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Outcome measures in intensive care unit: A baseline study

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Abstract
Background: The advantages of Acute Physiology and Chronic Health Evaluation (APACHE II) score include its ability to prognosticate sepsis with a single assessment at 24 hours and its components being routine parameters being monitored in the ICU. APACHE II is a severity-of-disease classification system, one of several ICU scoring systems. It is applied within 24hours of admission of a patient to an ICU and an integer score from 0-71 is computed based on several measurements. Higher scores correspond to more severe disease and a higher mortality. A study was designed to evaluate performance of APACHE II score in prediction of mortality risk, as well as in determination of model validity in critically ill patients.
Methods: All the patients who were admitted in ICU were included. APACHE II score is calculated on the 1st or 2nd day of admission in the ICU and it is collected on odd & even days of the patients stay in intensive care unit (ICU). The following data were collected for each patient like age, name, sex, chronic health status, physiological measurements, laboratory investigations etc.
Results: No significant difference was observed between Odd and Even groups with pretest mean APACHE II scores (t=-0.5750, p=0.5653) at 5% level of significance. No significant difference was observed between Odd and Even groups with posttest mean APACHE II scores (t=-0.1278, p=0.8983) at 5% level of significance. No significant difference was observed between Odd and Even groups with change in mean APACHE II scores from pretest to posttest (t=0.0639, p=0.9491) at 5% level of significance. A significant difference was observed between pretest and posttest in APACHE II scores in total samples (t=7.0269, p=0.0001) at 5% level of significance. A significant difference was observed between pretest and posttest in APACHE II scores in odd group (t=4.9266, p=0.0026) at 5% level of significance. A significant difference was observed between pretest and posttest in APACHE II scores in even group (t=4.6309, p=0.0036) at 5% level of significance.
Conclusions: Acute physiology and Chronic Health Evaluation (APACHEII) score assessed at 24 hours after admission is able to predict morbidity, mortality. The presence of a physiotherapist in the intensive care unit contributes decisively to the early recovery of the patient, reducing mechanical ventilation support need, number of hospitalization days, and incidence of respiratory infection and risk of mortality.

Keywords: Intensive care unit, chest physiotherapy, neuro intensive care, surgical intensive care, early mobilization

Introduction
Illness severity scoring systems (SSs) are increasingly being used to provide information about patients severity of illness and outcome in terms of mortality or length of Intensive care Unit (ICU) and hospital stay[1]. Many patients with CNS infection need to be managed in an intensive care unit (ICU) because of problems such as raised intracranial pressure, status epilepticus, deep coma and respiratory paralysis, and mortality is high among these critically ill individuals [1]. The advantages of Acute Physiology and Chronic Health Evaluation (APACHE II) score include its ability to prognosticate sepsis with a single assessment at 24 hours and its components being routine parameters being monitored in the ICU [1]. APACHE II is a severity-of-disease classification system, one of several ICU scoring systems. It is applied within 24hours of admission of a patient to an ICU and an integer score from 0–71 is computed based on several measurements. Higher scores correspond to more severe disease and a higher mortality.
The first Acute Physiology and Chronic Health Evaluation (APACHE) model was presented by Knaus *et al*. in 1981.

Prediction of patient prognosis admitted in ICU always remains an area of great concern for physicians as well as for patient's families. The impact of this prediction bears on different aspects of patient care like selection of medical therapy, triaging, end of life care and many more [3]. APACHE III was introduced to expand and improve the prognostic estimates provided by APACHE II. This system, which is only commercially available, comprises an APACHE III score and a series of predictive equations linked to diagnosis and the APACHE III database [3]. Although the Acute Physiology and Chronic Health Evaluation II (APACHE II) scoring system has been validated for benchmarking and mortality forecasts, only a few papers have been published to show that it is effective in neurological patients [3]. APACHE II scoring system1 has been often used to predict risk of ICU mortality. Utilisation of score has been suggested to result in management decisions that could salvage costly ICU resources scantily available in developing world. Thus, there is a need, not only to provide patients with quality care but also utilise available resources optimally, for example, through usage of prediction model like APACHE II [5].

However, Indian literature on this subject is scarcely available. The present study was, therefore, designed to evaluate performance of APACHE II score in prediction of mortality risk, as well as in determination of model validity in critically ill patients [5].

