N = 81,418 n (%)	*P* value
Age, years [median (IQR)]	77 (70-84)	76 (69-83)	< **0.001**
Female	1.531 (54.6)	43.363 (53.3)	0.18
Charlson Comorbidity Index [median (IQR)]	5 (4-7)	6 (4-8)	< **0.001**
Emergency department length of stay, hours [median (IQR)]	6.5 (4.8-9.3)	5.9 (4.3-8.2)	< **0.001**
Hospital length of stay, days [median (IQR)]	3.7 (2.0-5.8)	4.0 (2.4-7.2)	< **0.001**
In-hospital mortality	57 (2.0)	4.580 (5.6)	< **0.001**
30-day mortality	127 (4.5)	8.021 (9.9)	< **0.001**

IQR: interquartile range.
Bold values denote statistical significance ($P < .05$).
Age corresponds to that recorded in MIMIC-IV (anchor age), the same variable used in Table 2.

(n = 326) had a 0.9% mortality rate (3/326), and its inclusion in the reference group did not alter the main result (adjusted OR, 1.21).

Analysis by age

The primary endpoints were consistent across all age thresholds (from ≥ 65 to ≥ 85 years), with adjusted mortality ORs ranging from 1.20 to 1.39, all nonsignificant (Table 4). Continuous modelling of age showed no interaction with overnight stay and no nonlinearity ($P = .476$, $P = .486$, and $P = .548$, respectively).

Discussion

The main findings of this study are 2-fold. First, in older patients admitted from the ED, remaining overnight in the ED until the following morning was not significantly associated with in-hospital mortality, although the small number of events and patient selection preclude ruling out a harmful effect. Second, overnight stay was not associated with a longer overall care episode in the primary analysis; only when the analysis was restricted to medical patients, a more homogeneous group, was a significant increase observed (+0.61 days), driven by bed-waiting time.

From a pathophysiological perspective, overnight ED stays have been associated with plausible mechanisms of harm in older patients: medication delays and adverse events, sleep disruption, and a higher risk of delirium.[14-17] The absence of an association with increased mortality in this cohort may reflect the lower frequency and severity of overnight stays in this setting and the inability to capture intermediate outcomes (delirium, falls, adverse events) that were not coded.

Unlike the findings of Roussel *et al.* in France, who reported a clear increase in mortality among patients remaining overnight in the ED (adjusted OR, 1.50; 95% CI, 1.09-2.06),[18] the present findings are consistent with the neutral results of the Spanish EDEN cohort study (OR, 1.12; 95% CI, 0.80-1.58)[19] and the Italian study, which found no association and even suggested a protective effect approaching significance.[20] One possible explanation for this divergence lies in the degree of system overcrowding: the frequency of overnight stay in this cohort (approximately 12%) was much lower than in the European studies (34-44%). Where overcrowding is uncommon, beds are allocated to the sickest patients and those who remain overnight are the more stable patients. Our data support this interpretation: without the requirement for an admission order (analysis D), overnight stay was even associated with lower mortality (adjusted OR, 0.68; 95% CI, 0.48-0.97), an effect with no biological plausibility that reflects this prioritisation.

Comparison with the US literature is relevant because the centre is a US hospital. In highly overcrowded centres, Singer *et al.* and Sun *et al.* reported higher mortality associated with bed waiting and overcrowding,[7,25] in line with systematic reviews.[26-28] Our centre, at the opposite end of the spectrum, retains capacity for prioritisation: the harm associated with waiting for a bed does not appear to be intrinsic, but rather emerges when overcrowding forces even severely ill patients to wait.

In Spain, evidence published in this journal converges on the importance of time spent in the ED: Fernández Castro *et al.* associated it with higher in-hospital mortality,[6] and the EDEN-18 study, involving 6,333 older patients, found a higher risk of death and prolonged hospitalisation among those with longer stays,[29] a problem extending beyond the ED.[30] Our findings add nuance: where remaining overnight is the exception, it selects patients with a better prognosis and loses value as a risk marker.

