Evaluation of different scoring systems predictive ability in relation to outcome in ICUs

Thesis
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بسم الله الرحمن الرحيم

" قالوا سبحانك لا علم لنا
إلا ما علّمتنا إنك أنت
العليم الحكيم"

صدق الله العظيم

سورة البقرة ، اية رقم(٣٢)

Dedication

This work is dedicated to the individuals who have given meaning to my life;

To the spirit of my father, grandfather and grandmother who , gave me every thing and took nothing.

To my mother, who helped me in every step of my life.

To my brothers and sisters, who supported me in my life

To my wife ,who encouraged me to complete this work

To my kids, Mahmoud and Mariem, who made my days to shine

To my family and all my friends, who helped me

Ahmed Elsebaie

Abstract

Background:- Tools to measure quality are becoming widespread and focus either on the outcomes of care or the processes of care. For intensive care units (ICUs), the main focus on research on outcome measurement has been on the development of mortality prediction models.

Purpose:- The aim of this study was to evaluate the performance of three general severity-of-illness scores, Acute Physiology and Chronic Health Evaluation [APACHE] IV, Simplified Acute Physiology Score [SAPS] II, and Mortality Probability Model [MPM] II24 systems in critical care departments of four hospitals in Egypt, i.e: mulicentre study.

Methods:- A prospective observational cohort study was performed on 873 patients admitted to the intensive care units of Kasr Alaini hospital, the new kasr Alaini teaching hospital, Nasser institute and Almokattam hospital between 13 October 2009 to 13 January 2010. The following data were collected over the first 24 hours of ICU stay: demographics, APCHE IV and SAPS II scores, MPM II24 variables, ICU outcome.

Measurements: Predicted mortality was calculated using original regression formulas. SMR was calculated with 95% confidence intervals. Calibration was assessed by using the chi-squared value from the Hosmer-Lemeshow test. Discrimination was evaluated by calculating area under the receiver operating characteristic curve [AU-ROC].

Results:- The observed ICU mortality was 24.17%. Predicted mortality by APACHE IV and SAPS II systems was different from actual mortality, whereas MPM II24 has the nearest prediction one [SMR for APACHE IV: 1.69, SAPS II: 1.47, MPM II24: 1.28]. All the models showed reasonable discrimination using the area under the receiver operating characteristic curve (APACHE IV, 0.833; SAPS II, 0.836; MPM II, 0.818) with the best for SAPS II. For same data sets, SAPS II demonstrated superior calibration to all the models. (SAPS II 11.557 [P = 0.172]; APACHE IV 12.914 [P = 0.115]; and MPM II24 17.830 [P = 0.023].

Conclusion:- Overall mortality prediction was underestimated by APACHE IV and SAPS II. MPM II was the nearest to predict outcome. Calibration of SAPS II was the best, making it the most appropriate model for comparisons of mortality rates in different ICUs.

Key words:- APACHE IV score; SAPS II score; MPM II score; mortality prediction.

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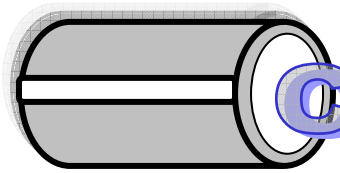

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Abbreviations

ICU	Intensive Care Unit
RCT	Randomized Controlled Trials
APACHE	Acute Physiology And Chronic Health Evaluation
USA	United States Of America
LOS	Length of stay
SAPS	Simplified Acute Physiology score
MPM	Mortality Probability Model
MODS	Multiple Organ Dysfunction Syndrome
AIS	Abbreviated Injury Score
ISS	Injury Severity Score
TISS	Therapeutic Intervention Scoring System
SOFA	Sepsis-Related organ Failure Assessment
MELD	Model of End-stage Liver Disease
APS	Acute Physiology Score
AHA	American Hart Association
ROC	Receiver operating characteristics
AUC	Area Under the Resultant Curve

CABG	Coronary Artery Bypass Grafting
PaO2	Partial Oxygen Tension In Arterial Blood
FiO2	Fraction of Inspired Oxygen
SMR	Standardized Mortality Ratio
APS	Acute Physiologic Score
US	United States
BMI	Body Mass Index
P-Value	Probability value
UK	United Kingdom
mmol/L	Mill mole per Liter
mmHg	Millimeter mercury
%	Percent
Hct %	Hematocrit Percent
WBC	White Blood Cells
Dx	Diagnosis
MI	Myocardial Infarction
Mg/dl	Milligram per deciliter
ENAS	European-North American Study
CPAP	Continuous Positive Airway Pressure

MV	**Mechanical Ventilation**
Pco2	**Partial Pressure Of Carbon Dioxide Tension**
O/E	**Observed/estimated**
Hco3	**Bicarbonate**
SOI	**Severity Of Illness**
ROM	**Risk of mortality**
BUN	**Blood Urea Nitrogen**
CI	**Confidence Interval**
SE	**standard error**
CVS	**Cardiovascular System**
CNS	**Central Nervous System**
GIT	**Gastrointestinal Tract**
CPR	**Cardiopulmonary Resuscitation**

Introduction

Quality of care has been defined by the Institute of Medicine as the "degree to which health services for individuals and populations increase the likelihood of desired health outcomes" **[1]**. Quality of care has become a central issue in the arena of healthcare policy debate. In part, this is caused by the concern that the increased emphasis on cost cutting will compromise quality **[2].** In addition, there is increasing recognition of the wide variation in healthcare practices and, more importantly, of the potential effect of this variance of healthcare delivery on outcomes **[3].**

Tools to measure quality are becoming widespread and focus either on the outcomes of care or the processes of care. For intensive care units (ICUs), the main focus on research on outcome measurement has been on the development of mortality prediction models. These models have been used to perform risk adjustment on ICU mortality rates to compare outcomes across ICUs **[4]**.

Scoring systems are necessary to indicate severity of intensive care unit (ICU) patients. There are many scoring systems used; these include the Glasgow Coma Scale (GCS), the Simplified Acute Physiology Score (SAPS), and the Acute Physiology and Chronic Health Evaluation (APACHE) scoring systems. APACHE is probably the most widely used and commercialized **[5]**.

Scoring systems have been developed in response to an increasing emphasis on the evaluation and monitoring of health services. These systems enable comparative audit and evaluative research of intensive care. The ideal components of a scoring system are data collected during