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APACHE II Score to Predict Outcomes of Ventilated Patients in the Intensive Care Unit of a Tertiary-Level Hospital in Chitwan, Nepal

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ABSTRACT

Background

Predicting outcomes in critically ill mechanically ventilated patients in the intensive care unit (ICU)s remains challenging. The Acute Physiology and Chronic Health Evaluation II (APACHE II) score is widely used for severity assessment, but its predictive performance varies. The study aimed to evaluate the effectiveness of the APACHE II score in predicting mortality among mechanically ventilated patients admitted to the medical ICU in central Nepal.

Methods

This cross-sectional study, conducted over one year in a 17-bed medical ICU of a university teaching hospital, included 216 mechanically ventilated adult patients. APACHE II scores were calculated using the worst physiological values recorded within the first 24 hours of mechanical ventilation. Patient outcomes were categorized as survival or death at ICU discharge. Predictive performance was assessed using receiver operating characteristic (ROC) curve analysis.

Results

Of the 216 patients, 129 (59.7%) were male, with a mean age of 55.04 ± 18.89 years. Overall ICU mortality was 64.35%. The mean APACHE II score was significantly higher among non-survivors compared to survivors (31.99 ± 8.92 vs. 17.66 ± 5.73; $p < 0.001$). Mortality increased progressively with higher APACHE II scores, and no patient with a score greater than 30 survived. The area under the ROC curve for APACHE II in predicting mortality was 0.913 (95% CI: 0.877–0.949; $p < 0.001$), indicating excellent discrimination.

Conclusions

APACHE II is a reliable and highly accurate predictor of mortality among mechanically ventilated ICU patients. A score above 30 was associated with death, underscoring its value in prognostication and clinical decision-making in resource-limited ICUs.

Keywords: APACHE II; Intensive care unit; Mechanical ventilation; Mortality.

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INTRODUCTION

Managing critically ill patients is challenging for treating physicians due to complex medical conditions.[1-3] So, it is essential to have a reliable model to accurately predict the outcome of such patients.[4] Scoring systems like Acute Physiology and Chronic Health Evaluation (APACHE), simplified acute physiology score (SAPS), sequential organ failure assessment (SOFA), and multiple organ dysfunction score (MODS) have been advocated, which help clinicians with appropriate treatment planning and prognostication.[5-10] APACHE score was modified into APACHE II, APACHE III, and APACHE IV in 1985, 1991, and 2006 respectively.[5-7, 11] Out of these, APACHE II is the most used tool for assessing disease severity and predicting mortality among ICU patients. 12 physiological measurements are recorded, to which age and prior health status are added to the final score.[12] It has shown good predictive values in various studies. [11, 13, 14] This study aimed to evaluate the effectiveness of the APACHE II score in predicting outcomes for mechanically ventilated patients.

METHODS

This cross-sectional study was conducted in the College of Medical Sciences-Teaching Hospital in a 17-bedded Medical ICU for a period of 1 year after ethical approval from Instutional review committee (COMSTH-Ref No-/2025-017). Any patient less than 18 years, no informed consent from a legally authorized representative, pregnancy, and patients ventilated after cardiac arrest with ROSC were excluded. The sample size was calculated using the formulan=Z^2pq/e^2. Here Z=1.96 and p=0.5 as the previous population is not known and e= 0.07 as 7 % marginal error is allowed

n=1.96^2*0.5(1-0.5)/$.07^2$

n=195

To allow 10% of non-compliance, number of samples is considered to be 196+19.6= 216.

All eligible mechanically ventilated patients admitted to the MICU during the study period from March 2025 to February 2026 were consecutively enrolled. Demographic details, clinical parameters, and laboratory investigations obtained within the first 24 hours of initiation of mechanical ventilation were recorded. For variables measured more than once during the first 24 hours, the worst recorded values were used for the calculation of the APACHE II score. APACHE II scores were calculated using an authorized online calculator (MDCalc.com) by the investigator. Patient outcomes were recorded at the time of ICU discharge, categorized as either transfer out of ICU or death. Patients who left the hospital against medical advice (LAMA) were classified as death, considering the extremely poor prognosis of mechanically ventilated patients outside a hospital setting.

