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Research Article

Association between admission diagnoses and intensive care unit mortality: A retrospective cohort study

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ABSTRACT

Background: Mortality in the intensive care unit (ICU) is primarily driven by the severity of acute organ dysfunction; however, the prognostic contribution of admission clinical diagnoses beyond severity scores remains incompletely defined. This study aimed to evaluate the association between admission diagnoses and ICU mortality after adjustment for organ dysfunction severity.

Methods: This retrospective cohort study included adult patients admitted to a tertiary ICU between January 2024 and December 2025. Patients with missing baseline data or ICU length of stay <24 hours were excluded. Demographic characteristics, comorbidities, admission diagnoses, and disease severity scores were recorded. ICU mortality was the primary outcome. Multivariable logistic regression analysis was performed using the Sequential Organ Failure Assessment (SOFA) score as the primary severity adjustment variable.

Results: A total of 1,248 patients were included; 763 (61.1%) died during the ICU stay. In the SOFA-adjusted multivariable model, age (adjusted odds ratio [aOR] 1.02; 95% CI 1.02–1.03), SOFA score (aOR 1.33 per point; 95% CI 1.25–1.41), post–cardiac arrest status (aOR 6.21; 95% CI 4.17–9.23), sepsis (aOR 1.73; 95% CI 1.15–2.59), and active malignancy (aOR 1.69; 95% CI 1.17–2.44) were independently associated with ICU mortality. Neuromuscular disease showed a trend toward increased mortality but did not reach statistical significance.

Conclusion: Beyond organ dysfunction severity, selected admission diagnoses—particularly post–cardiac arrest status, sepsis, and active malignancy—provide independent prognostic information for ICU mortality. Incorporating diagnosis-based risk stratification alongside severity scores may improve early prognostic assessment in critically ill patients.

Trial Registration: The study was registered at ClinicalTrials.gov (ID: NCT07369206).

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1. Introduction

Intensive care units (ICUs) provide care for critically ill patients with life-threatening acute conditions and remain associated with substantial short-term mortality worldwide [1]. Mortality in critically ill patients is widely recognized as a multifactorial outcome influenced by demographic characteristics, underlying comorbidities, and the severity of acute physiological derangements at the time of ICU admission [2,3]. To support risk stratification and outcome prediction, severity-of-illness scoring systems such as APACHE II, SAPS, and the Sequential Organ Failure Assessment (SOFA) score have been extensively developed and validated [4–6]. Among these

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tools, the SOFA score has gained particular importance because it quantifies the burden of acute organ dysfunction and demonstrates a strong association with ICU mortality across diverse critical illness syndromes [6,7].

However, severity-of-illness scores are primarily driven by physiological and organ dysfunction parameters and may not fully capture the prognostic impact of the clinical diagnoses and syndromic conditions present at ICU admission [2,3]. In real-world ICU practice, patients are rarely admitted with a single isolated diagnosis; instead, overlapping clinical syndromes such as sepsis or septic shock, acute respiratory failure, acute respiratory distress syndrome (ARDS), post–cardiac arrest syndrome, and multiple organ dysfunction syndrome frequently coexist [6,8-10]. Previous investigations of ICU mortality have predominantly focused on specific disease subgroups or treatment-related variables, including sepsis, ARDS, trauma, or cardiac arrest, rather than systematically evaluating admission diagnoses in heterogeneous ICU populations [3,8,9]. As a result, the independent and combined prognostic contribution of admission clinical diagnoses beyond established severity scores remains incompletely defined [2,3].

The objective of this study was to evaluate the association between admission clinical diagnoses and ICU mortality in adult patients admitted to a tertiary mixed ICU while adjusting for acute organ dysfunction severity using the SOFA score [6]. By integrating diagnosis-based variables with severity adjustment, we aimed to determine whether selected admission diagnoses provide additional prognostic information beyond conventional risk stratification tools [2,3].

The primary hypothesis of this study was that selected admission clinical diagnoses contribute independently to ICU mortality beyond the severity of acute organ dysfunction as measured by the SOFA score. In particular, we hypothesized that post–cardiac arrest syndrome, sepsis, and active malignancy would remain significant predictors of ICU mortality after multivariable adjustment [6,9].

2. Materials and Methods

2.1. Study design, setting, and ethical approval

This single-center retrospective cohort study was conducted at a tertiary-care university hospital between January 1, 2024 and December 31, 2025. Institutional Ethics Committee approval was obtained (approval number: B.30.2.ATA.0.01.00/934). The study was registered at ClinicalTrials.gov (NCT07369206). The registration was completed to enhance transparency in the context of a retrospective design; the study represents a noninterventional observational analysis. The study was performed in accordance with the principles of the Declaration of Helsinki. Due to the retrospective nature of the study, informed consent was not obtained from participants.

2.2. Participants: Inclusion and exclusion criteria

The inclusion criteria comprised adult patients aged ≥18 years who were admitted to the ICU within the specified study period. In cases where a patient had multiple ICU admissions during the study timeframe, only the first ICU admission was included in the analysis to preserve the assumption of independence between observations.

Exclusion criteria included ICU stays of less than 24 hours and cases with missing essential data that precluded assessment of the primary outcome. The core dataset consisted of demographic characteristics (age and sex), ICU discharge status (survival or mortality), clinical diagnoses present at admission, and clinical records enabling the calculation of disease severity scores, including APACHE II, SAPS, and SOFA.

