Original Article

Does the SOFA Score Have the Ability to Predict Length of Stay and Mortality as well as Other Scorings?

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Abstract

Background: In the intensive care unit (ICU), critically sick pneumonia has a high mortality rate, so forecasting the prognosis is crucial for making decisions. Early detection of clinical deterioration and the implementation of early intervention and care can be achieved through the use of scoring systems. The Acute Physiology and Chronic Health Evaluation II (APACHE II) scoring system is a better system in predicting mortality in critically ill patients. However, in this study, we aim to observed the use of the Sequential Organ Failure Assessment (SOFA) score as a predictor of mortality and length of stay (LOS).

Methods: From April to August 2023, we treated 125 critically sick pneumonia patients in the ICU as part of a prospective observational research. An integrated ICU mortality calculator was used to assess the performance of the APACHE II, Simplified Acute Physiology Score II (SAPS II), and SOFA scores. Descriptive statistics will be used for data analysis, and the Fisher exact test and Chi-square test will be used for testing. logistic regression and linear regression methods are used in multivariate analysis. If the p-value is less than 0.05, it will be statistically significant.

Results: APACHE II, SAPS II, and SOFA scores were significant in predicting the outcome of critically ill pneumonia patients (cut-off of ≥14.5, ≥34.5, and ≥3.5, respectively). The Spearman rank correlation for LOS shows that APACHE II, SOFA, and SAPS II scores have a very weak relationship with the p-values are 0.121, 0.766, and 0.436, respectively.

Conclusion: The SOFA score is a good mortality predictor in critically ill pneumonia patients yet is simpler and easier to use in all settings in the hospital.

Keywords: APACHE II, mortality, pneumonia, SOFA, SAPS II

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INTRODUCTION

Pneumonia, an acute inflammation of the lung parenchyma brought on by bacteria, viruses, fungi, and parasites, remains a major global health concern with high rates of morbidity and mortality.[1,2] Up to 10% of pneumonia patients are admitted to the intensive care unit (ICU) as a result of complications such as sepsis, septic shock, and acute respiratory distress syndrome (ARDS). Up to 75% of pneumonia patients need to be hospitalized.[3]

Pneumonia has clinical variations from mild to severe and can progress to sepsis and septic shock.[4] Global Burden of Disease in 2019 stated that 30% of the causes of sepsis were related to pneumonia. Pneumonia causes the majority of ARDS.[2] The clinical appearance of pneumonia is influenced by pathogenic virulence, age, and several risk factors, including malnutrition, immunodeficiency, diabetes, alcoholism, smoking, chronic obstructive pulmonary disease (COPD), cardiovascular disease, and renal comorbidities.[5,6]

Sepsis progresses quickly to a critical stage so failure to identify and adequately treat it early will have fatal consequences.[4,7] Identification of signs of clinical deterioration can be assisted by a scoring system so that clinicians can begin early intervention and management, including increasing attention to care, determining emergency status, determining treatment

status, and activating a rapid response from the medical emergency team.[8] Early diagnosis and awareness of signs of deterioration accompanied by adequate management are the keys to success in reducing pneumonia morbidity and mortality rates.[3]

Confusion-urea respiratory blood pressure-65 (CURB-65), systemic inflammatory response syndrome (SIRS), quick sequential organ failure assessment (qSOFA), sequential organ failure assessment (SOFA), national early warning score (NEWS), and modified early warning score (MEWS) are among the scoring systems that are frequently used in the initial diagnosis of pneumonia.[8] The use of this scoring is easy because it does not use many supporting examination parameters so it helps clinicians in estimating the patient's prognosis at the start of diagnosis, thus increasing awareness and adequate management. To more accurately predict mortality, patients with critical conditions in intensive care units frequently receive a more complex scoring system, such as the simplified acute physiology score II (SAPS II) and acute physiology and chronic health evaluation II (APACHE II) scoring, which uses clinical conditions and several supporting examination elements as support.[9,10]