Although the primary analysis did not show an increase in total duration of the index episode, the longer duration observed among patients remaining overnight when the analysis was restricted to medical patients should be interpreted cautiously: it primarily reflects bed-waiting time in the ED, because ward length of stay did not increase, and therefore does not equate to a clinically longer hospitalisation.

Moreover, estimates remained stable across all age thresholds (from ≥ 65 to ≥ 85 years), with no modification of the effect by age. Although patients aged 65 years or older were included, compared with 75 years or older in the European series, stability at the ≥ 75-year threshold supports comparability. This suggests that overnight ED stay does not have a particularly deleterious effect in the oldest patients.

Immortal time bias warrants comment: to be classified in the overnight group, a patient must remain alive and in the ED at 08:00; therefore, a patient who dies during the night is counted in the control group, biasing the estimate in favour of overnight stay. The landmark analysis corrects this and shifted the estimate to-

Table 2. Characteristics of patients included in the study who remained overnight in the emergency department and controls (no overnight stay)

Variable	Control group (ED departure before 00:00 h) N = 2,471 n (%)	Overnight-stay group (ED departure from 08:00 h onwards) N = 335 n (%)	*P* value
Demographics and context			
Age, years [median (IQR)]	77 (70-84)	76 (70-84)	0.402
Female	1,354 (54.8)	177 (52.8)	0.537
Race/Ethnicity			< **0.001**
White	1,983 (80.3)	239 (71.3)	
Black	273 (11.0)	54 (16.1)	
Hispanic/Latino	65 (2.6)	13 (3.9)	
Asian	70 (2.8)	10 (3.0)	
Other	47 (1.9)	18 (5.4)	
Unknown	33 (1.3)	1 (0.3)	
Insurance			0.242
Medicare	2,146 (86.8)	292 (87.2)	
Medicaid	81 (3.3)	17 (5.1)	
Private	230 (9.3)	23 (6.9)	
Other	11 (0.4)	2 (0.6)	
Unknown	3 (0.1)	1 (0.3)	
English language	2,176 (88.1)	277 (82.7)	0.007
Married	1,178 (47.7)	124 (37.0)	< **0.001**
Weekend arrival	707 (28.6)	99 (29.6)	0.770
Time of arrival at the ED	12 (9-15)	14 (12-17)	< **0.001**
Arrival between 16:00 and 22:59	468 (18.9)	134 (40.0)	< **0.001**
Cardiovascular risk factors and comorbidities			
Charlson Comorbidity Index [median (IQR)]	5.0 (4.0-7.0)	5.0 (4.0-7.0)	0.156
Hypertension	1,823 (73.8)	269 (80.3)	0.012
Diabetes mellitus	712 (28.8)	122 (36.4)	0.005
Dyslipidaemia	1,182 (47.8)	182 (54.3)	**0.030**
Obesity	121 (4.9)	28 (8.4)	**0.012**
Smoking	521 (21.1)	134 (40.0)	< **0.001**
Alcohol consumption	82 (3.3)	17 (5.1)	0.140
Ischaemic heart disease	686 (27.8)	125 (37.3)	< **0.001**
Previous myocardial infarction	260 (10.5)	47 (14.0)	0.066
Heart failure	501 (20.3)	80 (23.9)	0.145
Atrial fibrillation/flutter	655 (26.5)	94 (28.1)	0.591
Valvular heart disease	185 (7.5)	29 (8.7)	0.517
Peripheral vascular disease	286 (11.6)	30 (9.0)	0.183
Cerebrovascular disease	472 (19.1)	26 (7.8)	< **0.001**
Chronic kidney disease	507 (20.5)	82 (24.5)	0.110
COPD	535 (21.7)	81 (24.2)	0.328
Dementia	139 (5.6)	34 (10.1)	**0.002**
Cancer	304 (12.3)	37 (11.0)	0.567
Liver disease	82 (3.3)	15 (4.5)	0.352
Anaemia	589 (23.8)	84 (25.1)	0.667
Reason for admission			
Principal diagnosis			< **0.001**
Heart failure	86 (3.5)	9 (2.7)	
Other cardiovascular	224 (9.1)	60 (17.9)	
Pneumonia/respiratory infection	41 (1.7)	3 (0.9)	
COPD/respiratory failure	40 (1.6)	11 (3.3)	
Sepsis/infection	55 (2.2)	5 (1.5)	
Renal/urinary	101 (4.1)	27 (8.1)	
Neurological/stroke	302 (12.2)	3 (0.9)	
Gastrointestinal/hepatobiliary	348 (14.1)	10 (3.0)	
Endocrine/metabolic	63 (2.5)	14 (4.2)	
Trauma/fall/fracture	631 (25.5)	72 (21.5)	
Cancer/haematology	92 (3.7)	4 (1.2)	
Other	488 (19.7)	117 (34.9)	
ED care times			
Time to decision, hours [median (IQR)]	4.5 (3.0-6.2)	4.7 (3.4-6.5)	**0.049**
Bed-waiting time, hours [median (IQR)]	1.2 (0.5-2.1)	20.1 (16.9-24.1)	< **0.001**
Total ED length of stay, hours [median (IQR)]	6.0 (4.6-8.0)	25.1 (21.3-29.6)	< **0.001**

