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Factors influencing when intensive care unit nurses go to the bedside to investigate patient related alarms: A descriptive qualitative study

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ABSTRACT

Objective: This study examines what prompts the intensive care unit (ICU) nurse to go to the patient's bedside to investigate an alarm and the influences on the nurse's determination regarding how quickly this needs to occur.
Method: A qualitative descriptive design guided data collection and analysis. Individual semi-structured interviews were conducted. Thematic analysis guided by the Patient Risk Detection Theoretical Framework was applied to the data.
Setting: Four specialty intensive care units in an academic medical center.
Results: ICU nurses go the patient's bedside in response to an alarm to catch patient deterioration and avert harm. Their determination of the immediacy of patient risk and their desire to prioritize their bedside investigations to true alarms influences how quickly they proceed to the bedside.
Conclusion: Ready visual access to physiological data and waveform configurations, experience, teamwork, and false alarms are important determinants in the timing of ICU nurses' bedside alarm investigations.

Implications for clinical practice

- ICU administrators should evaluate the feasibility of adding auxiliary monitors to their units to enhance visibility of information potentially useful to nurses in their decisions when faced with choosing between different courses of action to best keep the patient safe.
- For nurses new to critical care, transition programs should be implemented that include recognition of clinically significant alarms, and instruction in processes of determining risk of patient harm.
- To optimize the development and effective deployment of alarm management policies and procedures, organizations should incorporate input from the bedside nurse.

Introduction

Alarms are an important detection tool that alert nurses to a potentially detrimental change in a patient's clinical status or malfunctioning equipment, yet multiple alarms may actually pose a risk to patient safety. Alarms are sources of distraction and care interruption (Feil, 2013; Institute for Safe Medication Practices, 2012; Rivera-Rodriguez and Karsh, 2010). Distractions and interruptions are a common cause of potential error and pose a threat to patient safety (Feil, 2013). Further, exposure to excessive alarms leads to alarm fatigue, a desensitization to alarms that increases the risk of delayed or missed detection of patient deterioration (Agency for Healthcare Research and Quality, 2015; Sendelbach and Funk, 2013). Alarm fatigue is a global patient safety concern (Borowski et al., 2011; Bridi et al., 2014; Christensen et al., 2014).

Patients have been harmed due to missed or delayed responses to alarms. The United States Food and Drug Administration (2015) received 500 reports of patient deaths between January 1, 2005 and December 31, 2015 related to physiologic monitoring systems, many claiming that the system failed to alarm for a critical change in a patient's clinical status. Yet investigation of these monitor-

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ing devices frequently demonstrated that alarms had deployed and had been either silenced or disabled after deployment (U.S. Food and Drug Administration, 2015). Funk et al. (2014) found that 18% of survey respondents knew of adverse patient events related to alarms. The ECRI Institute (2015), a non-profit organization in the United States that researches medical procedures, devices, drugs and processes, listed missed alarms as one of its top 10 health technology hazards for 2016.

Intensive care unit (ICU) patients are a particularly vulnerable population, at risk for both subtle and sudden physiological deterioration due to the critical nature of their illness (Hartigan, 2000). The ICU environment is complex and, at times, chaotic with variable patient acuity levels and multiple stimuli from alarms, patients, families and other care providers, all of which compete for the nurse's attention (Despins et al., 2010). Alarms from monitors and care equipment can number as high as 187 audible alarms per ICU bed per day with over 87% of them false (Drew et al., 2014). When the number of false alarms is disproportionately high, individuals will more often miss signals, such as those indicative of patient risk (e.g. clinically significant alarms) (Dixon et al., 2007).

A key component of the nurse's role in patient safety is that of patient risk assessment (Henneman et al., 2012). When faced with choosing a course of action, it is part of the nurse's practice to determine the risk associated with each course in order to maximize patient outcomes while minimizing unintended consequences (Meyer and Lavin, 2005). Several factors can influence the nurse's risk assessment and therefore, their response to an alarm. Nurses have used the patient's past medical history, end-of-shift handoff and prior experience to anticipate alarms and guide care activities (Gazarian et al., 2015). Nurses' responses to alarms have included silencing them or allowing them to self-correct in order to not disrupt their workflow (Christensen et al., 2014; Varpio et al., 2012). In a 170-bed hospital in Brazil, Bridi et al. (2014) sought to determine if coronary care unit patients were at risk for alarm-related incidents and found that proceeding to the patient's bedside in response to an alarm took up to nine minutes. Yet, nurses perceive it to be their professional responsibility to respond to an alarm by going to the patient's bedside and many consider themselves to be sensitive to alarms and quick to respond (Christensen et al., 2014; Funk et al., 2014).