The advantage of using SOFA scores is simple, able to predict long-term mortality and improve discrimination using serial scores. The SOFA and SAPS II score comparison show that the SOFA score has better sensitivity and accuracy (sensitivity SOFA VS SAPS II = 73.37% vs 47.29%; accuracy SOFA vs SAPS II = 67.18% vs 66.23%). Systematic review shows APACHE II has a lower validity than SAPS II and the area under the curve (AUC) of SOFA scores are greater in the diagnosis of patient mortality than other scores. Studies on sepsis patients give good results which state APACHE II scores and SOFA scores have the same effectiveness in assessing mortality in sepsis patients yet series evaluation using SOFA score and mean SOFA score is more useful in predicting mortality than other score.[11–14]

Several studies have been conducted to compare which scoring is better in predicting mortality in pneumonia patients. On this occasion, the author would like to directly compare SOFA, APACHE II, and SAPS II scoring in pneumonia patients with critical conditions and also analyze further their relationship to length of hospital stay (LOS) and patient outcomes along with other clinical factors that are thought to contribute to the patient's clinical condition. It is hoped that the results of this research will provide a better description of the clinical scoring system that best suits the characteristics of critical condition pneumonia cases at Dr. Moewardi.

METHODS

This is a prospective observational study from April to August 2023 in the ICU of Dr. Moewardi General Hospital, which is a referral hospital for Central Java and surrounding areas. Subjects were all patients above 18 years old diagnosed with pneumonia based on current guidelines that include new or progressive infiltrates in chest radiography accompanied with clinical symptoms and signs indicating infection such as acute fever, productive cough, shortness of breath, physical examination shows bronchovesicular breath sounds or crackles, and leukocytosis/leucopenia.[15]

Patients with pneumonia in this study may have had ventilator-associated pneumonia (VAP), hospital-acquired pneumonia (HAP), or community-acquired pneumonia (CAP), and they may have been in critical condition with sepsis, septic shock, or using mechanical ventilation breathing apparatus, and being treated in the ICU.

Overall 125 patients were included in and was determined using purposive sampling. Patients with pneumonia due to COVID-19 were not included in the research. We exclude patients with Pneumonia with COVID-19 because in a previous study it stated the use of SOFA score is inadequate and inaccurate in assessing the mortality of pneumonia patients with COVID-19 with Under the Receiver Operating

Operating Characteristic Curve (AUROC) of 0.74 to 0.75. Furthermore, patients with pneumonia with COVID-19 have a higher level of mortality comparable with the worsening of the SOFA score which can cause bias to the SOFA score of pneumonia patients without COVID-19.[16,17]

At the time of initial admission, the APACHE II, SOFA, and SAPS II scores of every patient were evaluated. The scoring is calculated using the combined ICU mortality calculator from https://clincalc.com/IcuMortality/, the total scores and mortality predictor values for each scoring system are obtained.[18] Baseline data of the subjects include sex, age, chronic disease or comorbidities, vital signs, routine and chemistry blood tests, arterial blood gas (ABG), and any elective or emergency surgical procedure. The patient is then recorded for the length of stay and the outcome, whether the patient ultimately lives or dies.

Version 22.0 of SPSS software was utilized to analyse the study's data. Subject descriptive analysis is shown as mean±standard deviation (SD) or median (min-max) for numerical data, and as a frequency distribution for categorical data. The numerical data in this study fulfilled the independent t-test's normality assumptions. For categorical variables in the multivariate analysis, logistic regression is used, while linear regression is used for numerical variables. This research was carried out in compliance with the Declaration of Helsinki, and Dr. Moewardi Hospital's Health Research Ethics Committee (415/III/HREC/2023) gave its approval for the study plan.

RESULTS

In this study, 125 patients with severe pneumonia; 56.8% of the patients were male. The study's subjects were 57.97±13.09 years old on average. There were more patients with sepsis (65.6%) than septic shock. Only a small number were hospitalized with the need for surgery (1.6%). The most common type of pneumonia is CAP (65.6%), and the least common type is VAP (2.4%). Most of the accompanying comorbidities were DM (33.6%), while the least common comorbidities were COPD (4.8%). The APACHE II, SOFA, and SAPS II obtained average scores of 16.60±5.71, 5.34±2.21, and 33.46±10.31, respectively. The average of LOS was 7.08±3.77 days. Among them, 73 patients died (58.4%) and 52 patients survived (41.6%) (Table 1).

