There is an ever-changing case mix on general wards with increasing numbers of older, comorbid and acutely ill patients needing more complex care and procedures. This requires a more proactive and standardised approach to the early detection of patient deterioration and monitoring of vital signs (Prgomet et al, 2016). Poor monitoring is still a concern and, of the six vital signs, respiratory rate (RR) has been shown to be the most neglected in clinical practice (Elliott, 2016). Lack of automation has been cited as one possible reason why nurses do not always prioritise RR monitoring (Elliott, 2016). The interpretation of continuous monitoring data still requires expert nurses and clinicians to inform patient care.

Continuous monitoring of vital signs on general wards has resulted in earlier identification of deterioration and a decreased need for patient rescue (Taenzer et al, 2010). Similar benefits have also been associated with intermittent monitoring strategies, such as early warning scoring systems, but this relies on accurate and timely monitoring (Prgomet, 2016). The interpretation of continuous monitoring data still requires expert nurses and clinicians to inform patient care.

Technological limitations have held back the adoption of continuous RR monitoring on acute wards. However, recent advances in sensor technology have led to devices that are non-invasive, wireless and motion-tolerant, and deliver high-quality measurement (Subbe, 2018; Lee, 2015). These devices can potentially allow clinicians to detect the earliest signs of patient deterioration and develop more accurate early warning scores to improve clinical outcomes.

For example, Danish researchers at South West Hospital, Jutland are investigating continuous RR monitoring of patients with suspected sepsis and looking at whether RR can indicate deterioration earlier compared with other vital signs, particularly oxygen saturation (SpO₂). During early stages of deterioration, identification of deterioration, increased rapid response activation and a decreased need for patient rescue (Brown et al, 2014; Tænzer et al, 2010). Similar benefits have also been associated with intermittent monitoring strategies, such as early warning scoring systems, but this relies on accurate and timely monitoring (Prgomet, 2016). The interpretation of continuous monitoring data still requires expert nurses and clinicians to inform patient care.

Continuous monitoring of vital signs has been recognised by clinicians as a way of identifying trends that might otherwise be missed by intermittent monitoring: a patient’s condition can markedly change between routine sets of observations and these ‘gaps’ pose a potential to miss signs of deterioration (Prgomet, 2016). While the time constraints may not allow more frequent manual observation, automated devices can continuously monitor vital signs.

Two studies assessing the impact of continuous monitoring of vital signs in general wards showed the use of this technology was associated with earlier identification of deterioration, increased rapid response activation and a decreased need for patient rescue (Brown et al, 2014; Tænzer et al, 2010). Similar benefits have also been associated with intermittent monitoring strategies, such as early warning scoring systems, but this relies on accurate and timely monitoring (Prgomet, 2016). The interpretation of continuous monitoring data still requires expert nurses and clinicians to inform patient care.

In this article...
- Developing technology to continuously monitor respiratory rate
- Case study of how this development could inform care

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Abstract Changes in respiratory rate often occur in advance of other vital sign changes, such as heart rate or blood pressure. Recent technological advances in sensor technology can empower nurses to continuously and accurately monitor the respiratory rate of patients on acute wards and could lead to earlier detection and intervention compared with current care.

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Box 1. Case study
Admission
Jean Everitt*, aged 73, was admitted to an acute medical admission unit at 11am with a pyrexia. She had a history of hypertension, hypercholesterolemia, atrial fibrillation and transient ischaemic attacks, and had been taking oral penicillin for a skin infection for the past two days. Doctors prescribed intravenous broad-spectrum antibiotics; blood tests confirmed highly elevated C-reactive protein and white cell count indicating infection and dehydration. Staff measured vital signs on arrival, then at 3pm and 9pm, and 9am the next morning. Ms Everitt was given intravenous fluid for dehydration, administered from arrival until 7am the next day.

Day 2
At 6am, Ms Everitt’s RR was manually counted and it was normal (16bpm) but she had a low SpO2 (89%), so an arterial blood gas test was ordered. She quickly deteriorated and her SpO2 decreased to 81%. Oxygen therapy restored normal oxygen saturations. Pulmonary oedema was diagnosed and treated and her condition was stabilised after receiving oxygen therapy and appropriate drug treatment.

Continuous monitoring
Ms Everitt had been enrolled in a study to see whether continuous monitoring of RR could help clinicians predict and identify patients’ deterioration earlier than usual care. This involved wearing a RespiraSense device, which constantly monitors respiratory rate and calculates a mean every 15 minutes. Data was available retrospectively and did not inform care. Before each deterioration, continuous monitoring showed an upward trend in RR, at six and 12 hours respectively. Manual counting identified a rise before the second incident, but in the first incident deterioration was only noticed when the patient had overt clinical evidence of severe dyspnoea.

Had the study data been available to clinicians, they could have used it to predict or identify the patient’s clinical deterioration sooner, allowing for more timely assessment and intervention.

Day 3
At 4am Ms Everitt deteriorated again. Prior to deterioration, her vital signs were acceptable, although her respiratory rate was elevated (Fig 1). At deterioration, her respiratory rate peaked and SpO2 fell. Again, acute pulmonary oedema was suspected and she was stabilised after receiving oxygen therapy and appropriate drug treatment.

References