IQR: interquartile range; COPD: chronic obstructive pulmonary disease; ED: emergency department.
Bold values denote statistical significance ($P < .05$).

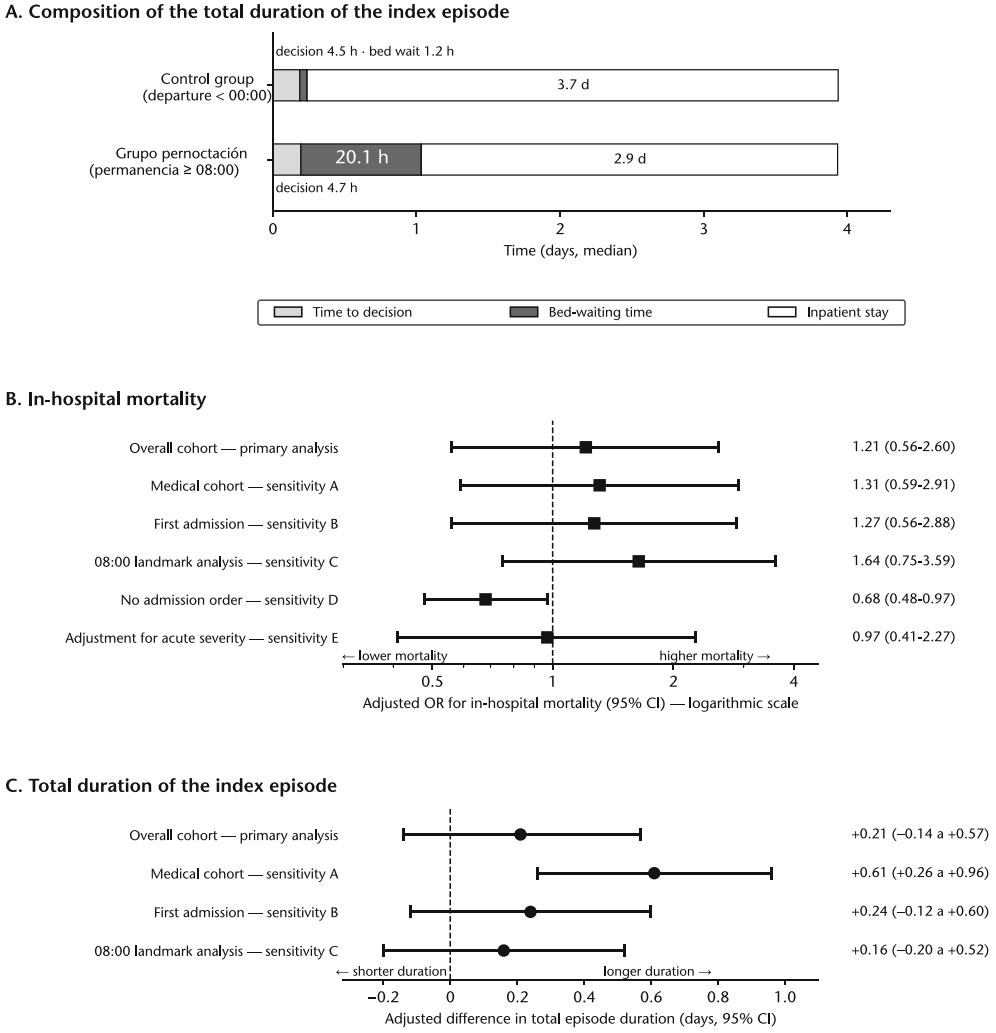


Figure 3. Main results. (A) Composition of the total duration of the index episode (time to admission decision, bed-waiting time, and inpatient stay); the difference between groups is concentrated in bed-waiting time. (B) Adjusted odds ratio for in-hospital mortality (95% CI, logarithmic scale) in the primary analysis and sensitivity analyses A-E. (C) Adjusted difference in total episode duration (days, 95% CI).

wards increased risk (adjusted OR, 1.64; 95% CI, 0.75-3.59): if anything, the neutral result is biased towards the absence of harm.

This study has several limitations. First, it is a single-centre study and, most importantly, the analytical cohort represents a selected lower-risk subgroup defined by the availability of a documented admission order, which limits representativeness and reduces statistical power (only 8 deaths in the overnight group). Second, the study was conducted in a country with a health care system with a strong private component in service provision; therefore, the results may not be directly generalisable to countries with universal public health care systems such as Spain. Third, adjustment was limited to age, sex, and Charlson Comorbidity Index, without information on triage level, vital signs, markers of acute severity, or baseline functional status; therefore, residual confounding remains, and the effect of overnight stay cannot be separated from clinical patient selection. Additional adjustment for indirect indicators of acute severity (analysis E) did not alter the conclusion, but these indicators depend on the intensity with which tests are ordered and do not replace a validated severity measure. Furthermore, because the dates were deidentified, it was not possible to assess the influence of seasonality or the COVID-19 pandemic period.

In conclusion, among older patients admitted to hospital through the ED in a hospital with a low frequency of overnight ED stays, no association was demonstrated between remaining overnight in the ED and in-hospital mortality. However, the small number of events and cohort selection bias preclude definitively ruling out such an association and do not allow the results to be extrapolated to systems with more overcrowded EDs, such as Spain. Overnight stay may prolong the care episode because of bed-waiting time, as suggested by the analysis restricted to medical patients.