Table 1. Characteristics of the subjects, length of stay, outcome, and scoring systems (n=125).

Parameters	n	%
Sex		
Male	71	56.8%
Female	54	43.2%
Age, (mean±SD)	57.97±13.09	
Severity		
Sepsis	82	65.6%
Septik shock	43	34.4%
Medical		
No (surgical)	2	1.6%
Yes	123	98.4%
Type of pneumonia		
CAP	82	65.6%
HAP	40	32.0%
VAP	3	2.4%
Comorbidities		
DM	42	33.6%
Stroke	16	12.8%
Cardiac failure	12	9.6%
CKD	18	14.4%
COPD	6	4.8%
Malignancy	24	19.2%
Scoring systems		
APACHE II (0-71), (mean±SD)	16.60±5.71	
SOFA (0-24), (mean±SD)	5.34±2.21	
SAPS II (0-163), (mean±SD)	33.46±10.31	
Outcome		
Dead	73	58.4
Survive	52	41.6
Length of hospital stay, (mean±SD)	7.08±3.77	
>7 days	53	42.4%
≤7 days	72	57.6%

Note: CAP=community-acquired pneumonia;
HAP=hospital-acquired pneumonia;
VAP=ventilator-associated pneumonia;
DM=diabetes mellitus;
CKD=chronic kidney disease;
COPD=chronic obstructive pulmonary disease;
APACHE II=acute physiology and chronic health evaluation II;
SOFA=sequential organ failure assessment;
SAPS II=simplified acute physiology score II

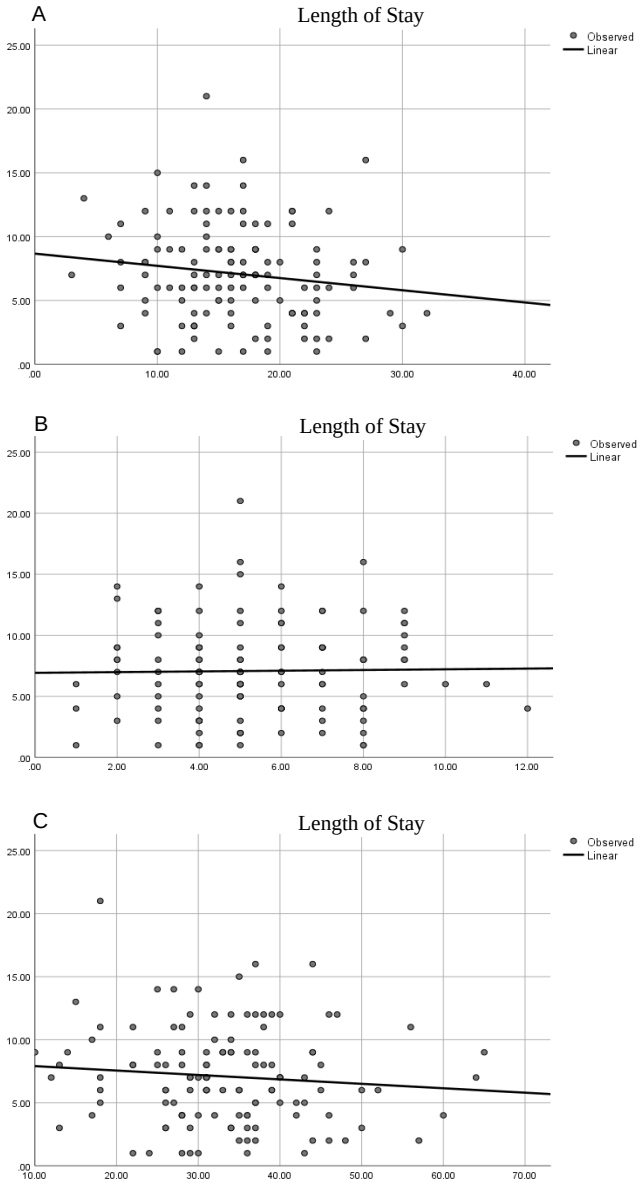

Figure 1. Scatterplot relationship between scoring systems and LOS. (A. APACHE II score; B. SOFA score; C. SAPS II score)

An overview of the data on the relationship between scoring systems and LOS can be seen with a scatterplot as follows in Figure 1. From top left to bottom right, the scatterplot data distribution of the association between LOS APACHE II, and SAPS II scores forms a linear line, indicating that the higher the LOS and the higher the APACHE II and SAPS II scores. This demonstrates that APACHE II and SAPS II have a negative connection with LOS.