RESULTS

Out of 216 patients, 129 patients (59.72%) were male while 87 patients (40.28%) were female. The mean age of the patients was 55.04 ±18.89 years. The mean APACHE II score of the patient in the study was 26.88 ±10.49. The distribution of case department wise was non-significant as given in the (Table 1).

Table 1. Distribution of patients with outcome (n=216).

Department	Survived	Expired	p-value
Respiratory	23	44	0.107
Cardiology	12	11	
Nephrology	13	28	
Gastroenterology	8	29	
Neuromedicine	21	27	

ns: non-significant using the Pearson chi square test

In the study, 139 (64.35%) expired while only 77 (35.65%) survived. Of the survived patients, the mean APACHE II score was 17.66 ± 5.73 and those with mortality had Apache II score of 31.99 ± 8.92, which was statistically significant (p value <0.000). The mortality of the patient was also found to be increasing with increase in the APACHE II score. No patient survived with APACHE II score of more than 30 as shown in (Table 2).

The predictability of mortality by APACHE II was done using area under ROC curve (Figure 1).

Table 2. Association between APACHE II score and mortality (n=216).			
Apache score	Number of cases	Survived (%)	Expired (%)
5-9	11	11 (100)	-
10-14	18	15 (83.33)	3 (16.67)
15-19	20	14 (70.00)	6 (30.00)
20-24	46	28 (60.86)	18 (39.14)
25-29	40	9 (22.50)	31 (77.50)
30-34	29	-	29 (100)
>34	52	-	52 (100)

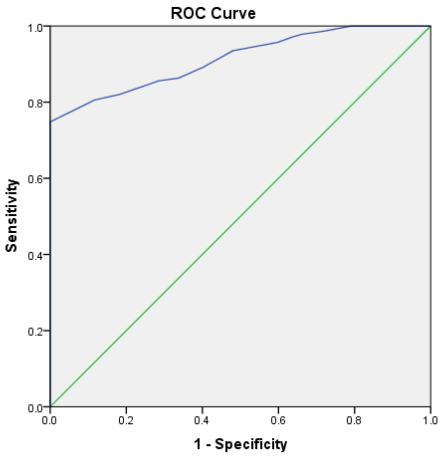

Figure 1. ROC curve for APACHE II score.

The area under the curve is 0.913 with strong value <0.05 indicating the APACHE II score has high predictability (Table 3).

Table 3. Area under the curve (n=216).				
Area	Std. Error[a]	p-value	Asymptotic 95% confidence interval	
			Lower bound	Upper bound
0.913	0.018	<0.001	0.877	0.949

DISCUSSION

This study, conducted in the College of Medical Sciences-Teaching Hospital in Nepal, assesses the utility of the APACHE II scoring system in predicting mortality among critically ill mechanically ventilated patients. Out of 216 patients in the study, the overall mortality was 64.35%. This high mortality rate reflected the severity of illness in patients in our ICU and the challenges faced in resource-limited settings of low and middle-income countries. The mean APACHE II score was significantly higher among expired patients (31.99 ± 8.92) than among survivors (17.66 ± 5.73), suggesting a strong association between higher scores and poorer outcomes.

There were no statistically significant differences in outcomes of patients admitted by various subspecialties. The higher mortality was associated with a higher APACHE II score. The ROC curve analysis further strengthened this finding, with an area under the curve (AUC) of 0.913, demonstrating excellent predictive accuracy of the APACHE II score in this setting.