In the United States, ICU nurses often care for two critically ill patients (Swinny, 2010). Given the competing care priorities that the ICU nurse must address while keeping their patients safe, it is unfortunate that research is limited regarding the influences on the ICU nurse's determination of how soon to proceed to the patient's bedside in response to an alarm. Such knowledge is necessary in order to develop interventions that optimize the nurse's response to alarms. The purpose of this study was to examine what prompts the ICU nurse to proceed to the patient's bedside in response to an alarm and the influences on the nurse's perception regarding how quickly this needs to occur.

Theoretical framework

Researchers have described nurses' responses to alarms as "the observable activity" resulting from a decision-making process (Gazarian et al., 2015). Results from previous research indicate that organizational and individual attributes influence this decision (Despins, 2014; Funk et al., 2014; Varpio et al., 2012). The Patient Risk Detection Theoretical Framework (PRDTF) (Despins et al., 2010) provides a lens through which to explore organizational and individual influences on the nurse's decision in responding to an alarm. The framework posits that in a complex environment with multiple stimuli, the nurse's decision regarding their response to a stimulus, such as an alarm, depends both on their ability to differentiate true signals of patient risk from clinically non-significant stimuli and their priorities at the time of the stimulus. Organizations influence this response by the design of educational and work systems that enhance or hinder the capacity to detect patient risk signals, and by their message to the staff regarding patient safety as a priority (Despins et al., 2010).

PRDTF integrates concepts of attentive-cognitive processes (preoccupation with failure, sensitivity to operations, and reluctance to simplify) from High Reliability Theory, an organizational theory, with concepts from Signal Detection Theory (sensitivity and responder bias), a decision-making theory (Despins et al., 2010). Preoccupation with failure denotes an organizational mindset focused on early detection of incipient failures. Sensitivity to operations promotes examining processes as they actually are with an ongoing awareness of the connection between immediate actions and distal consequences. Reluctance to simplify is an acknowledgment that failures can occur by multiple methods and encourages resistance to making broad generalizations (Weick and Sutcliffe, 2007). Organizational attributes, such as monitor visibility, enhance the nurse's access to patient physiologic data. Policies and procedures addressing nursing requirements for education and competency in patient care, as well as leadership behaviors that communicate the importance of catching early patient deterioration, can positively influence the nurse's behaviors in terms of constantly scanning for, and attending to, small discrepancies, such as alarms, that could be early signals of patient deterioration. Such attributes influence the nurse's awareness of the current clinical condition of their own patients and that of the other patients in the unit (Despins et al., 2010).

Sensitivity is a measure of how well an individual is able to distinguish a signal from amongst multiple stimuli (Macmillan and Creelman, 2005). A nurse's sensitivity with regards to alarms depends on how distinct a true alarm is from a false alarm, the nurse's level of training and experience, and their fatigue level (Despins et al., 2010; Macmillan and Creelman, 2005). Responder bias reflects the individual's willingness to identify a stimulus as a signal and is governed by the individual's priorities (Macmillan and Creelman, 2005). Thus, a nurse's individual attributes, level of training and experience, fatigue level, and willingness to acknowledge a stimulus as a signal of potential patient risk, can also influence their decision regarding their response to an alarm (Despins et al., 2010).

Method

Study design

Understanding why and when a nurse goes to the patient's bedside in response to an alarm is important to nursing educators and administrators in order to provide education and environmental conditions that optimize rapid responses to clinically significant alarms. A qualitative design that would produce detailed findings close to the data was determined to best advance such understanding. Therefore, a qualitative descriptive design was chosen to examine factors prompting when nurses choose to proceed to the patient's bedside to investigate an alarm. This design can provide answers to questions of special relevance, such as optimizing nurses' responses to alarms, to practitioners and policy makers (Sandelowski, 2000, 2010).

Sample and setting

A convenience sample of registered nurses was recruited from four adult specialty ICUs (medical, cardiology/cardiothoracic, surgical/trauma/burn and neuroscience) in a single mid-western academic medical center in the United States. The overall pro-

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