Evaluation of standard and modified severity of illness scores in the obstetric patient[☆],[☆☆]

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Abstract
Purpose: To test discrimination and calibration of APACHE-II and SAPS-II risk prediction scores in a
cohort of obstetric patients, and to evaluate the effect of modifying these scores for the physiological
changes in pregnancy.
Materials and Methods: A retrospective review of obstetric patients, 12 weeks gestation to 48 hours
postpartum, admitted to the ICU for more than 24 hours. APACHE-II and SAPS-II, and versions
modified for the physiological changes of pregnancy, were evaluated by receiver operating
characteristic (ROC) curves and standardized mortality ratios (SMR). Multivariable analysis identified
other parameters associated with mortality.
Results: Data were obtained from 332 patients from 5 countries, with a mortality rate of 12%. Mean
(± SD) APACHE-II score was 16.8 ± 6.1 and SAPS-II score 26.5 ± 15.8. Good discrimination was
demonstrated with area under the ROC curves of 0.82 and 0.78 respectively, with no improvement after
modification for altered maternal physiology. APACHE-II overestimated mortality, with an SMR of

0.43 (0.52 after including diagnostic weighting) compared with 0.89 for SAPS-II. Bilirubin, albumin and Glasgow Coma Scale were independently associated with mortality.

Conclusion: APACHE-II and SAPS-II are good discriminators of illness severity and may be valuable for comparing obstetric cohorts, but APACHE-II significantly over-estimates mortality.

Obstetric patients comprise only a small fraction of patients admitted to the Intensive Care Unit (ICU), but these patients often present with unfamiliar conditions and have the potential for catastrophic deterioration. Maternal mortality varies widely worldwide, from under 10 per 100,000 deliveries to more than 1,500 per 100,000 [1]. While some studies characterizing the course and outcome of this patient group have documented a relatively short ICU stay and low mortality rate (<5%), others have reported mortality rates greater than 20% [2]. Risk prediction scores may be useful to standardize data for comparative research purposes as well as possibly to assist in the identification of obstetric patients who truly require intensive care management from those requiring only short term monitoring. Commonly used severity of illness scores have been evaluated in several case series of obstetrical ICU admissions [3-13]. Although there is significant variation between these studies, APACHE II and SAPS II appear to have good discrimination of outcome, but tend to overestimate mortality. It has been suggested that a modified scoring system may be beneficial, adjusted for the normal physiological responses to pregnancy and for pregnancy-specific complications [3,10,11,14].

This study used a multi-center database of clinical information on critically ill obstetric patients derived from diverse geographic and socio-economic areas, to evaluate the operating characteristics of APACHE-II and SAPS-II in this population. The objectives were to confirm previous findings regarding the discrimination and calibration of these scoring systems in a large diverse obstetric cohort, to evaluate the effect of correcting the scores for the physiological changes in pregnancy, and to identify other physiological and laboratory parameters associated with mortality in the pregnant or postpartum patient.

1. Methods

1.1. Data collection

Approval was obtained from the Research Ethics Board at Mount Sinai Hospital and from institutional ethics boards at each site, and the need for informed consent for this chart review was waived. Obstetric patients were defined as pregnant women more than 12 weeks gestation or within 48 hours of delivery. A retrospective chart review was performed of all obstetric patients who were admitted to the ICU for at least 24 hours, during a 4 year period (1994 to 1998). Eighteen sites were invited to participate, of which 6 were able to provide data (Table 1). Data collected included demographic information, ICU admission diagnosis, clinical and physiological data from the first 24 hours in the ICU to determine APACHE II [15] and SAPS II scores [16], other laboratory data including platelet count, liver investigations and culture results, the development of organ failure and maternal hospital mortality. Data was entered into an Access database (Microsoft, Seattle WA) and cross-checked for accuracy. Missing data were considered normal for calculating severity of illness scores. Results are expressed as mean ± standard deviation.

1.2. Severity of illness scores

APACHE II and SAPS II scores were calculated for each patient. Normal values for many clinical and physiological parameters incorporated in these scores are different in later pregnancy [17], and a modification of each score was developed empirically to compensate for these altered normal ranges. The zero point normal range was altered according to known normal values in pregnancy (Table 2)

Table 1   Participating sites and characteristics of the study population

Hospital	Country	n	Deaths	Gestation mean ± SD (weeks)	ICU length of stay median (IQR) (days)
Mater Misericordiae Adult Hospital	Australia	68	1	32.6 ± 6.5	1.0 (1 − 2)
Erasme University Hospital	Belgium	31	0	29.9 ± 6.9	2.0 (2 − 3)
Medical University of South Carolina	USA	16	0	29.8 ± 6.2	2.0 (2 − 3)
Kingston General Hospital	Canada	13	0	35.0 ± 3.0	1.0 (1 − 15)
King Edward VIII Hospital	South Africa	148	38	30.6 ± 8.2	4.0 (2 − 8)
Mount Sinai Hospital	Canada	56	1	32.1 ± 5.1	1.5 (1 − 2)
Total	-	332	40	31.2 ± 4.4	2.0 (1 − 5)