The scatterplot of the relationship between SOFA scoring with LOS forms a linear line from bottom left to top right, which means that the higher the SOFA score, the longer the LOS. This shows that there is a positive relationship between SOFA and LOS. All the distribution of scatterplots appear to spread far from a linear line so the relationship may be in the very weak category. The Spearman rank correlation for LOS shows that APACHE II, SOFA, and SAPS II scores have a very weak relationship and are not statistically significant with the values of *P* are 0.121, 0.766, and 0.436, respectively.

Based on mortality prediction using the scoring system as described in Table 2, it was found that the APACHE II score tended to be higher in patients who died (mean=18.67) compared to patients who survived (mean=13.69) with *P*<0.01. The effect size of the APACHE II score between survived and dead patients was 0.936 (large = 0.80 ≤ ES < 1.30). Additionally, the SAPS II shows that, with *P*<0.001, the mean score for deceased patients was higher (mean=36.33) than the mean score for survivors (mean=29.44). Between patients who survived and those who did not, the SAPS II effect size was 0.705 (medium = 0.50 < ES < 0.80). Meanwhile, the SOFA scores also tended to be higher in dead patients (mean=5.79) compared to survived patients (mean=4.71), with *P*=0.014 and the effect size is medium (0.502).

With a cut-off value of >14.5 a sensitivity of 78.1% and a specificity of 59.6%, the area under the receiver operating characteristic curve (AUC) value of the APACHE II parameter on the outcome of critically ill pneumonia patients is 0.755. It means that 78.1% of patients with a death outcome could be detected with the APACHE II examination of ≥14.5 and the patient that will have a survival outcome can be detected with the APACHE II <14.5 is 59.6%.

The PPV value was found to be 73.1%, which means that if the APACHE II is ≥14.5, there is a 73.1% chance of the patient getting a death outcome. Meanwhile, the NPV value is 66.0%, which means that if the APACHE II result is <14.5, there is a 66.0% chance that the patient will get a survival outcome. The statistical test results obtained a value of *P*<0.001.

Table 2. Analysis of the relationship between APACHE II, SOFA, and SAPS II as mortality predictors in critically ill pneumonia patients.

Scoring systems	Dead	Survived	*P*	Effect Size	95% CI
APACHE II	18.67±5.04	13.69±5.35	<0.001**	0.963	0.604-1.322
SOFA	5.79±2.12	4.71±2.20	0.014*	0.502	0.142-0.861
SAPS II	36.33±9.26	29.44±10.45	<0.001**	0.705	0.346-1.064

Note: [a]Independent t-test (numerical data meets normality assumptions); [b] Mann-Whitney test (numerical data does not meet the assumption of normality); [c]Effect size analysis Cohen d *Significant at *P*<0.05; ** Significant at *P*<0.01.

Table 3. The cut-off for APACHE II, SAPS II, and SOFA scores as predictors of mortality in critically ill pneumonia patients.

Scoring systems	Cut-Off	AUC (95% CI)	%Sensitivity (95% CI)	%Specificity (95% CI)	%PPV (95% CI)	%NPV (95% CI)	*P*
APACHE	≥14.5	0.755 (0.670- 0.827)	78.1 (66.9 - 86.9)	59.6 (45.1 - 73.0)	73.1 (65.6 - 79.4)	66.0 (54.3 - 75.9)	<0.001**
SOFA	≥3.5	0.628 (0.537- 0.712)	90.4 (81.2 - 96.1)	32.7 (20.3 - 47.1)	65.3 (60.6 - 69.8)	70.8 (52.1 - 84.5)	0.015*
SAPS	≥34.5	0.695 (0.607-0.774)	58.9 (46.8 - 70.3)	75.0 (61.1 - 86.0)	76.8 (66.6 - 84.6)	56.5 (48.7 - 64.1)	<0.001**