Table 3. Study results. Primary and sensitivity analyses

	Control n (%)	Overnight stay n (%)	*P* value	Unadjusted estimate (95% CI)	Adjusted estimate (95% CI)*
Primary endpoints					
In-hospital mortality					
Primary analysis	49 (2.0)	8 (2.4)	0.541	1.21 (0.57-2.58)	1.21 (0.56-2.60)
Sensitivity analysis A**	29 (2.0)	8 (2.4)	0.672	1.18 (0.53-2.61)	1.31 (0.59-2.91)
Sensitivity analysis B***	42 (1.8)	7 (2.2)	0.654	1.24 (0.55-2.78)	1.27 (0.56-2.88)
Sensitivity analysis C****	36 (1.5)	8 (2.4)	0.238	1.64 (0.75-3.55)	1.64 (0.75-3.59)
Sensitivity analysis D*****	1,006 (2.7)	33 (1.8)	**0.024**	0.66 (0.47-0.94)	0.68 (0.48-0.97)
Sensitivity analysis E******	49 (2.0)	8 (2.4)	0.937	1.21 (0.57-2.58)	0.97 (0.41-2.27)
Total duration of the index episode (from ED arrival to discharge or death), days [median (IQR)]					
Primary analysis	3.9 (2.2-6.0)	4.0 (2.9-6.0)	0.528	+0.12 (–0.26 a 0.50)	+0.21 (–0.14 a 0.57)
Sensitivity analysis A**	3.4 (2.1-5.5)	4.0 (2.9-6.0)	**0.001**	+0.61 (0.24 a 0.99)	+0.61 (0.26 a 0.96)
Sensitivity analysis B***	3.9 (2.2-6.0)	4.0 (2.9-6.0)	0.433	+0.15 (–0.23 a 0.53)	+0.24 (–0.12 a 0.60)
Sensitivity analysis C****	3.9 (2.3-6.1)	4.0 (2.9-6.0)	0.682	+0.08 (–0.30 a 0.47)	+0.16 (–0.20 a 0.52)
Secondary endpoints					
7-day mortality from ED arrival					
Primary analysis	43 (1.7)	5 (1.5)	1.000	0.86 (0.34-2.18)	0.86 (0.34-2.21)
Sensitivity analysis A**	29 (2.0)	5 (1.5)	0.661	0.73 (0.28-1.90)	0.81 (0.31-2.14)
Sensitivity analysis B***	40 (1.7)	5 (1.6)	1.000	0.92 (0.36-2.36)	0.94 (0.37-2.42)
Sensitivity analysis C****	30 (1.2)	5 (1.5)	0.604	1.22 (0.47-3.16)	1.24 (0.47-3.24)
30-day mortality from ED arrival					
Primary analysis	112 (4.5)	15 (4.5)	1.000	0.99 (0.57-1.71)	0.96 (0.55-1.69)
Sensitivity analysis A**	77 (5.4)	15 (4.5)	0.586	0.82 (0.47-1.45)	0.90 (0.50-1.60)
Sensitivity analysis B***	102 (4.4)	14 (4.5)	0.884	1.02 (0.57-1.80)	1.00 (0.56-1.80)
Sensitivity analysis C****	99 (4.1)	15 (4.5)	0.661	1.11 (0.64-1.93)	1.08 (0.61-1.91)
Inpatient length of stay after ED departure, days [median (IQR)]					
Primary analysis	3.7 (1.9-5.8)	2.9 (1.8-4.9)	< **0.001**	–0.72 (–1.12 a –0.32)	–0.64 (–1.00 a –0.27)
Sensitivity analysis A**	3.1 (1.8-5.1)	2.9 (1.8-4.9)	0.486	–0.14 (–0.52 a 0.25)	–0.26 (–0.61 a 0.10)
Sensitivity analysis B***	3.6 (1.9-5.7)	2.9 (1.8-4.9)	**0.001**	–0.69 (–1.09 a –0.30)	–0.52 (–0.89 a –0.16)
Sensitivity analysis C****	3.7 (2.0-5.8)	2.9 (1.8-4.9)	< **0.001**	–0.74 (–1.14 a –0.34)	–0.68 (–1.04 a –0.32)

*In the mortality rows, the estimate corresponds to the OR; in the length-of-stay rows, it corresponds to the difference in median days (overnight stay – control). Adjustment was performed for age, sex, and Charlson Comorbidity Index; unadjusted 95% CIs for differences in medians were calculated by bootstrap.
** Includes only patients admitted to medical departments.
*** Includes only unique patients.
**** Landmark analysis at 08:00.
***** Cohort of patients aged 65 years or older admitted from the ED without requiring a documented admission order (36,959 controls and 1,816 with an overnight stay); groups were defined solely according to the time of ED departure.
****** Primary cohort with additional adjustment for indirect indicators of acute severity (abnormal laboratory parameters within the first 6 hours and ordering of lactate, blood gas analysis, or troponin).
In the length-of-stay rows (days), the final 2 columns correspond to the difference in medians (unadjusted and adjusted) estimated using quantile regression, not to odds ratios; the P value is that of the corresponding regression.
IQR: interquartile range; OR: odds ratio; CI: confidence interval; ED: emergency department.
Bold values denote statistical significance ($P < .05$).