As patients survive acute illness, long-term complications are more apparent. A feasible approach to obtain complications decrease is the use of physical therapy techniques in these critically ill patients. Physiotherapists in an ICU setting have focused to treat functional impairment especially in the patient on mechanical ventilation support. The physiotherapeutic care begins with a detailed assessment and scheduling goals of treatment. This care involves the use of techniques such as endotracheal suction of bronchial secretions, mobilization and positioning of the patient. The physiotherapy treatment is addressed to prevent and reduce potential pulmonary complications such as hypoventilation, hypoxemia and infection in order to restore muscular and pulmonary function as fast as possible. Although physiotherapy is seen as an integral part of the multidisciplinary team in most ICUs, On the other hand, Burtin *et al*. showed that physiotherapy care for ICU patients promotes early recovery [7].

We hypothesized that 24 h/day of physiotherapy care provided for ICU admitted patients is associated to a reduced length of hospitalization and required mechanical ventilation support as well as to a lower incidence of pulmonary infection and mortality. We aimed to assess if a 24 h/day physiotherapy care provided for ICU admitted patients would reduce the length of hospitalization and the required mechanical ventilation support, as well as to pulmonary infection and mortality, as compared to a 6 h/ day physiotherapy care service [7].

The chest physiotherapy treatment protocol consisted of inspiratory muscle training, manual hyperinflation, chest wall mobilization, rib-cage compression, posture drainage, secretion removal, cough function training, extremity range of motion exercise, and early therapy intervention training sessions were conducted by an experienced physical therapist for subjects in the intervention group. Physical training included bedside strengthening exercises for the upper and lower extremities and functional activity retraining. All subjects in the intervention group either continued to receive mechanical ventilator assistance or used an oxygen supplement during training. Exercise intensity was judged based on subjects physiological responses to the training, rate of progression was then adjusted by the physical therapist. Upper-extremity exercises included range-of-motion exercises for the wrist; elbow and shoulder flexion and extension; and shoulder abduction, adduction, and internal and external rotation, with 10 repetitions of each motion per set for 2 sets. Subjects initially performed these exercises against gravity in a supine position and progressed to a sitting position as tolerated. Lower extremity exercises included ROM exercises for ankle dorsiflexion and plantar flexion, hip and knee flexion and extension, and straight leg raising, with 10 repetitions of each motion per set for 2 sets in the supine position. Bedside functional retraining included turning from side to side on the bed; transfers to and from the bed, chair, and; and coming to a standing position. Ambulation was instituted as early as subjects could tolerate it. Subjects were allowed to rest between training sets, and pulse oxygen saturation (SpO2) and any sign or symptom that indicated intolerance were closely monitored throughout the training session [8].

Some prospective studies have reported improved functional outcome with early mobilization of critically ill patients in ICU. Patients in the mobilization groups treated with a defined activity regimen had more physical therapy sessions, fewer days to first day out of bed, fewer hospital days, better functional outcomes at hospital discharge, a shorter duration of delirium, and more ventilator-free days compared with the usual-care group. However, it is still unclear how to accomplish the optimal level of mobilization in critically ill patients. Mobilization is facilitated in the ICU by the chest Physiotherapist and entire team of ICU. It is not known whether patients mobilized by Physiotherapists reach different levels of mobility. Furthermore, the barriers to mobilization are not well documented. We tested the hypothesis (primary) that physical therapists mobilize their patients to higher levels than entire team of ICU. We tested the secondary hypothesis that Physiotherapists defined different barriers for progressing to the next mobilization level. Mobilization was defined as the process of enhancing mobility in the surgical ICU, including bed mobility, edge of bed activities, transfers out of bed to a chair, and gait training; the mobilization level was measured on the Surgical intensive care unit optimal mobilization scale, a 5-point (0-4) numerical rating scale [9].

A 5-point (0-4) numerical scale was developed to assess the mobilization level achieved by each patient. Phase 0 of activity refers to patients who were not able to be mobilized because they had a contraindication (inability to accomplish adequate arterial blood pressure or target oxygen saturation). Phase 1 level of activity includes passive range of motion and sitting in bed. Phase 2 activities include transferring the patient to a chair via a mechanical lift and/or sitting on the side of the bed, and were indicated if patients followed one step commands, and performed volitional movement. Phase 3 activities characterize patients standing from a chair or side of bed. Phase 4 activities include patient ambulation [9].