2.3. Data sources and data collection

Data were retrospectively retrieved from the hospital information management system and ICU clinical records. To ensure standardization, all variables were recorded based on data obtained within the first 24 hours following ICU admission. In our unit, all patients are clinically evaluated by the same attending faculty member during both daytime and nighttime periods, including twice-daily ward rounds. Admission diagnoses are verified through these clinical evaluations in conjunction with medical records. This standardized approach was implemented to minimize inter-observer variability in diagnostic classification.

2.4. Variables and operational definitions

2.4.1. Demographic variables

Age (years) and sex were recorded for all patients.

2.4.2. ICU admission characteristics

Type of ICU admission

The type of ICU admission was classified as medical, emergency surgical, or elective surgical, in accordance with widely accepted approaches based on the presence and urgency of a surgical intervention prior to ICU admission [11,12].

- Medical admission: Patients admitted to the ICU primarily for medical reasons, without a requirement for a planned or performed surgical intervention prior to or at the time of ICU admission. Typical indications included sepsis, septic shock, ARDS or non-ARDS acute respiratory failure, post–cardiac arrest syndrome, and similar conditions.
- Emergency surgical admission: Patients admitted to the ICU in an unplanned manner following an emergency surgical procedure, generally performed within 24 hours of decision-making.
- Elective surgical admission: Patients admitted to the ICU for postoperative monitoring and/or treatment following an elective surgical procedure that had been planned at least 24 hours in advance.

Source of ICU admission

The source of ICU admission was categorized according to the hospital unit from which the patient was physically transferred to the ICU, as emergency department, hospital ward, or operating room. This classification was adapted from previously published ICU admission studies [13].

- Emergency department: Patients who presented to the hospital through the emergency department and were directly admitted to the ICU due to an ICU indication.
- Hospital ward: Patients who were hospitalized in a clinical ward and subsequently transferred to the ICU following clinical deterioration necessitating intensive care.
- Operating room: Patients admitted to the ICU directly from the operating room (or via the post-anesthesia care unit) following a surgical procedure.

Requirement for Invasive Mechanical Ventilation at Admission

The requirement for invasive mechanical ventilation (IMV) at admission was defined as admission to the ICU while already intubated and receiving invasive mechanical ventilation. This variable was recorded as a binary outcome (yes/no).

2.4.3. Severity scores

The APACHE II, SAPS, and SOFA scores were calculated using the worst clinical and laboratory values recorded during the first 24 hours following ICU admission.

2.4.4. Comorbidities

Comorbidities were defined as chronic diseases present prior to ICU admission and were recorded as binary variables (yes/no). The following comorbid conditions were assessed: hypertension, diabetes mellitus, chronic obstructive pulmonary disease (COPD), chronic kidney disease (stage ≥3), congestive heart failure, and a history of cerebrovascular events.

2.4.5. Clinical diagnoses at admission

The following clinical diagnoses were recorded as binary variables (yes/no), provided that they were present at the time of ICU admission and documented in the clinical records:

- Sepsis: Patients with a documented diagnosis of sepsis in the clinical records.
- Septic shock: Patients with a documented diagnosis of septic shock in the clinical records.
- ARDS: Patients with a documented diagnosis of acute respiratory distress syndrome (ARDS) in the clinical records.
- In our ICU, diagnoses of sepsis and septic shock are routinely established according to the Sepsis-3 definitions in daily clinical practice. Because this study had a retrospective design, the investigators did not perform an independent retrospective reassessment of Sepsis-3 criteria. Instead, sepsis and septic shock diagnoses were recorded exactly as documented in the clinical records by the attending ICU physicians during routine patient care.
- Non-ARDS acute respiratory failure: Patients admitted with acute hypoxemic and/or hypercapnic respiratory failure who did not meet the diagnostic criteria for ARDS, including conditions such as cardiogenic pulmonary edema, pneumonia, acute exacerbation of COPD, pleural effusion, and similar causes.
- MODS: Patients with a documented diagnosis of multiple organ dysfunction syndrome involving more than one organ system.
- PCAS: Patients with return of spontaneous circulation after cardiac arrest and a documented diagnosis of post–cardiac arrest syndrome.
  In our ICU, post–cardiac arrest syndrome (PCAS) is clinically defined in patients who achieve return of spontaneous circulation following cardiac arrest and subsequently require intensive care management due to neurological, cardiovascular, or systemic complications related to global ischemia–reperfusion injury. Because of the retrospective design of this study, additional variables such as the type of cardiac arrest (in-hospital or out-of-hospital), duration of arrest, or the use of targeted temperature management were not systematically analyzed. PCAS diagnoses were recorded as documented in the clinical records by the treating ICU physicians during routine clinical practice.
- Catastrophic neurological condition: Patients with a clinical diagnosis consistent with severe impairment of consciousness and/or life-threatening intracranial pathology due to primary neurological injury, including intracerebral hemorrhage, subarachnoid hemorrhage, large territorial infarction, or malignant cerebral edema.
- Multiple trauma: Patients with severe or multiple traumatic injuries requiring ICU admission, such as major thoracic trauma or trauma associated with long-bone fractures.
- Pulmonary embolism: Patients with a documented diagnosis of pulmonary embolism in the clinical records.
- Active malignancy: Patients with documentation of active malignancy at the time of ICU admission; cases with a history of malignancy in remission or under post-curative follow-up were excluded from this category.
- Neuromuscular disease: Patients with a documented diagnosis of a neuromuscular disease in the clinical records.
- Morbid obesity: Defined as a body mass index (BMI) ≥40 kg/m^2 and recorded as present when documented in the clinical records.