Table 4. Study results. Primary outcome results according to age cut-off

Patient inclusion criterion	Overnight-stay group Deaths/N (%)	Control group (no overnight stay)	% overnight stay	Adjusted OR for in-hospital mortality (95% CI)*	Overnight-stay group [median (IQR)], hospitalisation days	Control group (no overnight stay) [median (IQR)], hospitalisation days	Difference in hospital stay, days (95% CI)
≥ 65 years	8 / 335 (2.4)	49 / 2,471 (2.0)	11.9	1.21 (0.56-2.60). p = 0.624	4.0 (2.9-6.0)	3.9 (2.2-6.0)	+0.21 (–0.14 a 0.57). p = 0.237
≥ 70 years	8 / 257 (3,1)	43 / 1,907 (2.2)	11.9	1.39 (0.64-3.03). p = 0.405	4.0 (2.9-6.0)	4.0 (2.3-6.0)	+0.13 (–0.28 a 0.55). p = 0.526
≥ 75 years	7 / 191 (3.7)	39 / 1,437 (2.7)	11.7	1.36 (0.59-3.12). p = 0.467	4.0 (2.8-6.0)	4.0 (2.3-6.0)	+0.00 (–0.46 a 0.46). p = 0.994
≥ 80 years	5 / 127 (3.9)	33 / 1,011 (3.3)	11.2	1.20 (0.46-3.14). p = 0.714	4.2 (2.9-6.0)	3.9 (2.4-6.0)	+0.35 (–0.20 a 0.91). p = 0.213
≥ 85 years	3 / 76 (3.9)	19 / 568 (3.3)	11.8	1.34 (0.38-4.71). p = 0.647	3.9 (2.9-5.7)	4.0 (2.6-5.9)	–0.06 (–0.77 a 0.66). p = 0.879

*Adjusted for age, sex, and Charlson Comorbidity Index.
IQR: interquartile range; OR: odds ratio; CI: confidence interval.

Larger and more representative cohorts are needed to definitively clarify its effect on mortality.

Conflict of Interest Disclosures: None reported.

Funding: The authors declare the non-existence of funding related to this article.

Ethical Responsibilities: All authors have confirmed the maintenance of confidentiality and respect for patients' rights in the author's responsibilities document, publication agreement and assignment of rights to EMERGENCIAS. The study is based on MIMIC-IV, a controlled-access database whose use is approved by the institutional review boards of Beth Israel Deaconess Medical Center and the Massachusetts Institute of Technology; the data are anonymised and were accessed by a credentialled researcher after completion of the required CITI training. Therefore, the study was exempt from additional approval by a local ethics committee.

Article not commissioned by the Editorial Board and with external peer review.