Note: Determination of Cut-off based on Youden Index J; *Significant at *P*<0.05; **Significant at *P*<0.01

With a cut-off value of >34.5 and an AUC value of 0.695, SAPS II has a sensitivity of 58.9% and specificity of 75.0% when it comes to the outcome of critically ill pneumonia patients. It means that 58.9% of patients with a death outcome could be detected with SAPS II ≥34.5, and the patient that will have a survival outcome can be detected with SAPS II <34.5 is 75.0%. The PPV value was found to be 76.8%, which means that if the SAPS II is ≥34.5, there is a 76.8% chance of the patient getting a death outcome. Meanwhile, the NPV value is 56.5%, which means that if the SAPS II result is <34.5, there is a 56.5% chance that the patient will get a survival outcome. The statistical test results obtained a value of *P*<0.001.

The AUC value of the SOFA scores on the outcome of critically ill pneumonia patients is 0.628, with a SOFA score cut-off value of >3.5 and corresponding sensitivity and specificity of 90.4% and 32.7%. It means that 90.4% of patients with a death outcome could be detected with SOFA ≥3.5, and the patient that will have a survival outcome can be detected with SOFA <3.5 is 32.7%. The PPV value was found to be 65.3%, which means that if the SOFA is ≥3.5, there is a 65.3% chance of the patient getting a death outcome. Meanwhile, the NPV value is 70.8%, which means that if the SOFA result is <3.5, there is a 70.8% chance that the patient will get a survival outcome. The statistical test results obtained a value of *P*<0.001. Determination of the cut-off and ROC curve of those scoring systems as predictors of mortality in critically ill pneumonia patients were described in Table 3.

Bivariate analysis of APACHE II, SAPS II, and SOFA scores as mortality predictors in critically ill pneumonia patients can be seen in Table 4. The APACHE II ≥14.5, the SAPS II ≥34.5, and the SOFA ≥3.5 were significantly 5.26, 4.30, and 4.58 times at risk of mortality in critically ill pneumonia patients, respectively.

Table 4. Bivariate analysis of APACHE II, SOFA, and SAPS II as mortality predictors in critically ill pneumonia patients.

Scoring systems	Dead	Survived	OR (95% CI)	*P*
APACHE II				
≥14.5	57 (78.1%)	21 (40.4%)	5.26 (2.40-11.52)	<0.001**
<14.5	16 (21.9%)	31 (59.6%)		
SOFA				
≥3.5	66 (90.4%)	35 (67.3%)	4.58 (1.73-12.09)	0.001**
<3.5	7 (9.6%)	17 (32.7%)		
SAPS II				
≥34.5	43 (58.9%)	13 (25.0%)	4.30 (1.97-9.40)	<0.001**
<34.5	30 (41.1%)	39 (75.0%)		

Note: Chi-Square test;**Significant at *P*<0.05.

In this study, we also found that systolic blood pressure (SBP), heart rate, serum sodium level, and serum urea level have a significant correlation (*P*<0.05) with the outcome in critically ill pneumonia patients (data not shown). Based on that result, we also did a multivariate analysis of APACHE II, SOFA, and SAPS II as well as characteristic variables and blood tests (which obtained a value of *P*<0.05) using logistic regression as mortality predictors in critically ill pneumonia patients (Table 5).

Table 5. Multivariate analysis of APACHE II, SOFA, SAPS II, characteristic variables, and blood chemistry tests (which obtained *P*<0.05) as mortality predictors in critically ill pneumonia patients.

