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Nurses' response to frequency and types of electrocardiography alarms in a non-critical care setting: A descriptive study

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ABSTRACT

Background: An important role of the registered nurse is to identify patient deterioration by monitoring the patient condition and vital signs. Increasingly, this is supplemented with continuous electrocardiographic (ECG) monitoring. Continuous monitoring is inefficient in identifying deterioration because of the high number of false and nuisance alarms. Lack of strong evidence or formal guidelines for the care of patients receiving ECG monitoring has led clinicians to rely too heavily on this technology without consideration of its limitations. The nursing workload associated with alarm management remains unexamined.
Objective: To describe nurses' routine practices related to continuous ECG monitoring, frequency and types of alarms, their associated nursing interventions, and the impact on the patient's plan of care.
Methods: Design. Prospective, descriptive, observational study. *Setting and participants.* Between January 2011 and March 2011 we observed nine Registered Nurses providing care for patients receiving continuous ECG monitoring in non-critical care areas. The PI and two research assistants observed each nurse for two 3-h observation periods and recorded data on a researcher designed observation tool. At the end of each observation period, the observers printed the alarm events as recorded by the central monitoring computer.
Results: Nurses responded to 46.8% of all alarms. During the observation period, there were no dysrhythmia adverse events. One patient had a change in condition requiring transfer to a higher level of care. A range of nursing interventions occurred in response to alarms.
Conclusion: Nurses routine practices related to monitoring continue to reveal gaps in practice related to alarm management. Observations of practice also revealed the difficulties and complexities of managing alarm systems and the range of nursing interventions associated with managing alarms.

What is already known about the topic?

- There is a significant body of research demonstrating that many hospitalized patients exhibit signs of clinical deterioration while hospitalized.
- ECG monitors only detect limited parameters of deterioration such as heart rate, rhythm, and ST segment ischemia.
- Clinical deterioration is detected by combining several parameters therefore ECG monitors are inefficient at identifying clinical deterioration.
- Despite this they are the most prevalent method of patient monitoring in hospitals.
- False alarms associated with continuous 18 ECG monitoring are as high as 99.4%, producing alarm desensitization and potential adverse events.

What this paper adds

- There continue to be frequent false and nuisance alarms.

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- There are inconsistencies in practice related to alarm management by nurses.
- Nursing interventions related to alarm management include patient assessment, consultation and collaboration in addition to managing technology.

1. Introduction

One of registered nurses' fundamental roles is to identify signs and symptoms of deterioration in their patients' condition and act to interrupt continued deterioration. Early recognition of deterioration can logically be assumed to prevent adverse events such as delay in diagnosis and treatment (Considine and Botti, 2004; Taenzer et al., 2011). Many hospitalized patients exhibit signs of clinical deterioration, such as changes in vital signs, prior to experiencing critical events (Gazarian et al., 2010). Increasingly monitoring of vital signs, especially heart rate and rhythm, is accomplished through various continuous monitoring devices, creating a convergence of technology and clinical processes that has profoundly changed clinical practice. Once considered primarily for critical care areas, many forms of sophisticated monitoring are now available on medical surgical units. This proliferation in technology into non-critical care areas redistributes workflow and tasks. However, overall it increases the physical and cognitive demands for nurses as they integrate technology into their work (Militello, 1998).

The importance of detecting early signs of patient deterioration cannot be understated. However, it is also apparent that continuous electrocardiographic (ECG) monitor alarms are inefficient at alerting clinicians of patient deterioration. Continuous ECG monitoring produces many more false and nuisance alarms than notifications of true clinical events. This results in alarm fatigue and system work-arounds. Applying continuous ECG monitoring to detect deterioration produces a situation that may in fact subvert the nurses' ability to provide proper clinical surveillance of patients' conditions (Larson and Brady, 2008). It is important to understand the impact of monitor alarms on nurses' work in order to inform the appropriate use of continuous ECG monitoring in clinical practice. The purpose of this report is to describe aspects of the nurses' work on medical surgical units (non-critical care areas) associated with continuous ECG monitoring and their associated alarms.

2. Deterioration of hospitalized patients

There is a significant body of research demonstrating that many hospitalized patients exhibit signs of clinical deterioration, such as changes in vital signs, prior to experiencing a cardio-pulmonary arrest (CPA) or transfer to an intensive care unit (Buist et al., 2004; DeVita et al., 2010; Goldhill et al., 1999). Other signs of clinical deterioration supported by the research include changes in level of consciousness (LOC) or mental status, and changes in oxygenation status (Gazarian et al., 2010; Taenzer et al., 2011). Although blood pressure, LOC, and oxygenation are well-documented indicators of patient deterioration, the most commonly monitored parameter in the acute care setting is heart rate and rhythm through continuous ECG monitoring. Given that electrocardiographic monitors will detect only one parameter of deterioration, change in heart rate and rhythm, they are inefficient in identifying clinical deterioration.

3. Indication for continuous electrocardiographic (ECG) monitoring

Despite the limitations of ECG monitoring to detect patient deterioration, it is the most prevalent method of monitoring patients in hospitals today. It is common practice for patients to have continuous ECG monitoring applied without consideration of clinical indications (Funk et al., 2010). There is evidence that continuous ECG monitoring is of use in specific patient populations, such as those with acute coronary syndrome (ACS), and that sophisticated monitoring parameters such as ST segment monitoring are useful in detecting cardiac ischemia in those at risk (Drew et al., 2004). Additionally, there are situations in which ECG monitoring is of no therapeutic benefit such as permanent rate controlled atrial fibrillation (Drew and Funk, 2006; Drew et al., 2004) There is no evidence that continuous ECG monitoring alone will detect clinical deterioration among other populations who do not have indications for ECG monitoring.

4. Monitor alarms

Attendant to the prevalence of continuous ECG monitoring are their associated alarms. Several issues have been documented related to clinical alarms. Alarm systems are highly sensitive yet lack specificity (Chambrin et al., 1999), resulting in rates of false alarms as high as 99.4% (Atzema et al., 2006; Chambrin et al., 1999). The proliferation of monitoring equipment and frequency of alarms creates risks for the development of staff desensitization to the alarms or worse, work-a-rounds such as turning alarms off. Because human cognitive capacity has limits, each time a registered nurse responds to an alarm, attention resources are re-distributed and another patient care task now has to be reprioritized. Laboratory researchers have described this phenomenon as the cry wolf effect wherein the human behavioral response to alarms is adjusted according the perceived false alarm rate (Bliss and Dunn, 2000). When there is a low rate of false alarms, human responses are more appropriate. With high rates of false alarms, the natural human response is to respond less frequently. This is a human adaptive mechanism triggered to manage cognitive burden and attention resources.

Little is known about the actual work processes related to managing continuous ECG monitoring and their alarms. Lack of strong evidence or standards for the care of patients with ECG monitoring have led clinicians to rely too heavily on this technology without consideration of its limitations. Before implementing quality improvement programs to improve alarm response by registered nurses or to expand monitoring capability, it is important to understand the actual work that registered nurses perform in managing their patient receiving continuous ECG monitoring. The aim of this study was to describe the work of registered