References

1 Pines JM, Griffey RT. What we have learned from a decade of ED crowding research. Acad Emerg Med. 2015;22:985-7.
2 Juan Pastor A. Gestión de camas de hospitalización y saturación de los servicios de urgencias: una asignatura siempre pendiente. Emergencias. 2026;38:85-6.
3 Fernández M. ¿Es realmente el anciano responsable de la saturación de los servicios de urgencias? Emergencias. 2025;37:247-8.
4 Peterson SM, Harbertson CA, Scheulen JJ, Kelen GD. Trends and characterization of academic emergency department patient visits: a five-year review. Acad Emerg Med. 2019;26:410-9.
5 Millán Soria J, Medina Álvarez J, Sánchez Suárez L, Cano Cerviño C, Serrano Lázaro L, García-Minguillán Castillo MC, et al. Predicción en tiempo real de los ingresos del servicio de urgencias mediante un modelo de inteligencia artificial y su integración en la planificación de las camas de hospitalización. Emergencias. 2026;38:98-106.
6 Fernández Castro I, Mayán Conesa P, Franco Álvarez M, Barba Queiruga JR, Fernández Cambeiro M, Casariego Vales E. Influencia del tiempo de estancia en urgencias en la mortalidad hospitalaria en un hospital español de tercer nivel. Emergencias. 2025;37:353-9.
7 Singer AJ, Thode HC, Viccellio P, Pines JM. The association between length of emergency department boarding and mortality. Acad Emerg Med. 2011;18:1324-9.
8 Jones S, Moulton C, Swift S, Molyneux P, Black S, Mason N, et al. Association between delays to patient admission from the emergency department and all-cause 30-day mortality. Emerg Med J. 2022;39:168-73.
9 Miró O, Sánchez M, Millá J. Hospital mortality and staff workload. Lancet. 2000;356:1356-7.
10 Samaras N, Chevalley T, Samaras D, Gold G. Older patients in the emergency department: a review. Ann Emerg Med. 2010;56:261-9.
11 Legramante JM, Morciano L, Lucaroni F, Gilardi F, Caredda E, Pesaresi A, et al. Frequent use of emergency departments by the elderly population when continuing care is not well established. PLoS One. 2016;11:e0165939.
12 Miró O, Jacob J, García-Lamberechts EJ, Piñera Salmerón P, Llorens P, Jiménez S, et al. Sociodemographic characteristics, functional status, and health resource use of older patients treated in Spanish emergency departments: a description of the EDEN cohort. Emergencias. 2022;34:418-27.
13 Shenvi CL, Platts-Mills TF. Managing the elderly emergency department patient. Ann Emerg Med. 2019;73:302-7.
14 Miró O, Osorio G, Alquézar-Arbé A, Aguiló S, Fernández C, Burillo G, et al. Hyperactive delirium during emergency department stay: analysis of risk factors and association with short-term outcomes. Intern Emerg Med. 2024;19:535-45.
15 Sri-On J, Chang Y, Curley DP, Camargo CA, Weissman JS, Singer SJ, et al. Boarding is associated with higher rates of medication delays and adverse events but fewer laboratory-related delays. Am J Emerg Med. 2014;32:1033-6.
