## Editorial

# RECOGNIZE THE TIPPING POINTS IN VITAL SIGNS
## BEWARE THE TREACHEROUS TRIADS

Late in 2011, we passed a true milestone in critical care: the 50th anniversary of the concept of a coronary care unit (CCU). In October 1961, a California cardiologist named Morris Wilburne[1] published the first description of a CCU as a program of care distinguished from the existing model of an intensive care unit (ICU). In contrast to the wide array of medical and surgical health problems that might bring patients into the then sometimes noisy and nearly always brightly lighted ICU, the CCU was envisioned as a more restful milieu where patients at high risk for sudden death due to acute myocardial infarction could be continuously and electronically monitored by nurses with expertise in the recognition and immediate treatment of life-threatening cardiac dysrhythmias.

As the assessment of critically ill patients continued to transform beyond the frequent, static, manual, and serial measurements of temperature, pulse, respiration and blood pressure obtained in the 1960s to the continuous, dynamic and automated simultaneous multisystem appraisals of related sets of hemodynamic, pulmonary, and other clinical parameters available today, critical care nurses can appreciate both the blessings as well as the burdens of needing to attend to, integrate, and interpret an expanding volume of clinical data.

When we begin orienting nurses new to critical care, preceptors and peers emphasize the need to assess patients, not numbers, to evaluate the whole patient, not just selected quantitative indices, and to examine trends in data, rather than discrete

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measurements. Despite these general injunctions for critical care nurses to use a wide angle lens for patient appraisals, all of us who have attempted to simultaneously weigh the relative importance of 15 to 25 clinical data points would (perhaps secretly) covet the ability to immediately zoom in on the findings most relevant to patient outcomes. Two recent studies may help critical care nurses focus our patient assessment lens and thereby sharpen our ability to detect when changes in vital signs become clinically significant.

### What a Million Vital Signs Tell Us: Pay Attention to Toxic Triplets

In a longitudinal study[2] aimed at determining the predictive value of abnormal vital signs on a patient's risk of death, researchers from Wake Forest University School of Medicine collected 1.15 million vital sign measurements from all 42 430 patient admissions to the University Medical Center between January 1, 2008, and June 30, 2009. In this study "critically abnormal vital signs," such as those used to activate hospital rapid response teams, included the following:

- Temperature less than 35°C or greater than 38.9°C
- Heart rate greater than 120 beats/minute
- Respiratory rate ≤12 or ≥24 breaths/minute
- Systolic blood pressure less than 85 mm Hg
- Oxygen saturation less than 91%
- Level of consciousness other than "Alert"

Although the occurrence of any single critically abnormal vital sign correlated with only a 0.92% mortality rate, the simultaneous existence of any 3 of these critically abnormal vital signs was associated with a mortality of 23.6%.

## Table Modified[a] early warning score[3(p193)]

| Warning sign | Normal range (score = 0) |
|---|---|
| Temperature, °C | 36.6 - 37.5 |
| Heart rate, beats/minute | 51 - 100 |
| Breath rate, breaths/minute | 9 - 14 |
| Systolic blood pressure, mm Hg | 101 - 200 |
| Transcutaneous oxygen saturation[b] | |
| Level of consciousness[a] | Alert |
| Decreased urine output[a,c] | |
| Concern of nursing staff about a patient's condition[a,d] | |

[a] Modified parameters added to existing early warning score system in 2009
[b] No score of zero; 3 points given if saturation less than 90% despite therapy.
[c] No score of zero; 1 point given if urine output <75 mL in past 4 hours.
[d] No score of zero; 1 point given if nurse felt uneasy with the patient's condition.

## Predicting Adverse Outcomes in Trauma and Surgical Patients: Respond to Early Warning Scores 3 or Higher

In the Netherlands, nearly 600 consecutive surgical patients who were admitted to a level 1 trauma and surgery center between March and September 2009 were followed to determine the relationship between early warning scores (EWS) and the incidence of major adverse clinical events during their hospitalization.[3] In this prospective study, Smith et al used an expanded version of their EWS system. The EWS score ranged from 0 to 3 points, depending on the amount of deviation above or below the normal ranges for each of the parameters listed in the Table.

An EWS score of 3 was considered to be a positive finding. The clinical endpoints considered as adverse outcomes included death, resuscitation, emergency surgery, severe complications, or unexpected admission to the ICU. Of the 572 patients in the study, 46 (8%) reached one or more established endpoints (44 with severe complications, 17 with ICU admission, 2 deaths). The researchers concluded that the expanded EWS independently predicted the occurrence of major adverse events in patients admitted to a general or trauma surgery unit. More specifically, an EWS score of 3 or higher was associated with a more than 10-fold increase in risk of experiencing one of the adverse clinical endpoints. The overlap between these parameters and those in the million vital signs study[2] are considerable and compelling.

## Implications for Critical Care Nursing

In addition to the obvious implications of these study findings for rapid response teams in investigating and managing patients whose clinical status may be faltering, patients already in critical care units who evidence either form of these potentially treacherous triads require enhanced clinical scrutiny to ensure they maintain their therapeutic course toward recovery. Critical care documentation systems and protocols, whether manual or automated, need to include alert mechanisms that recognize when these clinical fault lines have been breached so that nursing interventions and related therapies can be tailored in time to restore patient stability and avert further deterioration and complications. Critical care nurses who recognize the initial appearance and appropriately manage these potentially lethal triads have a first-hand opportunity to make a difference in patient outcomes and survival. CCN

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