



## Nurses' 'worry' as predictor of deteriorating surgical ward patients: A prospective cohort study of the Dutch-Early-Nurse-Worry-Indicator-Score



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### ARTICLE INFO

#### Article history:

Received 30 October 2015

Received in revised form 3 April 2016

Accepted 5 April 2016

#### Keywords:

DENWIS

Deterioration

Early recognition

Hospital Rapid Response Team

Intensive Care Unit

Nurses

Worry

### ABSTRACT

**Background:** Nurses' 'worry' is used as a calling criterion in many Rapid Response Systems, however it is valued inconsistently. Furthermore, barriers to call the Rapid Response Team can cause delay in escalating care. The literature identifies nine indicators which trigger nurses to worry about a patient's condition.

**Objectives:** The objective of this study is to determine the significance of nurses' 'worry' and/or indicators underlying 'worry' to predict unplanned Intensive-Care/High-Dependency-Unit admission or unexpected mortality among surgical ward patients.

**Design:** A prospective cohort study.

**Settings:** A 500-bed tertiary University affiliated teaching hospital.

**Participants:** Adult, native speaking surgical patients, admitted to three surgical wards (traumatology, vascular- and abdominal/oncological surgery). We excluded patients with a non-ICU policy or with no curative treatment. Mentally incapacitated patients were also excluded.

**Methods:** We developed a new clinical assessment tool, the Dutch-Early-Nurse-Worry-Indicator-Score (DENWIS) based on signs underlying 'worry'. Nurses systematically scored their 'worry' and the DENWIS once per shift or at any moment of 'worry'. DENWIS measurements were linked to routinely measured vital signs. The composite endpoint was unplanned Intensive-Care/High-Dependency-Unit admission or unexpected mortality. The DENWIS-indicators were included in a univariate and multivariate logistic regression analysis, subsequently inserting 'worry' and the Early Warning Score into the model. We calculated the area under the receiver-operating characteristics curve.

**Results:** In 3522 patients there were 102 (2.9%) patients with unplanned Intensive Care Unit/High Dependency Unit-admissions or unexpected mortality. 'Worry' (0.81) and the DENWIS-model (0.85) had a lower area under the receiver-operating characteristics curve than the Early Warning Score (0.86). Adding 'worry' and the Early Warning Score to the DENWIS-model

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resulted in higher areas under the receiver operating characteristics curves (0.87 and 0.91, respectively) compared with the Early Warning Score only based on vital signs.

**Conclusions:** In this single-center study we showed that adding the Early Warning Score based on vital signs to the DENWIS-indicators improves prediction of unplanned Intensive-Care/High-Dependency-Unit admission or unexpected mortality.

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### What is already known about the topic?

- Some Rapid Response Systems add 'worry' or 'concern' as subjective calling criterion, but it is valued inconsistently.
- Barriers for ward nurses to call an RRT are: lack of confidence, the need to justify the call, overestimation of own ability, and/or underestimation of clinical signs.
- The indicators 'changes in breathing', 'changes in circulation', 'rigors', 'changes in mentation', 'agitation', 'pain', 'no clinical progress', 'patient indicating not feeling well', and 'subjective nurse observations' were identified as underlying 'worry'.

### What this paper adds

- Development of the Dutch-Early-Nurse-Worry-Indicator-Score (DENWIS).
- DENWIS indicators or 'worry' added to an Early Warning System based on vital signs improves prediction of unplanned Intensive Care Unit admission or unexpected mortality.
- DENWIS can be an assessment tool to:
  - structure the reporting of signs and symptoms underlying nurses' 'worry',
  - improve (inter) disciplinary communication,
  - empower nurses and overcome barriers to call the RRT on the 'worry' criterion.

## 1. Introduction

Increasing complexity of patients on general wards warrants a rapid and adequate response in case of imminent deterioration. Rapid Response Systems (RRSs) can fill the gap when knowledge or skills of ward staff in managing deteriorating patients is insufficient. RRSs often provide supplementary knowledge and competencies of Intensive Care Unit (ICU) professionals to general ward patients through Rapid Response Teams (RRTs) (DeVita et al., 2006). As a consequence, treatment on the ward is optimized to prevent further deterioration at an early stage. Rapid Response Teams are activated through calling systems which are mainly based on abnormal vital signs, either as single calling criterion or as an aggregated system with cumulative scoring in an Early Warning System (EWS) (Gao et al., 2007).

In addition to vital signs, nurses' 'worry' can be a calling criterion to activate RRTs, but it is used and valued inconsistently (Gao et al., 2007; Hodgetts et al., 2002; Smith et al., 2013). Furthermore, nurses experience barriers to call an RRT such as a lack of confidence (Jones et al., 2009; Shapiro

et al., 2010), the need to justify a call (Astroth et al., 2013; Braaten, 2015; Mackintosh et al., 2012) or fear of criticism (Bagshaw et al., 2010). Apart from these feelings of uncertainty, also underestimation of the pathophysiology underlying clinical signs (Jones et al., 2006) or a belief that patients should or can be managed on the ward (Shearer et al., 2012) influence nurses' decisions to call the RRT. These barriers can cause a delay in escalating care.

In order to explore the 'worry' criterion, we recently performed a systematic literature review (Douw et al., 2015) and identified underlying signs and symptoms of the 'worry' criterion that nurses pick up and subsequently act upon. The signs were categorized into 10 indicator domains. Apart from 'intuitive knowing' these indicators included 'changes in breathing', 'changes in circulation', 'rigors', 'changes in mentation', 'agitation', 'pain', 'no clinical progress', 'patient indicating not feeling well', and 'subjective nurse observations'.

We hypothesized that nurses' 'worry' and/or the nine indicators underlying 'worry', can improve the system for RRT activation and potentially contribute to earlier treatment and better patient outcomes, such as unplanned ICU-admission or unexpected mortality. We designed a prospective observational study to determine the value of nurses' 'worry' and/or the other nine indicators underlying 'worry' to predict unplanned ICU/High Dependency Unit (HCU)-admission or unexpected mortality among patients admitted to a surgical ward, either in comparison or in addition to a vital signs based RRT calling system.

## 2. Methods

This prospective cohort study was performed from March 2013 until April 2014 in a 500-bed tertiary University affiliated teaching hospital in the Netherlands, including a level 3 ICU, capable of providing, complex, multisystem life support, a Medium Care Unit (MCU), and Cardiac Care Unit (CCU).

The hospital introduced an RRS in 2007, with the RRT consisting of an ICU-nurse, an ICU-resident and a consultant intensivist. All are available 24 h a day, seven days a week. Vital signs included in the EWS were: respiratory rate, arterial oxygen saturation, oxygen supply, systolic blood pressure, heart rate, temperature, and consciousness level. These vital signs could be awarded 0–4 points depending on the severity of deterioration, and with a maximum of 21 points. Although urine production and lactate were included in the EWS, they were not included in our present study, since these criteria frequently are not known at the first call. 'Worry' was an additional criterion which enabled nurses to consult the RRT-nurse with a low

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