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Association between APACHE II score and intensive care unit length of stay

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Abstract

Background: The Acute Physiology and Chronic Health Evaluation II (APACHE II) score is used to assess illness severity in critically ill patients. Illness severity may be associated with the duration of intensive care.
Purpose: To examine the relationship between APACHE II scores and ICU length of stay.
Method: This retrospective analytical study reviewed medical records of 172 ICU patients, of whom 102 met the eligibility criteria and were included through total sampling at Sari Asih Serang Hospital, Indonesia. The 70 excluded records did not meet the study criteria because of early death, transfer to another hospital, or incomplete data. Data were analyzed using univariate analysis and Somers' d, with statistical significance set at $p < 0.05$.
Results: Of the 102 patients, 58 (56.9%) had severe APACHE II scores (≥17), 30 (29.4%) had moderate scores (11–16), and 14 (13.7%) had mild scores (0–10). Most patients stayed in the ICU for 4–7 days (51; 50.0%), followed by 1–3 days (28; 27.5%) and ≥8 days (23; 22.5%). Somers' d indicated a very strong positive association between APACHE II scores and ICU length of stay ($d = 0.920$, $p < 0.001$).
Conclusion: Higher APACHE II scores were associated with longer ICU stays. These findings highlight the relevance of illness severity assessment in critical care planning and ICU resource management.

Keywords: APACHE II Score; Intensive Care Unit; Length of Stay.

INTRODUCTION

The Intensive Care Unit (ICU) is an essential component of hospital services, providing continuous monitoring and intensive treatment for patients with critical illnesses and life-threatening physiological disturbances. Critical illness may arise from various conditions, including severe infections, respiratory failure, cardiovascular disorders, and multiple organ dysfunction, which require timely assessment and appropriate clinical management (Vincent et al., 2014). Sepsis, in particular, remains an important cause of organ dysfunction among critically ill patients and often requires intensive treatment and organ support (Rello et al., 2017). The complexity of critical care requires appropriate clinical assessment to identify patients who need intensive interventions and to support decisions regarding the allocation of healthcare resources. Understanding the factors associated with ICU length of stay is therefore important for clinical management and the efficient use of intensive care services (Peres et al., 2020).

Length of stay in the ICU is an important indicator of healthcare utilization and reflects the complexity of patient care. Prolonged ICU stays may increase healthcare costs and limit the availability of intensive care beds for other patients who require urgent treatment. Previous research has identified several factors associated with ICU length of stay, including illness severity, patient characteristics, diagnosis, and

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treatment requirements (Peres et al., 2020). In addition, differences in patient-to-nurse ratios across healthcare settings may contribute to variations in the duration of intensive care (Khanna et al., 2022). A systematic review and meta-analysis also found that protocolized family support interventions were associated with reduced ICU length of stay, suggesting that care processes and family involvement may contribute to the duration of intensive care (Lee et al., 2019). Identifying clinical factors associated with ICU length of stay is important for supporting care planning and the efficient allocation of hospital resources.

Illness severity is an important consideration in the assessment of critically ill patients. Patients with more severe physiological disturbances may require closer monitoring, intensive treatment, and longer periods of recovery. The Acute Physiology and Chronic Health Evaluation II (APACHE II) score was developed as a severity-of-disease classification system incorporating acute physiological measurements, age, and chronic health conditions. It provides a structured approach to evaluating the severity of illness among critically ill patients. In clinical practice, severity assessment helps describe the patient's physiological condition and provides information that may support the evaluation of clinical risk and treatment needs.

The APACHE II score has been investigated as a clinical indicator associated with prolonged ICU stays. A Japanese multicenter retrospective cohort study examined the performance of APACHE II, APACHE III, and the Simplified Acute Physiology Score II (SAPS II) in predicting prolonged ICU stays, demonstrating the relevance of severity scores in assessing the likelihood of extended intensive care (Takekawa et al., 2022). Research involving patients with acute exacerbations of chronic obstructive pulmonary disease has also examined factors associated with prolonged intensive care, highlighting the importance of clinical characteristics when evaluating ICU duration (Doganci et al., 2024). Furthermore, a study of patients with acute respiratory distress syndrome found that APACHE II scores were associated with mechanical ventilation pressure parameters and had prognostic value in evaluating patient outcomes (Lu et al., 2023). Although these findings support the clinical relevance of APACHE II, their applicability to ICU length of stay may differ according to patient diagnoses, treatment requirements, and the clinical setting.