2.5. Source of diagnoses

Because this study was conducted using a retrospective design, no retrospective diagnostic adjudication was performed by the investigators. Clinical diagnoses present at admission were established as part of routine ICU practice by the attending faculty member and recorded during patient follow-up, including twice-daily ward rounds. The investigators coded diagnoses as binary variables (present/absent) exactly as documented in the clinical records.

2.6. Outcome measures

The primary outcome was defined as mortality occurring during the ICU stay (ICU mortality).

Secondary outcomes were ICU length of stay and ICU discharge disposition.

ICU discharge disposition was categorized into three groups:

- Death: Death occurring during the ICU stay.
- Transfer to hospital ward: Transfer from the ICU to hospital wards after resolution of the need for intensive care.
- Transfer to an external center: Transfer from the ICU to another institution after clinical stabilization due to patient/family preference or administrative/logistical reasons.

2.7. Statistical analysis

All statistical analyses were performed using data obtained during the ICU stay. Distributional characteristics of continuous variables were assessed using visual methods (histograms and Q–Q plots) and appropriate tests of normality. Continuous variables with a normal distribution are presented as mean ± standard deviation, whereas non-normally distributed variables are presented as median (interquartile range, IQR). Categorical variables are reported as counts and percentages.

Comparisons between survivors and non-survivors were performed using Student's t-test or the Mann–Whitney U test for continuous variables, depending on distribution. For categorical variables, the chi-square test or Fisher's exact test was used, as appropriate. For variables with more than two categories (e.g., type of ICU admission and source of ICU admission), the p value was reported to reflect the overall comparison across categories.

To identify variables associated with ICU mortality, univariable logistic regression analyses were initially conducted. Variables with $p<0.10$ in univariable analyses and/or those considered clinically relevant were selected as candidates for multivariable analyses.

Multivariable logistic regression was performed to evaluate independent predictors of ICU mortality. During model development, demographic variables, comorbidities, clinical diagnoses at admission, and severity-of-illness scores were considered. Because of potential multicollinearity among severity scores, APACHE II, SAPS, and SOFA were not entered into the model simultaneously. Based on clinical rationale, the SOFA score—reflecting the burden of acute organ dysfunction—was selected as the primary severity indicator, and the main multivariable model was constructed accordingly. Alternative models including other severity scores were examined as secondary analyses.

Results from logistic regression models are reported as adjusted odds ratios (ORs) with 95% confidence intervals (CIs). Model fit and collinearity among covariates were assessed using appropriate diagnostic methods. A two-sided p value <0.05 was considered statistically significant.

3. Results

Between January 2024 and December 2025, a total of 1,334 adult patients admitted to the ICU were assessed for eligibility. Of these, 12 patients were excluded due to missing essential baseline data, 27 patients were excluded because their ICU stay was shorter than 24 hours, and 47 patients were excluded due to readmission to the ICU during the study period. Consequently, 1,248 patients were included in the final analysis. Among the included patients, 485 were discharged from the ICU alive (either transferred to a hospital ward or transferred to an external center), whereas 763 patients died during the ICU stay (Fig. 1).

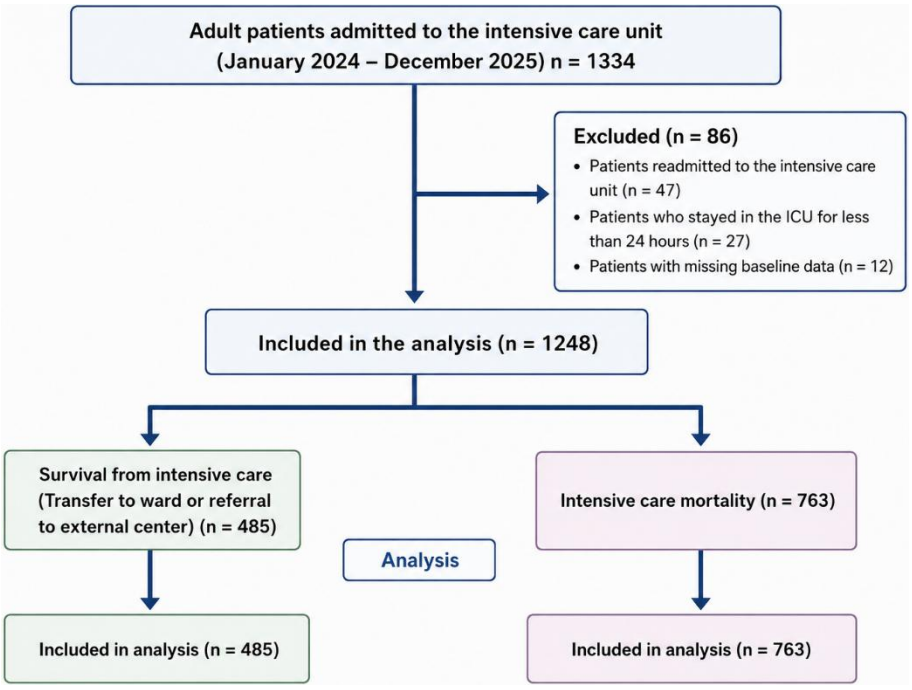

Fig. 1. Flow diagram of the research.