Acute Physiology and Chronic Health Evaluation (APACHE II) was a less sensitive predictor than Simplified Acute Physiology Score (SAPS II), but with higher specificity [6].

A study was conducted in the year 2016, Predictive value of Simplified Acute Physiology Score (SAPSII) and Acute Physiology and Chronic Health Evaluation (APACHE II) scoring systems for patient outcome in a medical intensive care unit whose objective was to determine SAPS II and APACHE II scores in medical intensive care unit (MICU) patients, to compare them for prediction of patient outcome, and to compare with actual hospital mortality rates for different subgroups of patients. Patients with an admission diagnosis of sepsis/septic shock had the highest values of both SAPS II and APACHE II scores, and also the highest hospital mortality rate of 55.1%. Both APACHE II and SAPS II had an excellent ability to discriminate between survivors and non-survivors. There was no significant difference in the clinical values of Simplified Acute Physiology Score (SAPS II) and Acute Physiology and Chronic Evaluation (APACHE II). A positive correlation was established between them. Sepsis/septic shock patients had the highest predicted observed hospital mortality rate [6].

Methodology

This was hospital based and this respective study was conducted at SDM medical college and hospital Dharwad, the subject's was taken from a Neuro intensive care unit (NICU), surgical intensive care unit (SICU). This study was conducted to assess and compare Acute Physiology and Chronic Health Evaluation II (APACHE II). The study was conducted on 2022.

All the patients who were admitted in ICU were included. APACHE II score is calculated on the 1st or 2nd day of admission in the ICU and it is collected on odd & even days of the patients stay in intensive care unit (ICU).

The following data were collected for each patient:

1. **Characteristics:** Age, sex, elective or emergency admission, any surgery done before ICU admission, any surgical service provided within first 24 h of ICU admission.
2. **Chronic health status:** The Presence or absence of chronic renal failure, liver insufficiency, underlying malignancy, immunosuppression, any admission to ICU in the previous 6 months. Patients with brain oedema are usually treated with steroids as an anti-oedema measure and hence, such patients were considered as immune-compromised.
3. **Physiologic measurements (values recorded in the first 24 h of admission to ICU):** The lowest and the highest values of the following: GCS, systolic blood pressure (SBP), diastolic blood pressure (DBP), heart rate, respiratory rate including both spontaneous and controlled breaths in intubated patients, temperature, urine output.
4. **Laboratory investigations (within first 24 h):** Serum sodium, potassium, blood urea, (blood urea nitrogen was calculated as blood urea/3), serum creatinine, blood glucose, haematocrit, total leucocyte count, platelet count, arterial pH, partial pressure of oxygen in arterial blood, fraction of inspired oxygen, partial pressure of carbon dioxide in arterial blood, blood bicarbonate levels and prothrombin time (PT).
5. **Intensity of treatment:** Number of invasive lines in place (endotracheal tube, arterial line, urinary catheter, central venous catheter, peripheral intravenous access, external ventricular drain, lumbar drain), cardiopulmonary resuscitation (CPR) before admission to ICU, any evidence of infection at admission or subsequently proven infection in 24 h, shock in the first 24 h and total number of hours of mechanical ventilation.

Design

Prospective cohort study.

Setting

Patients are recruited from surgical intensive care unit (SICU) and Neuro intensive care unit (NICU) of SDM Hospital.

Measurements

Demographic information, admission diagnosis, surgery classification and co-morbidities were recorded on admission to the unit. Acute Physiology and Chronic Health Evaluation (APACHE II) score was calculated. The two outcomes of ICU length of stay (LOS) and mortality were recorded on discharge from the unit.

Statistical Analysis

Table 1: Demographics of patients admitted

Profile	No of patients	% of patients
Age groups		
<=60yrs	5	35.71
61-70yrs	5	35.71
>=71yrs	4	28.57
Mean age	59.36	
SD age	12.91	
Gender		
Male	9	64.29
Female	5	35.71
Total	14	100.00

