

Effective Surveillance Monitoring Requires All Vital Signs

The data is clear: as many as 50% or more of non-DNR hospital deaths occur outside the ICU. The three reasons why are:

- increased patient acuity
- unpredictable or unknown patient risk factors, and
- patient deterioration that goes unrecognized.²

Most patients that decompensate show evidence of deterioration for as much as 6 to 12 hours prior to their clinical event. For detecting patients at risk, the current standard of checking vital signs every 4 to 8 hours is simply inadequate. Healthcare leaders and clinicians need new ways to create a safer environment for patients.

THE CASE FOR CONTINUOUS SURVEILLANCE MONITORING

Increasing Acuity in Acute Care Hospitals

Inpatient acuities are trending higher due in large measure to a growing number of older Americans who, despite chronic conditions, have benefitted from medical advancements that allow them to live longer. The evolution and availability of medical care has resulted in significant increases in the number of patients with chronic conditions such as heart disease, cancer, hypertension, stroke and diabetes - often with complex treatment regimens. When these patients are admitted to hospitals either for an elective procedure, or emergency treatment, their chronic disease burden adds to their complexity.¹

The rise in patient acuity in the hospital is further compounded by the practice of moving the less acute care cases to the outpatient setting, shortened hospital stays, and the desire to improve patient throughput by moving patients from intensive care and recovery room settings as soon as possible. In practice, the hospital has become the “intensive care unit” of the community.²

Condition Monitoring

Condition monitoring – routinely done in ICUs and telemetry units – is most often associated with higher acuity patients. These patients have been identified to be at risk for problems, such as complex medical conditions, those undergoing anesthesia or admitted with known or suspected disease. In the ICUs and telemetry units, the nurse to patient ratio is higher and care is designed to be individualized and highly sensitive in order to detect problems early and intervene.

Telemetry Not the Answer

While telemetry is often the default means to provide continuous oversight of at-risk patients, cardiac telemetry systems are severely limited in their ability to detect or predict early signs of clinical deterioration. In fact, it has now been established that vital sign abnormalities, rather than arrhythmias, presage serious patient deterioration.^{3,4,5}

Risk Outside of Traditional Monitoring Areas

Institute for Healthcare Improvement (IHI) data reveals that between 25-75% of non-DNR hospital deaths in U.S. hospitals occur unmonitored, outside of the ICU.⁶ This is consistent with a 1999 United Kingdom study showing that 66% of non-DNR deaths took place outside of the ICU⁷. Similarly, an Australian study showed that of 392 hospital deaths, only 107 took place in the ICU.⁴

Patients Show Signs of Deterioration Up to 8 Hours Prior to a Cardiac Event

In a review of in-hospital mortality studies, the evidence shows that patients frequently manifest signs of deterioration 6-12 hours prior to a clinical event.^{3,4,5}

There is a clear need for systems that detect this period of deterioration prior to a patient event, and communicate the information to nurses for immediate intervention.

WHICH VITAL SIGNS ARE NEEDED TO CAPTURE PATIENTS AT RISK?

The four standard vital signs for patient management include heart rate (HR), respiratory rate (RR), temperature, and blood pressure (BP). Additionally, blood oxygen saturation (SPO₂) and level of consciousness are routinely included in an acute care setting.⁸ Multiple attempts have been made to develop single parameter or an aggregate scoring method to identify patients at risk, but none has proven to be wholly sufficient.⁹ This is likely due to the fact that instability is not a static phenomenon as the patient's compensatory mechanisms attempt to correct the physiologic causes of instability.⁹

In reviewing the patient charts of those who experienced a cardiorespiratory arrest, the clearest signs of distress before the event were tachycardia, bradycardia, tachypnea, oxygen desaturation, low systolic blood pressure, respiratory distress and changes in mental status. That is to say, the highest specificity indicator for patients at risk was a combination of heart rate, respiratory rate, systolic blood pressure and change in mental status.¹⁰

Standard Outside of the ICU is for Rounding and Vital Sign Checks Every 4-8 Hours

Despite rising inpatient acuity levels, and the evidence that significant risks occur outside of ICUs, the prevailing standard for inpatient general care is for rounding and vital signs checks to occur every 4-8 hours, or more frequently during post-operative surgery, blood administration, and for patients taking certain medications as indicated by hospital policies. The data is clear: the less frequently vital signs are checked; the more likely evidence of a patient's deterioration will go undetected.