Among the 1,248 patients included in the study, the mean age was 66.9 ± 16.3 years. Of these patients, 771 (61.8%) were male and 477 (38.2%) were female. The majority of ICU admissions were for medical reasons, with 91.7% (n = 1,144) classified as medical admissions, whereas 5.7% (n = 71) and 2.6% (n = 33) were classified as emergency surgical and elective surgical admissions, respectively. Regarding the source of ICU admission, 56.3% (n = 703) of patients were admitted from the emergency department, 38.5% (n = 480) from hospital wards, and 5.2% (n = 65) from the operating room. Hypertension was the most prevalent comorbidity, present in 50.0% (n = 624) of patients. Other common comorbidities included diabetes mellitus in 30.6% (n = 382), chronic obstructive pulmonary disease in 21.4% (n = 267), congestive heart failure in 19.0% (n = 237), a history of cerebrovascular events in 17.8% (n = 222), and chronic kidney disease (stage ≥3) in 11.7% (n = 146). Nearly half of the patients required invasive mechanical ventilation at admission, with 49.8% (n = 621) admitted while intubated. The mean severity-of-illness scores were 25.0 ± 8.8 for APACHE II, 54.4 ± 18.5 for SAPS, and 6.8 ± 3.3 for SOFA. The mean ICU length of stay was 9.3 ± 14.2 days (Table 1).

Table 1. Demographic and clinical characteristics of the study population (n = 1,248).

Variable	Value
Number of patients	1,248
Age, years	66.9 ± 16.3
Sex	
Male	771 (61.8%)
Female	477 (38.2%)
Type of ICU admission	
Medical	1,144 (91.7%)
Emergency surgical	71 (5.7%)
Elective surgical	33 (2.6%)
Source of ICU admission	
Emergency department	703 (56.3%)
Hospital ward	480 (38.5%)
Operating room	65 (5.2%)
Comorbidities	
Hypertension	624 (50.0%)
Diabetes mellitus	382 (30.6%)
COPD	267 (21.4%)
Chronic kidney disease	146 (11.7%)
Congestive heart failure	237 (19.0%)
History of cerebrovascular events	222 (17.8%)
Requirement for invasive mechanical ventilation at admission	621 (49.8%)
APACHE II score	25.0 ± 8.8
SAPS score	54.4 ± 18.5
SOFA score	6.8 ± 3.3
ICU length of stay, days	9.3 ± 14.2

Note: Continuous variables are presented as mean ± standard deviation, and categorical variables are presented as n (%).

Abbreviations: ICU, intensive care unit; APACHE II, Acute Physiology and Chronic Health Evaluation II; SAPS, Simplified Acute Physiology Score; SOFA, Sequential Organ Failure Assessment; COPD, chronic obstructive pulmonary disease. Chronic kidney disease was defined as stage ≥3.

Non-survivors were significantly older than survivors [median (IQR): 72.0 (61.0–80.0) vs. 65.0 (53.0–76.0); p<0.001]. Severity-of-illness scores were markedly higher in the non-survivor group; APACHE II, SAPS, and SOFA scores were 28.0 (22.0–33.0), 61.0 (48.0–72.0), and 8.0 (5.0–10.0), respectively, among non-survivors, compared with 20.0 (16.0–25.0), 44.0 (33.0–55.0), and 5.0 (3.0–7.0) among survivors (all comparisons p<0.001). There was no significant difference in ICU length of stay between groups [median (IQR): 5.0 (2.0–12.0) vs. 4.0 (2.0–8.0); p=0.237]. The distribution of male sex was similar between survivors and non-survivors (p=0.799). With respect to comorbidities, hypertension, diabetes mellitus, congestive heart failure, and a history of cerebrovascular events were significantly more common among non-survivors (p=0.002, p=0.001, p=0.003, and p<0.001, respectively), whereas the prevalence of chronic obstructive pulmonary disease and chronic kidney disease (stage ≥3) did not differ significantly between groups (p=1.000 and p=0.339, respectively). The proportion of patients requiring invasive mechanical ventilation at admission was higher among non-survivors than survivors (53.2% vs. 44.3%; p=0.003). The distribution of both type of ICU admission and source of ICU admission also differed significantly between groups (both p<0.001). While the proportion of medical admissions was higher among non-survivors, elective surgical admissions and admissions from the operating room were more frequent among survivors (Table 2).

Table 2. Comparison of survivors and non-survivors.

Variable	Survivors (n = 485)	Non-survivors (n = 763)	p value
Age, years	65.0 (53.0–76.0)	72.0 (61.0–80.0)	<0.001
APACHE II score	20.0 (16.0–25.0)	28.0 (22.0–33.0)	<0.001
SAPS score	44.0 (33.0–55.0)	61.0 (48.0–72.0)	<0.001
SOFA score	5.0 (3.0–7.0)	8.0 (5.0–10.0)	<0.001
ICU length of stay, days	4.0 (2.0–8.0)	5.0 (2.0–12.0)	0.237
Male sex	297 (61.2%)	474 (62.1%)	0.799
Hypertension	215 (44.3%)	409 (53.6%)	0.002
Diabetes mellitus	122 (25.2%)	260 (34.1%)	0.001
COPD	104 (21.4%)	163 (21.4%)	1.000
Chronic kidney disease (stage ≥3)	51 (10.5%)	95 (12.5%)	0.339
Congestive heart failure	72 (14.8%)	165 (21.6%)	0.003
History of cerebrovascular events	62 (12.8%)	160 (21.0%)	<0.001
Requirement for invasive mechanical ventilation at admission	215 (44.3%)	406 (53.2%)	0.003
Type of ICU admission			<0.001
Medical	420 (86.6%)	724 (94.9%)	
Emergency surgical	38 (7.8%)	33 (4.3%)	
Elective surgical	27 (5.6%)	6 (0.8%)	
Source of ICU admission			<0.001
Emergency department	327 (67.4%)	376 (49.3%)	
Hospital ward	108 (22.3%)	372 (48.8%)	
Operating room	50 (10.3%)	15 (2.0%)	