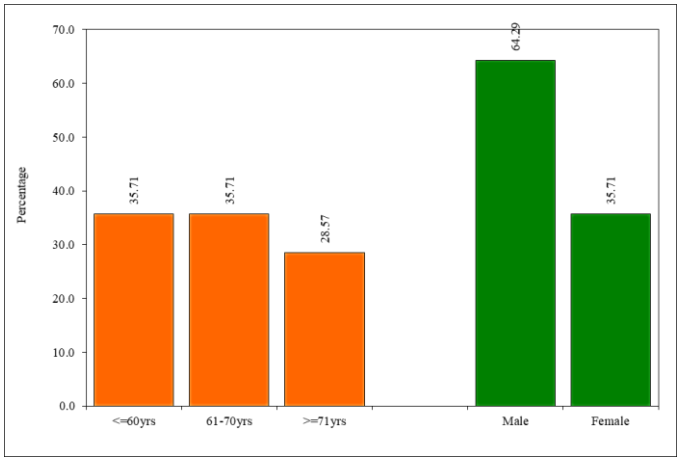

Fig 1: Demographics of patients admitted

Table 2: Comparison of two groups (Odd and Even) with pretest and posttest APACHE II scores of patients admitted by Independent t test

Times	Groups	Mean	SD	Median	IQR	t-value	p-value
Pretest	Odd	14.29	4.50	15.00	3.00	-0.5750	0.5653
	Even	15.57	5.50	15.00	4.50		
Posttest	Odd	8.86	3.76	9.00	2.00	-0.1278	0.8983
	Even	10.00	5.77	9.00	3.50		
Difference	Odd	5.43	3.10	6.00	2.50	0.0639	0.9491
	Even	5.57	2.99	6.00	2.50		

- No significant difference was observed between Odd and Even groups with pretest mean APACHE II scores (t=-0.5750, p=0.5653) at 5% level of significance. It means that, the pretest mean APACHE II score is similar in Odd and Even groups
- No significant difference was observed between Odd and Even groups with posttest mean APACHE II scores (t=-0.1278, p=0.8983) at 5% level of significance. It means that, the posttest mean APACHE II score is similar in Odd and Even groups
- No significant difference was observed between Odd and Even groups with change in mean APACHE II scores from pretest to posttest (t=0.0639, p=0.9491) at 5% level of significance. It means that, the change in mean APACHE II scores from pretest to posttest is similar in Odd and Even groups

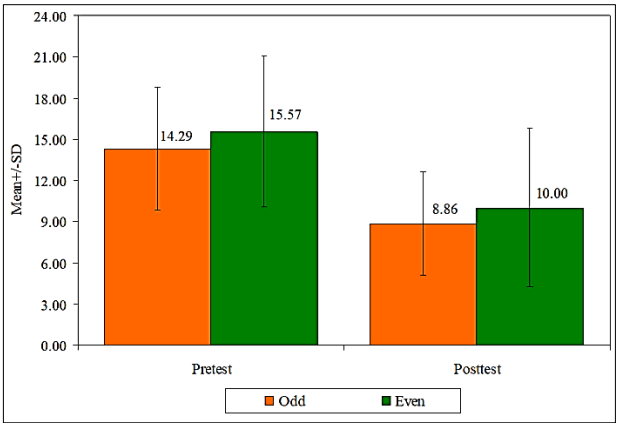

Fig 2: Comparison of two groups (Odd and Even) with pretest and posttest APACHE II scores of patients admitted

Table 3: Comparison of pretest and posttest APACHE II scores of patients admitted in two groups (Odd and Even) by Wilcoxon matched pairs test

Groups	Time point	Mean	SD	Mean Diff.	SD Diff.	% of change	t-value	p-value
Total	Pretest	14.93	4.87					
	Posttest	9.43	4.72	5.50	2.93	36.84	7.0269	0.0001*
Odd	Pretest	15.57	5.50					
	Posttest	10.00	5.77	5.57	2.99	35.78	4.9266	0.0026*
Even	Pretest	14.29	4.50					
	Posttest	8.86	3.76	5.43	3.10	38.00	4.6309	0.0036*

*p<0.05

Results

- A significant difference was observed between pretest and posttest in APACHE II scores in total samples (t=7.0269, p=0.0001) at 5% level of significance. It means that, the posttest APACHE II scores are significantly lesser as compared to pretest APACHE II scores with reduction of 36.84% of patients admitted as a whole.
- A significant difference was observed between pretest and posttest in APACHE II scores in odd group (t=4.9266, p=0.0026) at 5% level of significance. It means that, the posttest APACHE II scores are significantly lesser as compared to pretest APACHE II scores with reduction of 35.78% of patients admitted in odd group.
- A significant difference was observed between pretest and posttest in APACHE II scores in even group (t=4.6309, p=0.0036) at 5% level of significance. It means that, the posttest APACHE II scores are significantly lesser as compared to pretest APACHE II scores with reduction of 38.00% of patients admitted in even group.