These results are consistent with the literature, where APACHE II has been validated as a good predictor of mortality in intensive care units. [15-18] However, the particularly high mortality rate observed in our study may be due to factors such as delayed presentation, limited access to advanced interventions, or resource constraints typical of tertiary hospitals in low- and middle-income countries. No patients with APACHE II scores more than 30 survived in our study. This cutoff value could serve as a guide for clinicians in Nepal to identify high-risk patients in our settings, and help in counseling families and prioritizing care. Although many studies supported APACHE II as a discriminator of ICU mortality, it had failed to predict mortality accurately, especially in the surgical cohort of patients, where the observed deaths were higher than the predicted rate, indicating poor prognostic utility in this subgroup.[19, 20]

The excellent discriminatory ability of the APACHE II score in our study (AUC 0.913) aligns with several studies done in various subgroups of critically ill population. In a large cohort of critically ill cancer patients, the APACHE II score demonstrated excellent discrimination for hospital mortality with an AUROC of 0.863 (95 % CI 0.804–0.923).[21] The high discriminatory power of APACHE II was also found in other studies, which included patients with AKI and gastrointestinal bleeding.[21, 22]

However, there were studies with other subgroup of critically ill patients where APACHE II performed poorly and showed low to moderate discrimination.[17, 23] These findings reflect that the predictive power

of APACHE II may depend on the type of hospital settings, patient population, underlying diseases, and resource availability.

CONCLUSIONS

In conclusion, this study demonstrates that APACHE II scoring is a reliable predictor of mortality among critically ill patients in a university hospital in central Nepal. A score above 30 was uniformly associated with death, highlighting its clinical utility in prognostication. Future multicenter studies with larger cohorts and inclusion of treatment variables are recommended to validate these findings and guide critical care practices in Nepal.

Limitations

First, the study was conducted in a single center, which may limit generalizability to other hospitals in Nepal with different patient populations or resources. Second, the relatively small sample size may affect the precision of subgroup analyses. Third, potential confounders such as comorbidities, treatment modalities, and time to intervention were not fully explored, which could influence outcomes.

Conflict of interest: The authors declare that they have no conflict of interest.

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Availability of data and materials: All data analysed during this study will be made available upon reasonable request from the corresponding author.

Authors' contributions

Conceptualization: Kriti Devkota, Anima Pradhan.
Data curation: Kriti Devkota, Anima Pradhan.
Formal analysis: Kriti Devkota, Anima Pradhan.
Investigation: Kriti Devkota, Anima Pradhan.
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Supervision: Kriti Devkota, Anima Pradhan.
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Writing-review & editing: Kriti Devkota.

REFERENCES:

1. Hamed HMF, Ibrahim HG, Khater YH, Aziz ES. Ventilation and ventilators in the ICU: What every intensivist must know. Current Anaesthesia & Critical Care. 2006;17(1):77-83. [DOI]
2. Hosseini M, Ramazani J. Evaluation of Acute Physiology and Chronic Health Evaluation II and sequential organ failure assessment scoring systems for prognostication of outcomes among Intensive Care Unit's patients. Saudi journal of anaesthesia. 2016;10(2):168-73. [DOI]
3. Jackson M, Cairns T. Care of the critically ill patient. Surgery (Oxford, Oxfordshire). 2021;39(1):29-36. [DOI]
4. Efthimiou O, Seo M, Chalkou K, Debray T, Egger M, Salanti G. Developing clinical prediction models: a step-by-step guide. Bmj. 2024;386.[DOI]
5. Knaus WA, Draper EA, Wagner DP, Zimmerman JE. APACHE II: a severity of disease classification system. Critical care medicine. 1985;13(10):818-29.[DOI]
6. Knaus WA, Wagner DP, Draper EA, Zimmerman JE, Bergner M, Bastos PG, et al. The APACHE III prognostic system: risk prediction of hospital mortality for critically III hospitalized adults. Chest. 1991;100(6):1619-36.[DOI]
7. Knaus WA, Zimmerman JE, Wagner DP, Draper EA, Lawrence DE. APACHE—acute physiology and chronic health evaluation: a physiologically based classification system. Critical care medicine. 1981;9(8):591-7.[DOI]
8. Le Gall JR. The use of severity scores in the intensive care unit. Intensive care medicine. 2005;31(12):1618-23.[DOI]
9. Lambden S, Laterre PF, Levy MM, Francois B. The SOFA score-development, utility and challenges of accurate assessment in clinical trials. Critical Care. 2019;23(1):374.[DOI]
10. Buckley TA, Gomersall CD, Ramsay SJ. Validation of the multiple organ dysfunction (MOD) score in critically ill medical and