Note: Continuous variables are presented as median (interquartile range, IQR) because they were not normally distributed and were compared using the Mann–Whitney U test. Categorical variables are presented as n (%) and were compared using the chi-square test. For variables with more than two categories (type of ICU admission and source of ICU admission), the p value represents the overall comparison across categories. A p value <0.05 was considered statistically significant.

Abbreviations: ICU, intensive care unit; APACHE II, Acute Physiology and Chronic Health Evaluation II; COPD, Chronic obstructive pulmonary disease; SAPS, Simplified Acute Physiology Score; SOFA, Sequential Organ Failure Assessment.

When the association between clinical diagnoses at admission and ICU mortality was evaluated, the presence of sepsis and septic shock was significantly more frequent among non-survivors than survivors. Sepsis was observed in 31.1% of non-survivors compared with 13.8% of survivors (p<0.001). Similarly, septic shock was present in 10.9% of non-survivors versus 3.3% of survivors (p<0.001). There was no significant difference between groups in the prevalence of ARDS (p=0.231), whereas non-ARDS acute respiratory failure was more common among non-survivors (63.4% vs. 56.3%; p=0.014). The prevalence of MODS and PCAS was markedly higher in non-survivors than survivors (12.3% vs. 3.5% and 41.0% vs. 8.5%, respectively; both p<0.001). Catastrophic neurological condition was also more frequent in the non-survivor group (27.9% vs. 21.6%; p=0.016). In contrast, multiple trauma was more common among survivors than non-survivors (8.0% vs. 3.7%; p=0.001). Pulmonary embolism was also more frequent among survivors (11.8% vs. 7.5%; p=0.014). Additionally, the presence of active malignancy and neuromuscular disease was significantly higher in non-survivors compared with survivors (21.1% vs. 12.8%; p<0.001 and 6.4% vs. 2.5%; p=0.003, respectively). No significant difference was observed for morbid obesity (p=0.239) (Table 3).

Variables associated with ICU mortality were evaluated using univariable logistic regression analysis. Increasing age was associated with a higher likelihood of mortality (OR 1.03; 95% CI 1.02–1.03; p<0.001). Among comorbidities, hypertension (OR 1.45; 95% CI 1.15–1.82; p=0.001), diabetes mellitus (OR 1.54; 95% CI 1.19–1.98; p<0.001), chronic kidney disease (OR 1.87; 95% CI 1.27–2.74; p=0.002), congestive heart failure (OR 1.62; 95% CI 1.20–2.20; p=0.002), and a history of cerebrovascular events (OR 1.81; 95% CI 1.32–2.49; p<0.001) were significantly associated with mortality, whereas the presence of chronic obstructive pulmonary disease was not (OR 1.00; p=0.973). The requirement for invasive mechanical ventilation at admission (admission while intubated) was significantly associated with increased mortality (OR 1.43; 95% CI 1.14–1.80; p=0.002). Severity-of-illness scores showed a strong association with mortality; increases in APACHE II (OR 1.12; 95% CI 1.10–1.14; p<0.001), SAPS (OR 1.06; 95% CI 1.05–1.06; p<0.001), and SOFA (OR 1.38; 95% CI 1.31–1.45; p<0.001) scores were each associated with higher odds of mortality on a per-point basis. When clinical diagnoses at admission were examined, sepsis (OR 2.81; 95% CI 2.08–3.79; p<0.001), septic shock (OR 3.58; 95% CI 2.07–6.19; p<0.001), non-ARDS acute respiratory failure (OR 1.35; 95% CI 1.07–1.70; p=0.012), multiple organ dysfunction syndrome (MODS) (OR 3.87; 95% CI 2.28–6.57; p<0.001), post–cardiac arrest syndrome (PCAS) (OR 7.53; 95% CI 5.30–10.70; p<0.001), catastrophic neurological condition (OR 1.40; 95% CI 1.07–1.83; p=0.013), active malignancy (OR 1.82; 95% CI 1.33–2.51; p<0.001), and neuromas-

cular disease (OR 2.71; 95% CI 1.42–5.14; p=0.002) were significantly associated with increased mortality. In contrast, multiple trauma (OR 0.44; 95% CI 0.26–0.72; p=0.001) and pulmonary embolism (OR 0.61; 95% CI 0.41–0.89; p=0.011) were associated with lower odds of mortality. ARDS (p=0.171) and morbid obesity (p=0.159) were not significantly associated with ICU mortality (Table 4).

Table 3. Association between clinical diagnoses at admission and ICU mortality.