Nevertheless, ICU length of stay is not determined by illness severity alone. Patient diagnoses, treatment requirements, and healthcare organization may also contribute to differences in the duration of intensive care. A nationwide Danish cohort study examined the performance of SAPS II according to ICU length of stay, providing additional evidence regarding the assessment of illness severity across different durations of intensive care (Granholm et al., 2019). Furthermore, the development and validation of the Sequential Organ Failure Assessment (SOFA)-2 score reflect continuing efforts to improve the assessment of organ dysfunction in critically ill patients (Ranzani et al., 2025). These findings support the importance of evaluating illness severity within the broader clinical context of intensive care rather than considering a severity score as the sole determinant of the duration of treatment.

In Indonesia, ICU length of stay is also relevant to hospital resource utilization and the delivery of critical care services. A recent publication examining national health insurance claims from 2019 to 2024 addressed trends in ICU length of stay and in-hospital mortality in Indonesia (Putra et al., 2026). Research conducted at RSUD Raden Mattaher Jambi also examined APACHE II scores and length of stay among critically ill patients treated in the ICU and Intensive Cardiac Care Unit (ICCU). The study reported variation in length of stay across APACHE II score levels and did not identify a consistent increase in length of stay as scores increased (Manurung et al., 2025). This finding indicates that the relationship between illness severity and the duration of intensive care may not be uniform across clinical settings and warrants further investigation. However, national-level analyses and findings from other hospitals do not necessarily explain the relationship between APACHE II scores and ICU length of stay within an individual hospital.

Although previous studies have examined illness severity and prolonged ICU stays, the findings suggest that the association between severity scores and length of stay may vary across patient populations and healthcare settings. Evidence specific is needed to establish how APACHE II score categories are associated with ICU length of stay in its patient population. Examining this association may provide a clearer understanding of the distribution of

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illness severity, the duration of intensive care, and the strength and direction of the relationship between these variables. Specifically, the study described patient characteristics, APACHE II score categories, and ICU length of stay, and examined the strength and direction of the relationship between APACHE II scores and the duration of intensive care. The findings are expected to contribute to the evidence base for critical care nursing and support clinical assessment, nursing care planning, and ICU resource management.

RESEARCH METHOD

This study employed a quantitative observational analytical design with a retrospective approach to examine the association between Acute Physiology and Chronic Health Evaluation II (APACHE II) score categories and intensive care unit (ICU) length-of-stay categories. The study was conducted at Sari Asih Serang Hospital, Serang, Indonesia, using patient medical records from October 2025. The study population consisted of 172 patients admitted to the ICU during the study period. Total sampling was applied to all patients who met the predetermined eligibility criteria. Following the medical record screening process, 102 patients were included in the final analysis, while 70 records were excluded because they did not meet the eligibility criteria. The available study information identified early death, transfer to another hospital, and incomplete essential data as reasons for exclusion; however, the number of records excluded for each individual reason was not available.

The inclusion criteria were patients aged 18 years or older with complete APACHE II scores recorded during the first 24 hours of ICU admission and documented ICU admission and discharge dates. The exclusion criteria were patients who died within the first 24 hours of ICU admission, patients transferred from the ICU to another hospital, and patients whose medical records lacked essential information, particularly APACHE II scores or length-of-stay data. Accordingly, total sampling referred to the inclusion of all eligible patients during the study period rather than all 172 patients initially identified. The independent variable was the APACHE II score category, representing illness severity based on acute physiological measurements, age, and chronic health conditions. APACHE II scores were obtained from clinical information documented during the first 24 hours of ICU admission and classified as mild (0–10), moderate (11–16), and severe (≥17), according to the operational definitions reported in the study. The dependent variable was ICU length of stay, defined as the duration between documented ICU admission and discharge dates. Length of stay was recorded in days and categorized as short (1–3 days), moderate (4–7 days), and long (≥8 days). Patient characteristics included age, sex, primary medical diagnosis, and recorded comorbidities.

Data were collected retrospectively using a structured data extraction sheet. The extracted information included demographic characteristics, primary medical diagnoses, comorbidities, physiological parameters required to determine APACHE II scores, and ICU admission and discharge dates. The collected data were coded and entered into statistical software for analysis. Records with incomplete essential information were excluded according to the eligibility criteria. The study used existing medical records, and no intervention was administered to the patients. Data analysis consisted of univariate and bivariate analyses. Univariate analysis was used to describe patient characteristics, APACHE II score categories, and ICU length-of-stay categories. Categorical variables were summarized using frequencies and percentages, while age was presented as the mean, standard deviation, and range. Bivariate analysis was conducted using Somers' d to assess the direction and strength of the association between APACHE II score categories and ICU length-of-stay categories.