Parameters	Wald	OR	95% CI	*P*
APACHE II	4.303	2.63	1.05-6.55	0.038*
SOFA	1.509	2.06	0.65-6.49	0.219
SAPS II	3.026	2.42	0.89-6.54	0.082
Characteristic variables				
DM	1.067	1.70	0.62-4.63	0.302
SBP	4.918	0.98	0.96-1.00	0.027*
HR	2.785	1.03	0.99-1.07	0.095
Natrium	4.321	0.93	0.86-1.00	0.038*
Ureum	0.098	3.31	0.00-5788.41	0.754

Note: Logistic Regression Test; *Significant at *P*<0.05; **Significant at *P*<0.01

The results showed that, among critically sick pneumonia patients, the APACHE score (OR=2.63; *P*=0.038) was most strongly linked with mortality, followed by SOFA (OR=2.06; *P*=0.219) and SAPS II (OR=2.42; *P*=0.082). In critically ill pneumonia patients, blood sodium levels (OR=0.93; *P*=0.038) and SBP (OR=0.98; *P*=0.027) were additional indicators linked to mortality.

DISCUSSION

Pneumonia often leads to sepsis and even septic shock, resulting in long hospital stays and high mortality. In addition to developing guidelines for the management of pneumonia, sepsis, and septic shock, various scoring systems have also been developed which are expected to help clinicians predict the occurrence of worsening conditions in these patients so that vigilance is carried out from the start, including estimating the need for intensive care.[19,20]

Early vigilance is important because of worsening and death often occurs early in the patient's hospitalization. This condition was significantly found in our study, the subjects who died had short LOS. It means that they died early in the hospitalization period. This is as explained by Viasus et al in their literature study that early mortality (within the first 48 hours to 7 days after hospital admission) is related to the patient's basic condition and inadequate management.[21]

In this research data DM is the most common comorbidity, encountered and significantly increases the risk of mortality compared to other comorbidities. A study by Huang et al also showed similar results where he analyzed the association between severe CAP patients with DM and mortality risk factors. Compared to patients without diabetes, those with severe CAP and diabetes have different clinical traits and a greater death rate. It could have occurred as a result of the higher frequency of comorbidities and diabetes-related problems among DM patients.[22]

One of the scoring systems that is often used to assess critically ill patients in the ICU, including pneumonia, is APACHE II.[18,23] Age, Glasgow Coma Scale (GCS), body temperature, mean arterial pressure (MAP), heart rate, respiratory rate, oxygen fraction (FiO2), arterial potential of hydrogen (pH), serum sodium, serum potassium, serum creatinine, hematocrit, leucocyte, acute renal failure (ARF), severe organ system insufficiency, and need for surgery are among the parameters evaluated in APACHE II. After the APACHE II score, which has a range of 0 to 71 points, the mortality conversion will be determined.[18]

According to a study by Zhou et al, APACHE II was still a better predictor of death in patients with ventilator-associated pneumonia (VAP) than the clinical pulmonary infection score (CPIS). This is mostly because the APACHE II was intended to be a classification of disease severity that incorporates age points, chronic health points, and an acute physiology score.[23]

The SAPS II helps to predict in-hospital mortality.[24] The following parameters are evaluated in SAPS II: leucocytes, blood urea nitrogen (BUN), urine output, age, GCS, body temperature, heart rate, SBP, FiO2, PaO2, serum sodium, serum potassium, serum bicarbonate, serum bilirubin, and the presence of chronic disease. The range of the SAPS II score is 0 to 163 points, which is then used to predict hospital mortality.[18]

According to a study by Allyn et al, the SAPS II may be very helpful for end-of-life decision-making in intensive care units (ICUs), particularly in cases where the patient's choice to be placed in palliative care is made with an intermediate or low degree of certainty on ICU mortality. The SAPS II is less instructive for high degrees of certitude; in these situations, using a different score, like the SOFA score, may be helpful.[24]

A commonly used measure in emergency rooms and intensive care units (ICUs) to assess the state of patients with multiple organ failure and their prognosis is the SOFA score.[25] The parameters assessed in the SOFA score are FiO_2, PaO_2, the use of mechanical ventilation, platelets count, bilirubin, GCS, MAP, the use of vasopressors, serum creatinine, and urine output. The SOFA score ranges from 0 to 24 and then to be calculated to predict hospital mortality.[12]

Researchers Liu et al found that reevaluating the SOFA score about sepsis can dynamically reflect changes in organ function. Not only the SOFA score, but the combination with quick SOFA and delta (△) SOFA gives a greater value in diagnosing sepsis and assessing the condition and prognosis.[24] Iskandar et al in their study also showed that the SOFA score can be a mortality predictor in sepsis patients where a SOFA score ≥7 has a 3.8 times greater risk of death.[26]