Clinical diagnosis	Total (n = 1,248)	Survivors (n = 485)	Non-survivors (n = 763)	p value
Sepsis	304 (24.4%)	67 (13.8%)	237 (31.1%)	<0.001
Septic shock	99 (7.9%)	16 (3.3%)	83 (10.9%)	<0.001
ARDS	30 (2.4%)	8 (1.6%)	22 (2.9%)	0.231
Non-ARDS acute respiratory failure	757 (60.7%)	273 (56.3%)	484 (63.4%)	0.014
MODS	111 (8.9%)	17 (3.5%)	94 (12.3%)	<0.001
PCAS	354 (28.4%)	41 (8.5%)	313 (41.0%)	<0.001
Catastrophic neurological condition	318 (25.5%)	105 (21.6%)	213 (27.9%)	0.016
Multiple trauma	67 (5.4%)	39 (8.0%)	28 (3.7%)	0.001
Pulmonary embolism	114 (9.1%)	57 (11.8%)	57 (7.5%)	0.014
Active malignancy	223 (17.9%)	62 (12.8%)	161 (21.1%)	<0.001
Neuromuscular disease	61 (4.9%)	12 (2.5%)	49 (6.4%)	0.003
Morbid obesity	16 (1.3%)	9 (1.9%)	7 (0.9%)	0.239

Note: Data are presented as n (%). Comparisons between survivors and non-survivors were performed using the chi-square test. A p value <0.05 was considered statistically significant.

Abbreviations: ARDS, acute respiratory distress syndrome; MODS, multiple organ dysfunction syndrome; PCAS, post–cardiac arrest syndrome; ICU, intensive care unit.

Table 4. Univariable logistic regression analysis for ICU mortality.

Variable	OR	95% CI	p value
Age, years	1.03	1.02–1.03	<0.001
Hypertension	1.45	1.15–1.82	0.001
Diabetes mellitus	1.54	1.19–1.98	<0.001
COPD	1.00	0.75–1.31	0.973
Chronic kidney disease (stage ≥3)	1.87	1.27–2.74	0.002
Congestive heart failure	1.62	1.20–2.20	0.002
History of cerebrovascular events	1.81	1.32–2.49	<0.001
Requirement for invasive mechanical ventilation at admission	1.43	1.14–1.80	0.002
APACHE II score (per point)	1.12	1.10–1.14	<0.001
SAPS score (per point)	1.06	1.05–1.06	<0.001
SOFA score (per point)	1.38	1.31–1.45	<0.001
Sepsis	2.81	2.08–3.79	<0.001
Septic shock	3.58	2.07–6.19	<0.001
ARDS	1.77	0.78–4.01	0.171
Non-ARDS acute respiratory failure	1.35	1.07–1.70	0.012
MODS	3.87	2.28–6.57	<0.001
PCAS	7.53	5.30–10.70	<0.001
Catastrophic neurological condition	1.40	1.07–1.83	0.013
Multiple trauma	0.44	0.26–0.72	0.001
Pulmonary embolism	0.61	0.41–0.89	0.011
Active malignancy	1.82	1.33–2.51	<0.001
Neuromuscular disease	2.71	1.42–5.14	0.002
Morbid obesity	0.49	0.18–1.32	0.159

Note: Results are presented as odds ratios (ORs) with 95% confidence intervals (CIs). A p value <0.05 was considered statistically significant. For APACHE II, SAPS, and SOFA scores, ORs represent the effect per one-point increase. An OR >1 indicates an increased likelihood of ICU mortality, whereas an OR <1 indicates a decreased likelihood.

Abbreviations: ICU, intensive care unit; OR, odds ratio; CI, confidence interval; APACHE II, Acute Physiology and Chronic Health Evaluation II; COPD, Chronic obstructive pulmonary disease; SAPS, Simplified Acute Physiology Score; SOFA, Sequential Organ Failure Assessment; ARDS, acute respiratory distress syndrome; MODS, multiple organ dysfunction syndrome; PCAS, post–cardiac arrest syndrome.

Independent predictors of ICU mortality were evaluated using a multivariable logistic regression model that included the SOFA score as the severity-of-illness indicator. In this model, age (adjusted OR 1.02; 95% CI 1.02–1.03; p<0.001) and the SOFA score (per point; adjusted OR 1.33; 95% CI 1.25–1.41; p<0.001) were independently associated with mortality. The presence of post–cardiac arrest syndrome (PCAS) was associated with a marked increase in the odds of mortality (adjusted OR 6.21; 95% CI 4.17–9.23; p<0.001). Sepsis at admission (adjusted OR 1.73; 95% CI 1.15–2.59; p=0.008) and active malignancy (adjusted OR 1.69; 95% CI 1.17–2.44; p=0.005) remained independently associated with ICU mortality after adjustment for the SOFA score. Although neuromuscular disease showed a trend toward higher mortality, this association did not reach statistical significance (adjusted OR 2.01; 95% CI 0.90–4.50; p=0.089) (Table 5).

Table 5. Multivariable logistic regression analysis for ICU mortality (primary SOFA-based model).