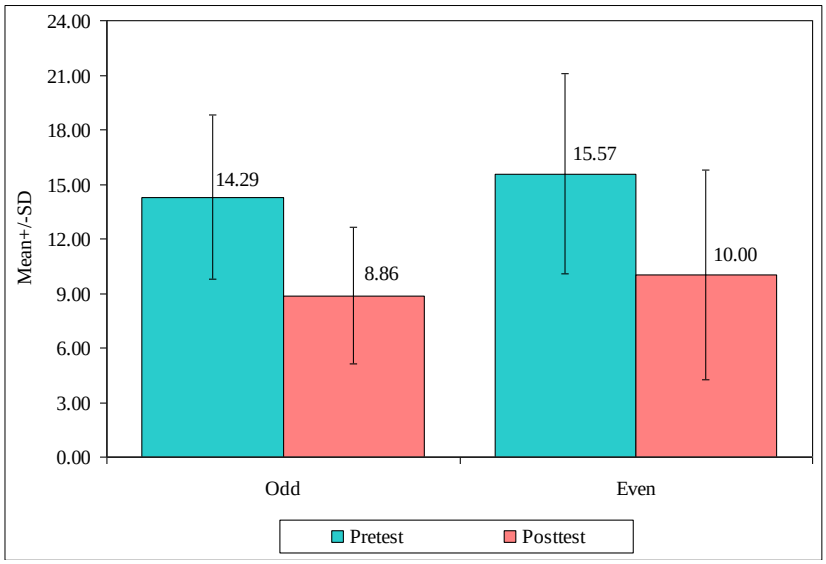

Fig 3: Comparison of pretest and posttest APACHE II scores of patients admitted in two groups (Odd and Even)

Discussion

Acute Physiology and Chronic Health (APACHE II) is a severity-of-disease classification system, one of several ICU scoring systems. It is applied within 24 hours of admission of a patient to an ICU and an integer score from 0–71 is computed based on several measurements. The APACHE II score exceeded 30–32, there was a higher chance of mortality despite surgical intervention. Patients who had an

APACHE score of 24–27 carried a high chance of morbidity, prolonged length of Hospital stay and Intensive care unit stay. However Higher scores correspond to more severe disease and a higher mortality.

In this single centre retrospective study, we found that the mortality rate predicted by different illness severity scoring system. In this present study there is:

- No significant difference was observed between Odd and Even groups with pretest mean APACHE II scores (t=-0.5750, p=0.5653) at 5% level of significance.
- No significant difference was observed between Odd and Even groups with posttest mean APACHE II scores (t=-0.1278, p=0.8983) at 5% level of significance.
- No significant difference was observed between Odd and Even groups with change in mean APACHE II scores from pretest to posttest (t=0.0639, p=0.9491) at 5% level of significance.
- A significant difference was observed between pretest and posttest in APACHE II scores in total samples (t=7.0269, p=0.0001) at 5% level of significance.
- A significant difference was observed between pretest and posttest in APACHE II scores in odd group (t=4.9266, p=0.0026) at 5% level of significance.
- A significant difference was observed between pretest and posttest in APACHE II scores in even group (t=4.6309, p=0.0036) at 5% level of significance.

Conclusion

Acute physiology and Chronic Health Evaluation (APACHE II) score assessed at 24 hours after admission is able to predict morbidity, mortality. An integer score from 0–71 is computed based on several measurements. If APACHE II score exceeded 30-32, there was a higher chance of mortality despite surgical intervention. The Patients who had an APACHE score of 24-27 carried a high chance of morbidity, prolonged length of Hospital stay and Intensive care unit stay. The presence of a physiotherapist in the intensive care unit contributes decisively to the early recovery of the patient, reducing mechanical ventilation support need, number of hospitalization days, incidence of respiratory infection and risk of mortality.

Limitations of study

The present study has some limitations. First, small sample size is a limiting factor in analysis. Also, being a single centre study, there is possibly some amount of bias due to differences in ICU admission policies.

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