# Clinical outcome using APACHE II score among patients admitted to the ICUs of a tertiary care hospital

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# Clinical outcome using APACHE II score among patients admitted to the ICUs of a tertiary care hospital

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## Abstract

**Introduction:** Due to very less number of intensive care units in the health sector, there is global burden on ICUs. The APACHE II scoring system is used to make clinically, ethically, and economically sound decision in critical care area. This study was carried out with the objective to determine APACHE II score for prediction and comparison of patient clinical outcomes. **Methods:** A descriptive survey study was done among 250 patients admitted in ICUs of a tertiary-care hospital of Udupi District. Data was collected for the period of three months from January to March 2014. Descriptive statistics, t-test, and receiver operative characteristics (ROC) curve were used to explain the findings. **Results:** A total of 70.8% of patients were male with the mean age of $53.14 \pm 2$ years. The neurological disorders accounted for 32% of total cases and 42% of mortality. The APACHE II score ranged from 3-40 (mean=18.84). The findings showed significant difference between the score of APACHE II among the dead and those who have survived (*t*-value =7.692, *p*-value < .001). The calculation of area under the curve (AUROC) for APACHE II is 0.785 (*p* value .001). APACHE II was 75.2% sensitive and 64.8% specific for the score of 18. The APACHE II score was fit ($\chi^2$= 7.31, *p value* = .503). **Conclusion:** APACHE II score has good calibration and portrays the difference between mortality and survival rates.

**Key word:** APACHE II, ICU patients, patient clinical outcome

## Introduction

The National Account for Statistics of India reported that there are about 70,000 ICU beds available in India that serves for ICU admission of five million critically ailing people per year (Jayaram, & Ramakrishnan, 2008). The Acute Physiology and Chronic Health Evaluation (APACHE II) score is the one that has been used globally to procure ICU status and severity of disease and illness. It is a measure of physiological parameters which depends upon the degree of difference between normal and a critical illness (Knaus, Draper, & Wagner, 1985). As APACHE II is able to measure the clinical severity of the ICU patients, this, in turn, acts as an important early marker of daily clinical workload; especially the demands to be fulfilled in the area of clinical care, respiratory care, diagnostic methods, and treatments.

Thus, validation of the APACHE II score in our set up greatly contribute in appraising latest modalities, examining resources usages, improving quality assessment, and predict the prognosis of critically ill patients. This study assessed the APACHE II score for ICU patients to predict the ICU mortality.

## Materials and methods

A descriptive survey study was conducted to assess the patient clinical outcome in the ICUs of tertiary hospital after obtaining clearance from the ethical committee. Non-probability purposive sampling technique was used to select patients. The study was conducted among 250 ICU patients. The APACHE II was calculated on the day of admission after obtaining the data from the laboratory reports, patient's file and the record

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of the most critical physiological value in 24 hours. The score comprises of physiological parameters like temperature, mean arterial pressure, heart rate, respiratory rate, arterial partial pressure of oxygen, blood ph, serum sodium, serum potassium, serum creatinine, hematocrit, WBC, and Glasgow Coma Scale (GCS). The age and chronic health conditions were also considered under the scoring system. Analysis was done with the help of SPSS 16. The data was analyzed by using descriptive statistics, comparison of mean through t-test and receiver operative characteristics (ROC) curve to explain the findings of the study.

## Results

The detail of sample characteristics is depicted in the table 1 below.

Table 1:
*Frequency and Percentage Distribution of Sample Characteristics*

N=250

| Variables | Frequency | Percentage |
|---|---|---|
| **Age (in years)** | | |
| <40 | 63 | 25.2 |
| 40-60 | 92 | 36.8 |
| >60 | 95 | 38 |
| **Gender** | | |
| Male | 177 | 70.8 |
| Female | 73 | 29.8 |

The study found that majority, 70.8% of patients were male with the mean age 53.14 years.

The component of sample characteristics also included patient's clinical diagnosis. The detail of which is elicited in figure 1.
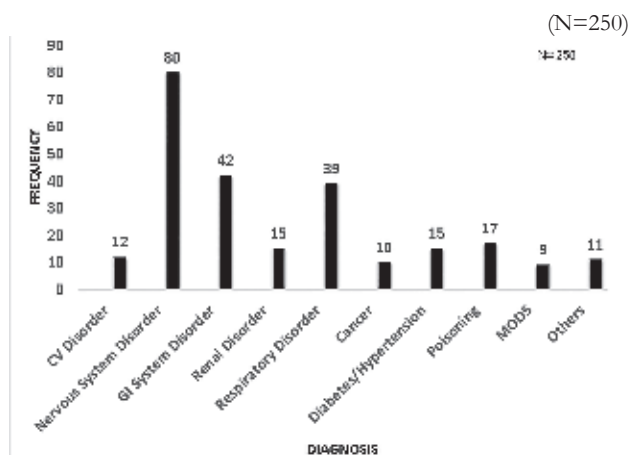
(N=250)



*Figure 1:* Bar diagram representing patient clinical diagnosis

The data presented in above figure represents that amongst all, neurological disorder accounts for 32% of ICUs admission, followed by gastrointestinal disorder (16.8 %) and the respiratory disorder (15.6%) of total ICUs admissions. Multi-organ dysfunction syndrome (MODS) accounted for only 3.6%.

The clinical outcome was recorded at the end of ICU stay that included discharge status and length of stay. The details are shown in the table 2.