Delays are Costly

Delays in the discovery of patient deterioration directly impact outcomes and cost. In one study, the authors conclude that hospital mortality increases 3% for each hour an ICU transfer is delayed, and that those patients who are transferred experience a longer length of stay.¹¹

RAPID RESPONSE SYSTEM TO DETECT ALL PATIENTS AT RISK

Early Detection

The basic premise behind a rapid response system is that early detection and action will be simpler and more effective than delayed detection and resuscitation.¹² Manual "track and trigger" approaches, which all utilize heart rate, respiration rate, systolic blood pressure, and level of consciousness, have been employed as a means to improve detection of patient deterioration. However, intermittent vital signs measurements, or delays in recording the information, reduce the effectiveness of these approaches. A study of mature rapid response systems with track and trigger mechanisms found that potentially avoidable cardiac arrests were missed due to intermittent patient evaluation.¹³ In addition to patient acuity, system factors such as: skill mix, nurse-to-patient ratios and bed shortages potentially impact surveillance and early detection of patient deterioration in these environments.¹⁴

The Proactive Approach: Use of Continuous Monitoring in General Care Settings

The use of continuous vital sign monitoring systems in the general care setting represents a more proactive approach to identifying patient deterioration, based upon the premise that physiologic changes can indicate, and perhaps predict, deterioration episodes.⁹ The concept of continuous monitoring of all hospitalized patients received significant support following a report from an international consensus conference on the "afferent limb" of rapid response systems.¹⁵ Published in 2010, the group emphasized the need to develop a rapid response system, rather than a team, which would provide the means to detect patients at risk, followed by meaningful intervention.

ENABLING CONTINUOUS SURVEILLANCE MONITORING: VISI MOBILE® SYSTEM

The ViSi Mobile System is a body worn, multi-parameter continuous vital signs monitoring system that measures Heart Rate, Pulse Rate, Respiration Rate, SpO₂, Continuous Non-Invasive Blood Pressure and Skin Surface Temperature. ViSi Mobile incorporates multiple parameters as published data shows that patients with abnormal vital signs are more likely to suffer a serious or lethal event, and no single parameter is sufficient for detecting critical deterioration.¹⁶

IMPLICATIONS TO PRACTICE: RECENT CASE EXPERIENCE

ViSi Mobile was evaluated for a 19-week period on a neurologic general care unit that had a high incidence of rapid response calls requiring escalation of care - the need for clinical intervention to prevent harmful complications.

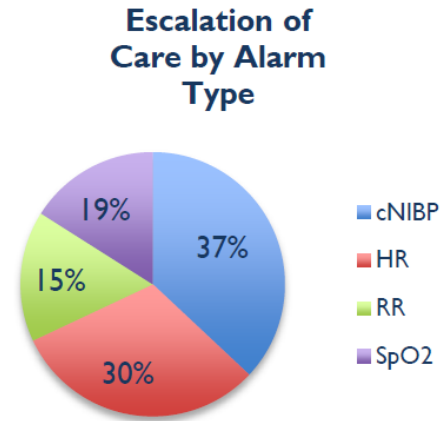
Minimizing Impact to Practice While Maximizing Value Delivered

The clinical team was highly supportive of continuous monitoring and realized the positive impact on nursing workflow and decision-making. Workflow efficiencies and timely access to data were enabled by automatically entering all vital signs data into the electronic health record (EHR). Nurses validated vital signs captured in the patient's charts, to ensure assessment and critical decision-making by the nurse. An additional layer of interoperability was achieved through integration with mobile devices routinely carried and used by the nurse. Physiologic alarms indicating the alarming condition were distributed directly to the nurse assigned to the patient, while technical alarms were sent to the nursing assistants.

All Vital Signs Mattered

All patients in the unit were monitored, regardless of their admitting diagnosis. During the study period there were numerous actionable events that included 18 incidents requiring escalation of care. The distribution of alarm types requiring caregiver attention showed the

escalation of care events by each vital sign, and in this population, continuous blood pressure, followed by heart rate, were the dominant indicators.



These findings support the consensus recommendation by the rapid response community that no single vital sign will catch all physiologic deterioration.

COST BENEFIT OF CONTINUOUS MONITORING

During this evaluation, the clinical staff reported that 31% of escalation of care incidents avoided an ICU transfer due to early intervention. As the data are finalized, savings are expected from either avoiding ICU transfer for these patients or reducing total length of stay. It is expected that the findings will be consistent with those of Dartmouth,¹⁷ and will merit consideration for all hospitals to justify the adoption of continuous surveillance monitoring on the general care floor.

REQUIREMENTS FOR EFFECTIVE SURVEILLANCE

- Provide continuous vital signs to
- The nurse caring for the patient
- Through the most effective means (a mobile device or EHR) for
- Early identification of patient deterioration and intervention.

CONCLUSIONS

The less frequently vital signs are checked, the more likely evidence of a patient's deterioration will go undetected, indicating a clear need for a continuous surveillance system to capture anomalies and allow clinical staff to intervene.

Studies indicate that no single vital sign will catch all physiologic deterioration. While numerous approaches have been taken to identify specific variables, the highest specificity indicator for patients at risk was a combination of heart rate, respiratory rate, systolic blood pressure and change in mental status.¹⁰

A rapid response system capturing a combination of vital signs including heart rate, respiratory rate and systolic blood pressure would provide the most effective means to detect patients at risk.

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