16 Mannion H, Molloy DW, O'Caoimh R. Sleep disturbance in older patients in the emergency department: prevalence, predictors and associated outcomes. Int J Environ Res Public Health. 2019;16:3577.
17 Prendiville R, Umana E, Avalos G, McNicholl B. No rest for the weary: a cross-sectional study comparing patients' sleep in the emergency department to those on the ward. Emerg Med J. 2020;37:42-4.
18 Roussel M, Teissandier D, Yordanov Y, Balen F, Noizet M, Tazarourte K, et al. Overnight stay in the emergency department and mortality in older patients. JAMA Intern Med. 2023;183:1378-85.
19 Miró O, Aguiló S, Alquézar-Arbé A, Fernández C, Burillo G, Guzmán Martínez S, et al. Overnight stay in Spanish emergency departments and mortality in older patients. Intern Emerg Med. 2024;19:1653-65.
20 Fabbri A, Tascioglu AB, Bertini F, Montesi D. Overnight stay in the emergency department and in-hospital mortality among elderly patients: a 6-year follow-up Italian study. J Clin Med. 2025;14:2879.
21 Johnson AEW, Bulgarelli L, Shen L, Gayles A, Shammout A, Horng S, et al. MIMIC-IV, a freely accessible electronic health record dataset. Sci Data. 2023;10:1.
22 von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. Lancet. 2007;370:1453-7.
23 Charlson ME, Pompei P, Ales KL, MacKenzie CR. A new method of classifying prognostic comorbidity in longitudinal studies: development and validation. J Chronic Dis. 1987;40:373-83.
24 Quan H, Sundararajan V, Halfon P, Fong A, Burnand B, Luthi JC, et al. Coding algorithms for defining comorbidities in ICD-9-CM and ICD-10 administrative data. Med Care. 2005;43:1130-9.
25 Sun BC, Hsia RY, Weiss RE, Zingmond D, Liang LJ, Han W, et al. Effect of emergency department crowding on outcomes of admitted patients. Ann Emerg Med. 2013;61:605-11.
26 Hoot NR, Aronsky D. Systematic review of emergency department crowding: causes, effects, and solutions. Ann Emerg Med. 2008;52:126-36.
27 Boudi Z, Lauque D, Alsabri M, Östlundh L, Onyeji C, Khalemsky A, et al. Association between boarding in the emergency department and in-hospital mortality: a systematic review. PLoS One. 2020;15:e0231253.
28 Lauque D, Khalemsky A, Boudi Z, Östlundh L, Xu C, Alsabri M, et al. Length-of-stay in the emergency department and in-hospital mortality: a systematic review and meta-analysis. J Clin Med. 2023;12:32.
29 Miró O, Rodríguez-Cabrera M, Alquézar-Arbé A, Piñol C, González del Castillo J, Burillo-Putze G. Tiempo de permanencia en urgencias de los pacientes hospitalizados y resultados a corto plazo (Estudio EDEN-18). Emergencias. 2025;37:343-52.
30 González Armengol JJ. La atención en urgencias y los pacientes en espera de cama de hospitalización como síntomas visibles del funcionamiento global de los sistemas sanitarios. Emergencias. 2025;37:323-5.