Our analysis demonstrated using scatterplots that there is a positive correlation between SOFA and LOS and a negative correlation between APACHE II and SAPS II with LOS. The LOS is shorter the higher the APACHE II and SAPS II scores because the higher the score, the more severe the disease and the mortality rate is high so that the patient is not hospitalized for long because they have not survived.[28]

Meanwhile, the higher the SOFA score, the longer the LOS shows in our study that patients with severe conditions calculated from SOFA can still survive but result in prolonged LOS because their disease conditions made them should be treated longer. However, all of these correlations are weak and not statistically significant. This is in line with research conducted by Sitohang et al where the APACHE II score can predict LOS in critical patients in the ICU although the strength of the correlation is very weak.[27]

The APACHE II score had a substantial effect of 0.936 (big = 0.80 < ES < 1.30) as a predictor of outcomes for critically sick pneumonia patients, according to mortality prediction utilizing the scoring systems. Additionally, it is shown that the SOFA score has a moderate impact of 0.502 (a little bit less than SAPS II) as a predictor of outcome for critically sick pneumonia patients, while the SAPS II has a moderate effect of 0.705 (medium = 0.50 < ES < 0.80). According to Tian et al's evaluation of APACHE II's predictive power for critically ill patient mortality, the test with a cut-off of 17 is the most effective biomarker for predicting ICU patient outcomes.[28]

With a cut-off of >14.5, >34.5, and >3.5, respectively, the AUC value demonstrated that the APACHE II, SAPS II, and SOFA scores were significant in predicting the prognosis of critically ill pneumonia patients. When comparing APACHE II to SAPS II and SOFA scores, bivariate analysis of mortality predictions in critically ill pneumonia patients revealed that APACHE II was a superior predictor (OR=5.26; $P \leq 0.001$). Compared to SOFA and SAPS II, multivariate analysis revealed that the APACHE II score (OR=2.63; $P=0.038$) was significantly and most strongly linked with mortality in critically sick pneumonia patients. The study's findings are consistent with those of several earlier investigations, such as the one by Czajka et al that found APACHE II and SAPS II scores to be reliable indicators of hospital death.[29]

In their research, Hosseini et al demonstrated that although both the SOFA and APACHE II scores had strong predictive accuracy for outcomes in surgical and medical ICUs, the SOFA is the preferred option due to its ease of use and ease of data recording.[30] SBP and serum salt level were shown to be substantially correlated with mortality in critically sick pneumonia patients, according to additional study findings. It might help the clinician to have an

awareness of blood pressure and sodium levels when treating patients with critically ill pneumonia.

LIMITATION

This study have several limitations. First, in this study, we used data that was established at the time of patient admission, which might not be the worst value of variables as should be stated in the literature. Second, not all comorbidities have been known or recorded when patients are assessed using a scoring system, so there may be data on chronic diseases or immune disorders that have not been taken into account in the assessment. Third, we did not compare some of the latest existing scoring systems, but we only compared APACHE II, SAPS II, and SOFA scores which we usually use every day at RSUD Dr. Moewardi, although not all three are carried out at once on one patient.

CONCLUSION

Although the APACHE II, SAPS II, and SOFA scores exhibit limited correlation with length of stay, they remain robust predictors of hospital mortality in critically ill patients. Among three of them, APACHE II was most dominantly associated with mortality compared to SOFA and SAPS II, respectively. However, the SOFA score is still an option to select, because it is a good mortality predictor yet is simpler and easier to use in all settings in the hospital. We still recommend that future research be carried out by comparing these scores with the new existing scoring systems.

CONFLICT OF INTEREST

There are no conflicts of interest in this study, according to the authors.

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AUTHORS' CONTRIBUTIONS

Every author made an equal contribution to the study's methodology and writing of the manuscript. Aditya Alfarizi and Rani Damayanti are the data collectors; Artrien Adhiputri is the lead investigator; Brigitta Devi Anindita Hapsari is a co-investigator and data manager; and Reviono is a co-investigator and consultant in data analysis.

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