APACHE II score category was designated as the independent variable, and ICU length-of-stay category was designated as the dependent variable. Statistical significance was set at $\alpha = 0.05$, with $p < 0.05$ considered statistically significant. The reported Somers' d coefficient was interpreted as an association between the two ordinal variables and not as evidence of causality or independently established predictive accuracy. This study received ethical approval from the Health Research Ethics Committee of the Faculty of Nursing, Sultan Agung Islamic University (UNISSULA), Semarang, Indonesia, under approval number 085/A.1-KEPK/FIK-SA/I/2026, dated January 19, 2026. The study involved a retrospective review of patient medical records. Patient confidentiality and anonymity were maintained

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throughout the research process. Personally identifiable information was excluded from the analytical dataset, and the collected data were used solely for research purposes. Access to medical records was subject to institutional authorization and applicable hospital confidentiality requirements.

RESEARCH RESULTS

Table 1. Distribution of Respondent Characteristics (N=102)

Variable	Results
Age (n/%)(Mean±SD)(Range)(Year)	**(56.0 ± 12.8)(20–85)**
<45	15/14.7
45–54	23/22.5
55–64	36/35.3
65–74	26/25.5
≥75	2/2.0
Gender (n%)	
Male	53/52.0
Female	49/48.0
Primary Medical Diagnosis (n%)	
Cardiovascular	25/24.5
Respiratory Failure / Pulmonary Tuberculosis	24/23.5
Neurological	22/21.6
Renal / Metabolic	19/18.6
Sepsis / Severe Infection	6/5.9
Postoperative	6/5.9
Comorbidities (n%)	
CKD / AKI	22/21.6
Diabetes Mellitus	18/17.6
Cardiovascular Disease (CHF, CAD, HT, ACS)	19/18.6
Pulmonary Tuberculosis / History of TB	11/10.8
COPD	8/7.8
Liver Disease (Cirrhosis)	10/9.8
Chronic Neurological Disease	7/6.9
Cancer	7/6.9
ICU Length of Stay (n%)	
Short (1–3 days)	28/27.5
Moderate (4–7 days)	51/50.0
Long (≥8 days days)	23/22.5
APACHE II Category (n%)	
Mild (0–10)	14/13.7
Moderate (11–16)	30/29.4
Severe (≥ 17)	58/56.9

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Table 1 presents the characteristics of the 102 patients included in the study. The largest age group was 55–64 years, comprising 36 patients (35.3%), followed by those aged 65–74 years, with 26 patients (25.5%). The mean age was 56.0 ± 12.8 years, with a range of 20–85 years. Male patients accounted for 53 (52.0%) of the sample, while female patients accounted for 49 (48.0%). Cardiovascular conditions were the most common primary diagnoses, affecting 25 patients (24.5%), followed by respiratory failure or pulmonary tuberculosis in 24 patients (23.5%) and neurological conditions in 22 patients (21.6%). Regarding comorbidities, CKD/AKI was the most frequently recorded category, involving 22 patients (21.6%), followed by cardiovascular disease in 19 (18.6%) and diabetes mellitus in 18 (17.6%). Most patients had severe APACHE II scores (≥17), accounting for 58 patients (56.9%), while 30 (29.4%) had moderate scores and 14 (13.7%) had mild scores. In terms of ICU length of stay, 51 patients (50.0%) received intensive care for 4–7 days, 28 (27.5%) stayed for 1–3 days, and 23 (22.5%) stayed for at least 8 days.

Table 2. Association Between APACHE II Score Category and ICU Length-of-Stay Category (N = 102)

Independent Variable	Dependent Variable	Somers' d	p-value
APACHE II Score	ICU Length of Stay	0.920	<0.001

Table 2 presents the reported association between APACHE II score category and ICU length-of-stay category. Somers' d was 0.920, with $p < 0.001$, indicating a statistically significant positive association according to the reported analysis. The positive direction suggests that higher APACHE II score categories tended to be associated with longer ICU stays. However, the coefficient should be interpreted in the context of the ordinal categorization of both variables and the retrospective study design.

DISCUSSION

These findings show that the ICU patient population was characterized by a predominance of middle-aged and older adults, a high prevalence of chronic diseases and comorbidities, and a substantial proportion of patients with severe APACHE II scores. These characteristics reflect the clinical complexity of the patients receiving intensive care during the study period. The presence of multiple comorbidities may complicate clinical management and increase the need for close monitoring and supportive treatment. These findings highlight the importance of assessing illness severity and examining its association with the duration of intensive care.