surgical patients. Intensive care medicine. 2003;29(12):2216-22.[DOI]
11. Zimmerman JE, Kramer AA, McNair DS, Malila FM. Acute Physiology and Chronic Health Evaluation (APACHE) IV: hospital mortality assessment for today's critically ill patients. Critical care medicine. 2006;34(5):1297-310. [DOI]
12. Chen FG, Koh KF, Goh MH. Validation of APACHE II score in a surgical intensive care unit. Singapore medical journal. 1993;34(4):322-4. [Link]
13. Bahtouee M, Eghbali SS, Maleki N. Acute Physiology and Chronic Health Evaluation II score for the assessment of mortality prediction in the intensive care unit: a single-centre study from Iran. 2019;24(6):375-80. [DOI]
14. Wong DT, Crofts SL, Gomez M, McGuire GP, Byrick RJ. Evaluation of predictive ability of APACHE II system and hospital outcome in Canadian intensive care unit patients. Crit Care Med. 1995;23(7):1177-83.[DOI]
15. Ali AHD, Harun SN, Othman N, Ibrahim B, Abdulbagi OE, Abdullah I, et al. Discriminatory Performance of APACHE II Score and the Prediction of Mortality within the ICU in Patients with Sepsis Admitted to the ICU. Materia socio-medica. 2025;37(2):153-8.[DOI]
16. Faruq MO, Mahmud MR, Begum T, Ahsan ASMA, Fatema K, Ahmed F, et al. A Comparison of Severity Systems APACHE II and SAPS II in Critically ill Patients. Bangladesh Critical Care Journal. 2013;1(1):27-32.[DOI]
17. Gupta R, Arora VK. Performance evaluation of APACHE II score for an Indian patient with respiratory problems. The Indian journal of medical research. 2004;119(6):273-82. [PubMed]
18. Naqvi IH, Mahmood K, Ziaullaha S, Kashif SM, Sh arif A. Better prognostic marker in ICU - APACHE II, SOFA or SAP II! Pakistan journal of medical sciences. 2016;32(5):1146-51.[DOI]
19. Ribeiro M, Carvalho R, Bastos J, Fagundes Jr A, Araujo H, Kopel L, et al. Value of APACHE II score to predict mortality in cardiogenic shock patients of a cardiologic ICU. Critical Care. 2006;10(1):P402. [DOI]
20. Falcao ALE, Barros AGdA, Bezerra AAM, Ferreira NL, Logato CM, Silva FP, et al. The prognostic accuracy evaluation of SAPS 3, SOFA and APACHE II scores for mortality prediction in the surgical ICU: an external validation study and decision-making analysis. Annals of Intensive Care. 2019;9(1):18.[DOI]
21. Xing X, Gao Y, Wang H, Huang C, Qu S, Zhang H, et al. Performance of three prognostic models in patients with cancer in need of intensive care in a medical center in China. PloS one. 2015;10(6):e0131329.[DOI]
22. Lincoln M, Keating N, O'Loughlin C, Tam A, O'Kane MM, MacCarthy F, et al. Comparison of risk scoring systems for critical care patients with upper gastrointestinal bleeding: predicting mortality and length of stay. Anaesthesiology Intensive Therapy. 2022;54(4):310-4.[DOI]
23. Martos-Benítez FD, Cordero-Escobar I, Soto-García A, Betancourt-Plaza I, González-Martínez I. APACHE II score for critically ill patients with a solid tumor: A reclassification study. Revista espanola de anestesiologia y reanimacion. 2018;65(8):447-55.[DOI]

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