Variable	Adjusted OR	95% CI	p value
Age, years	1.02	1.02–1.03	<0.001
SOFA score (per point)	1.33	1.25–1.41	<0.001
PCAS	6.21	4.17–9.23	<0.001
Sepsis	1.73	1.15–2.59	0.008
Active malignancy	1.69	1.17–2.44	0.005
Neuromuscular disease	2.01	0.90–4.50	0.089

Note: Results are presented as adjusted odds ratios (ORs) with 95% confidence intervals (CIs). The SOFA score was used as the severity-of-illness indicator in the model, and the OR for SOFA represents the effect per one-point increase. A p value <0.05 was considered statistically significant.

Abbreviations: ICU, intensive care unit; OR, odds ratio; CI, confidence interval; SOFA, Sequential Organ Failure Assessment; PCAS, post–cardiac arrest syndrome.

4. Discussion

In this retrospective cohort study, the independent predictors of ICU mortality were evaluated using a SOFA-based multivariable model, in which age, SOFA score, post–cardiac arrest syndrome (PCAS), sepsis, and active malignancy were found to be independently associated with mortality. These findings suggest that ICU mortality is shaped not only by "acute physiological derangement" but also by the additional prognostic burden imposed by certain clinical conditions present at admission [14].

The strong and independent association between the SOFA score and mortality is consistent with the ability of SOFA to quantitatively reflect the burden of organ dysfunction and its widespread acceptance as a predictor of ICU outcomes [7]. Moreover, the use of SOFA for clinical operationalization within the sepsis spectrum—such as the definition of organ dysfunction by an increase in SOFA score in Sepsis-3—provides a conceptual framework supporting its prognostic relevance [15]. Previous studies have reported that SOFA demonstrates comparable or, in certain contexts, superior discriminative performance relative to APACHE II, and that dynamic or serial SOFA assessments may further enhance prognostic accuracy [7,16].

The independent association between age and mortality may be explained by reduced physiological reserve and diminished tolerance to the stress of critical illness in older patients [14]. This finding aligns with the prevailing view that age in ICU outcome assessment represents not only a surrogate for comorbidity burden but also a determinant influencing the response to acute pathological processes [7].

The persistence of PCAS as one of the strongest predictors in the multivariable model is consistent with the well-recognized high mortality risk associated with post–cardiac arrest syndrome, which encompasses hypoxic-ischemic brain injury, myocardial dysfunction, and a systemic ischemia–reperfusion response [9,17]. In hospitalized cardiac arrest populations, survival to discharge has been reported in the range of approximately 50–60% in most studies, underscoring the generally poor outcomes observed in patients with PCAS [18,19]. Furthermore, prior investigations have shown that SOFA scores are associated with prognosis in PCAS and that their combined use with biomarkers may improve prognostic performance [20].

The finding that sepsis remained independently associated with mortality after adjustment for the SOFA score suggests that sepsis represents not merely a "static" reflection of existing organ dysfunction but rather a "dynamic" clinical syndrome that predisposes to ongoing organ failure and subsequent complications [15].

The independent association between active malignancy and mortality is consistent with the notion that malignancy-related immunosuppression, increased susceptibility to infection, and potential limitations in therapeutic intensity may aggravate the course of critical illness [21]. Systematic reviews demonstrating worse ICU outcomes among oncology patients—particularly in the presence of sepsis or septic shock—provide further support for this observation [22].

Although neuromuscular disease showed a trend toward increased mortality, this association did not reach statistical significance, which may be related to limitations in sample size and diagnostic heterogeneity within this subgroup [7].

In secondary analyses, the observation that APACHE II, SAPS, and SOFA scores were higher among non-survivors is consistent with the existing literature supporting the utility of ICU severity scores for mortality discrimination [16,23]. However, the use of a single severity

score (SOFA) in the multivariable model reduces overlap among scoring systems and contributes to a more parsimonious and interpretable model [14].

In the univariable analysis, multiple trauma and pulmonary embolism were associated with odds ratios below unity, which may reflect the fact that these diagnoses can represent more "reversible" clinical conditions in certain centers, as well as differences in patient profiles such as age and physiological reserve [23,24]. In trauma populations, ICU outcomes have been shown to be closely related to age, comorbidity burden, and injury severity, with higher survival rates observed among younger and less comorbid patients [23,24]. In pulmonary embolism, ICU mortality has been reported to vary widely and to differ substantially according to risk profile (e.g., massive vs. submassive PE, vasopressor requirement), rendering the interpretation of univariable odds ratios inherently cautious [25]. Additionally, these findings may also reflect center-specific patient selection patterns and referral policies. In some tertiary care settings, trauma and pulmonary embolism patients admitted to the ICU may represent relatively stabilized cases transferred for monitoring or specialized management, which could contribute to lower observed mortality risks in univariable analyses.

The lack of a significant association between ARDS and mortality in this cohort may be attributable to its relatively low prevalence, limited statistical power, and the heterogeneity of ARDS definitions and management strategies [7]. Similarly, the absence of a significant association for morbid obesity may be explained by the frequently debated "obesity paradox" in critical care literature, as well as the limited number of affected cases, which constrains statistical power [7].

Overall, this study demonstrates that even after adjustment with the SOFA score in a heterogeneous ICU population, sepsis and active malignancy continue to contribute independently to mortality risk, highlighting the importance of a diagnosis-based approach in early risk stratification [22]. In addition, the high-risk profile of patients with PCAS underscores the need for systematic consideration of neurological prognosis and post–cardiac arrest syndrome components alongside organ dysfunction scores [9,18].