Table 2:
*Frequency and Percentage Distribution of Patient Clinical Outcome Using APACHE II Score*

N=250

| Variables | Frequency | Percentage |
|---|---|---|
| **Discharge status** | | |
| Died | 105 | 42 |
| Survived | 145 | 58 |
| **Length of stay** | | |
| ≤7days | 148 | 59.2 |
| >7days | 102 | 40.8 |

The patient clinical outcome of the study findings shows that 42% of patients died at the end of ICU stay; with the average length of ICU stay of the patients were 7.48 days.

The performance of the APACHE II score in the study population was explained with the help of receiver operating characteristic (ROC) curve. The detail is explained in the figure below.
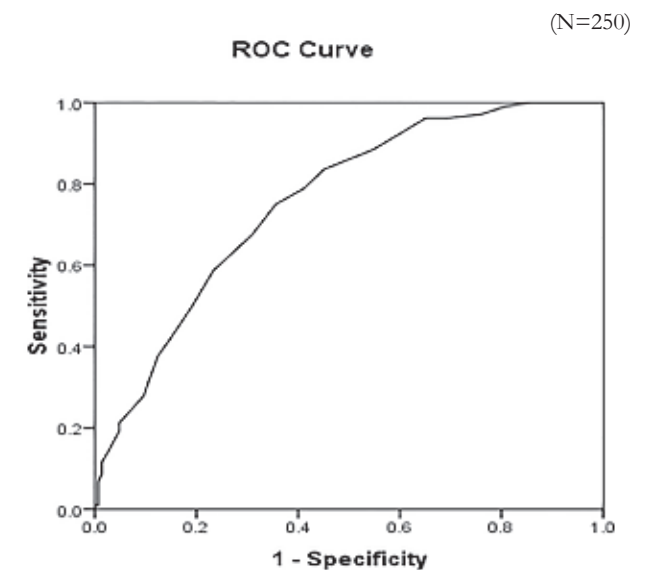
(N=250)



*Figure 2:* Receiver Operating Characteristics (ROC) curve plot for APACHE II

The performance of APACHE II score was described by receiver operating characteristic (ROC) curve. The calculation of area under the curve (AUROC) for APACHE II is 0.785 (p value <0.001) which concluded that APACHE II score actually does show the difference between the dead and the survivors. APACHE II has 75.2% sensitivity and 64.8% specificity for score of 18. The fitness of the score for APACHE II was calculated by Hosmer Lemeshow chi square test, $\chi^2$= 7.31, *p value* = .503. Hence the APACHE II score is having good calibration and valid to be used in our setup as well.

These results further describe the comparison of APACHE II score with patient clinical outcome and show the difference in these scores with discharge status and length of stay. Independent t-test was used in order to find out the comparison of the mean value of APACHE II score with patient clinical outcome.

Table 3:
*Comparison of Patient Clinical Outcome Using APACHE II Score*

N=250

| Variables | Mean ± SD | *t* value | CI | *p* value |
|---|---|---|---|---|
| **Discharge status** | | | | |
| Died | 22.14±5.55 | 7.69 | 4.23-7.15 | .001 |
| Survived | 16.45±6.08 | | | |
| **Length of stay** | | | | |
| ≤7 days | 19.16±6.87 | 0.951 | -0.83-2.38 | .36 |
| >7 days | 18.38±5.91 | | | |

The findings of the study also showed that APACHE II of survivors was 16.45±6.08 and 22.14±5.548 of those who perished. Thus, the result interprets that the patients with greater mortality risk has higher APACHE II score than that of the survivors. There is significant difference between the score of APACHE II between the patients who died and the survivors (*t-* =7.692, *p*-value < .001). There is no significant difference in these scores among patient having longer duration of ICU stay.

## Discussion

In this study, the mean APACHE II score among the ICU patient was found to be 18.84 and the APACHE II score between the survivors and those who died was found to be 16.45±6.08 and 22.14±5.548, respectively (*t*-value =7.692, *p* = < .001. The overall mortality of the patient was 42%. The finding was supported by a retrospective study done in Greece from 2008 to 2011 among 105 lung cancer patients admitted to ICU. The overall mortality was found to be 44.7%. The APACHE II score between survivors and non-survivors was 21.3 and 25.1, respectively (Anisoglou, Asteriou, & Barbetakis, 2013).

Also, findings from this study suggested that APACHE II have sensitivity of 75.2% and specificity of 64.8% under cut off value of 18 and area under the curve (AUROC) for APACHE II is 0.785 (*p* = < .001) with Hosmer Lemeshaw chi square test, $\chi^2$= 7.31, (*p* = .503).

The above-mentioned values were supported by a study done in Taiwan (Tseng et al., 2012) on 163 ICU patients. The study shows that the optimal cut off values for APACHE II score is 23.5 with the sensitivity and specificity of 82% and 57% for APACHE II. The area under the ROC curve indicated for APACHE II was 0.66 (*p* = < .001).

Another study showed that modified APACHE II model had good discrimination (AU-ROC = 0.88) and calibration (Hosmer–Lemeshow statistic= 3.707, *p* value = .834) (Su et al. 2009).

The study conducted by Juneja et al. in India put forward similar findings with mean APACHE II score of 24.2 ± 9.2 and the APACHE II score between survivors and the non-survivors was found to be 17.44 ± 5.94 and 29.41 ± 7.70, respectively. The sensitivity and specificity of APACHE II score more than 21 were 89.8% and 77.8%, respectively and area under the curve (AUROC) for APACHE II is 0.90 (*p* = <.001) (Juneja et al. 2009).

## Conclusion
APACHE II score possess good calibration to predict patient clinical outcome and have excellent discriminatory ability to distinguish patient's mortality at the end of ICU stay. Hence, APACHE II score can be used in critical care areas for risk assessment. However, APACHE II score is not a good prognostic measure to predict the length of ICU stay among the critically ill patients.

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