Older age may be clinically relevant because physiological reserve and the capacity to recover from acute illness vary among patients. In this study, the largest age group was 55–64 years, followed by patients aged 65–74 years. These characteristics provide context for interpreting the distribution of APACHE II scores and ICU length of stay. However, because the analysis focused on the association between APACHE II scores and length of stay, the independent contribution of age to the duration of ICU treatment cannot be established from the reported results.

The distribution of APACHE II scores showed that most patients were classified in the severe category, accounting for 58 patients (56.9%). This finding indicates that a substantial proportion of the study population had high illness-severity scores during the initial assessment. Systematic assessment of organ dysfunction is important in critical care because physiological deterioration is relevant to the evaluation of clinical outcomes. Research examining the Sequential Organ Failure Assessment (SOFA) score has demonstrated the relevance of systematic organ dysfunction assessment in evaluating outcomes among critically ill patients (Ferreira et al., 2001). Although SOFA and APACHE II use different scoring approaches, both provide structured clinical information that can support the assessment of critically ill patients.

The principal finding of this study was a very strong positive association between APACHE II score categories and ICU length-of-stay categories, as indicated by a Somers' d coefficient of 0.920 and a p-value below 0.001. This result suggests that patients with higher APACHE II scores tended to have longer ICU stays in the study population. The finding is clinically relevant because patients with greater physiological disturbances may require more intensive monitoring, supportive treatment, and time

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for clinical stabilization. Nevertheless, the strength of the observed association should be interpreted in the context of the study population, the categorization of the variables, and the retrospective design. The result demonstrates a statistically significant association but does not establish causality or independently confirm the predictive accuracy of APACHE II for ICU length of stay.

ICU length of stay may also be influenced by factors beyond the severity score recorded at admission. Differences in diagnoses, treatment requirements, complications, and clinical progress may contribute to variations in the duration of intensive care. Research examining depression and ICU length of stay has investigated the relationship between patient-related clinical factors and the duration of hospitalization (Liao et al., 2020). Anxiety has also been examined in critically ill patients in relation to its prevalence, risk factors, and associated patient outcomes (May et al., 2021). These findings suggest that the clinical course of ICU patients may involve multiple contributing factors, although psychological variables were not assessed in the present study.

Research examining emotional and physical distress during ICU admission has explored how clinical factors relate to patients' conditions during intensive care and their cognitive status at discharge (Doña-López et al., 2026). Psychological distress is also recognized as an important concern in critical care, while patients may experience psychological difficulties after discharge from intensive care (Kusi-Appiah et al., 2026; Needham et al., 2012). In addition, systematic reviews have examined the effects of ICU diaries on anxiety, depression, and post-traumatic stress disorder among ICU survivors (Sun et al., 2021; Gazzato et al., 2022). These studies provide broader context for understanding the complexity of ICU outcomes but do not directly establish the association between APACHE II scores and ICU length of stay observed in the present study.

From a critical care nursing perspective, the findings emphasize the importance of early illness-severity assessment and continuous monitoring of patients' clinical conditions. APACHE II scores may provide useful information when identifying patients who require close observation and comprehensive care planning. However, nursing interventions should be guided by ongoing clinical assessment and the patient's actual treatment needs rather than by the severity score alone. Appropriate monitoring, prevention of complications, nutritional support, and coordination of multidisciplinary care remain important components of managing critically ill patients.

At the healthcare-system level, identifying patients with greater illness severity may assist clinical teams in anticipating care requirements and supporting ICU resource planning. Information about the association between APACHE II scores and length of stay may contribute to planning bed availability, staffing requirements, and the allocation of critical care equipment. Nevertheless, these findings should be interpreted within the context of the hospital where the data were collected. Further research involving larger populations and additional clinical and organizational variables would help determine whether the observed association is consistent across different ICU settings.

Overall, this study identified a statistically significant and very strong positive association between APACHE II score categories and ICU length-of-stay categories among patients admitted to the ICU at Sari Asih Serang Hospital. The findings support the clinical relevance of assessing illness severity when evaluating the care needs of critically ill patients. However, the retrospective design and use of categorized variables limit conclusions about causality and predictive accuracy. Future studies should examine additional factors, including age, comorbidities, primary diagnosis, treatment requirements, and clinical complications, to provide a more comprehensive understanding of the factors associated with ICU length of stay.

CONCLUSION

This study reported a positive and statistically significant association between APACHE II score categories and ICU length-of-stay categories (Somers' $d = 0.920$, $p < 0.001$). Higher APACHE II score categories tended to be associated with longer ICU stays. These findings may inform clinical assessment and nursing care planning. However, the retrospective, single-center design, exclusion of some medical records, and lack of independent verification of the reported statistical coefficient limit the interpretation and generalizability of the findings. The results indicate an association and do not establish causality or predictive accuracy.

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