5. Clinical Implications

The findings of this study may have important implications for early risk stratification in critically ill patients. While severity-of-illness scores such as SOFA remain central tools for prognostic assessment in the ICU, our results suggest that certain admission clinical diagnoses provide additional prognostic information beyond organ dysfunction severity. In particular, the strong association of post–cardiac arrest syndrome, sepsis, and active malignancy with ICU mortality highlights the importance of integrating diagnosis-based clinical context into early prognostic evaluation. Recognizing these high-risk diagnostic categories at ICU admission may assist clinicians in identifying patients who require closer monitoring, early multidisciplinary management, and more individualized treatment strategies. Future studies may further explore how combining severity scores with diagnosis-based risk models could improve prognostic accuracy and clinical decision-making in critically ill populations.

Integration of diagnosis-based risk stratification into clinical practice may offer several practical advantages in ICU settings. For example, early recognition of high-risk diagnostic categories such as post–cardiac arrest syndrome, sepsis, and active malignancy may support triage decisions, assist in prioritizing ICU resources, and facilitate earlier multidisciplinary evaluation, including neurological prognostication and palliative care consultation when appropriate. From a systems perspective, incorporating diagnosis-based information alongside physiological severity scores may also improve resource planning in high-demand ICU environments.

In addition, the findings of this study may contribute to the future development of more comprehensive prognostic models. Current ICU risk prediction tools primarily rely on physiological variables and organ dysfunction scores. Our results suggest that selected admission diagnoses may provide complementary prognostic information. Future prospective studies integrating diagnosis-based variables with established severity scores may enable the development of hybrid risk prediction models with improved prognostic accuracy for heterogeneous ICU populations.

6. Study Limitations

This study has several limitations. First, the retrospective, single-center design may limit the generalizability of the findings. Due to the retrospective nature of the study, residual confounding cannot be completely excluded because of unrecorded or missing variables. Treatment-related factors potentially associated with ICU mortality (e.g., vasopressor doses, mechanical ventilation parameters, details of renal replacement therapy, or components of goal-directed sepsis management) were not included in the analyses, which may have precluded a comprehensive assessment of certain clinical effects. Another important limitation relates to the exclusion of several treatment-related variables that may influence ICU outcomes, including vasopressor use, mechanical ventilation parameters, renal replacement therapy, and components of goal-directed sepsis therapy. These variables were not included in the multivariable model primarily because the aim of the present study was to evaluate the prognostic contribution of admission clinical diagnoses independently of treatment-related interventions. Many of these variables represent downstream consequences of disease severity or therapeutic responses occurring after ICU admission and may therefore act as intermediate variables in the causal pathway between the underlying condition and mortality. Including such variables in the regression model could potentially lead to overadjustment or obscure the independent association between admission diagnoses and ICU mortality. Future prospective studies incorporating detailed treatment-related variables may provide additional insights into their interaction with diagnosis-based risk stratification.

Similarly, diagnoses of sepsis and septic shock were based on clinical documentation, and the source of infection and microbiological data were not analyzed in detail. The use of a single severity score (SOFA) as the severity-of-illness indicator was an intentional methodological choice; however, this approach may have prevented additional prognostic information provided by alternative scores such as APACHE II or SAPS from being reflected in the model. Nevertheless, selecting a parsimonious model to reduce collinearity among severity scores is a widely accepted approach that improves the interpretability of multivariable analyses. Finally, the limited sample size for certain clinical conditions, including neuromuscular disease, ARDS, and morbid obesity, may have reduced statistical power and hindered the detection of potential associations for these variables.

7. Conclusions

In this study, conducted in a heterogeneous ICU population, age, post–cardiac arrest syndrome (PCAS), sepsis, and active malignancy were independently associated with ICU mortality, even after adjustment using the SOFA score. These findings indicate that ICU mortality is determined not only by the severity of acute organ dysfunction but also by the additional prognostic burden of certain clinical diagnoses present at admission. In particular, the observation that mortality risk in patients with PCAS remained high independent of the SOFA score highlights the importance of early neurological assessment and prognosis-oriented clinical decision-making in this subgroup. The independent prognostic impact of sepsis and active malignancy further supports the need for early risk stratification and individualized treatment strategies in these patients.

Overall, consideration of specific clinical diagnoses at admission in addition to SOFA-based assessment may improve the prediction of mortality risk in ICU patients. This approach may serve as a basis for future prospective, multicenter studies and facilitate the development of more targeted risk models to guide patient management in the ICU.

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Conflict of Interest

The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this manuscript.

Data Availability

The datasets generated and/or analyzed during the current study are not publicly available but are available from the corresponding author upon reasonable request.

AI Assistance

No AI-based tools were used in the preparation of this manuscript.

Ethics Approval and Consent to Participate

This single-center retrospective cohort study was conducted at Atatürk University Faculty of Medicine Hospital, a tertiary-care university hospital, between January 1, 2024 and December 31, 2025. Institutional Ethics Committee approval was obtained (approval number: B.30.2.ATA.0.01.00/934). The study was registered at ClinicalTrials.gov (NCT07369206). The registration was completed to enhance transparency in the context of a retrospective design; the study represents a non-interventional observational analysis. The study was performed in accordance with the principles of the Declaration of Helsinki. Due to the retrospective nature of the study, informed consent was not obtained from participants.

Author Contributions

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Lale Ibrahimbeyli: *conceptualization, methodology, software, validation.*

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Nazim Dogan: *writing – original draft, writing – review & editing.*

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