To improve detection of patient deterioration and promote standardised practice, the Royal College of Physicians (2017; 2012) advocated for the implementation of the National Early Warning Score (NEWS) tool nationally. The tool is used to calculate an aggregate score from baseline vital signs that are key to identifying, escalating and prioritising patient deterioration.

After conducting a systematic review and narrative synthesis of the strengths and limitations of early warning scores, Downey et al (2017) found they have consistently demonstrated reliability in a variety of different patient populations. However, they highlighted the following common themes as causes for concern:

- Inaccurate recording of observations;
- Incomplete observations;
- Failure to escalate issues.

We also found these were a problem in NHS Lanarkshire. We were using a tool designed in collaboration with Scottish Patient Safety Programme, run by Health-care Improvement Scotland to encourage consistent and accurate measurement of NEWS reliability. The tool measured:

- All clinical parameters – pulse, respiratory rate, blood pressure, temperature, level of consciousness, oxygen saturation level and target oxygen saturation level;
- Frequency of observations;
- Whether the frequency is correct in the context of the NEWS score (following local observations policy);
- Frequency achieved;
- Whether there was recorded evidence of response or escalation for patients who score NEWS 3 in single parameter or NEWS 5 or greater;
- Mathematical accuracy.

In 2019, we identified a lack of reliability in the paper recording of the NEWS process in the hospital emergency care team (HECT). Specifically, there were errors in frequency, mathematical accuracy and patient escalation; in addition, ward NEWS compliance for recording vital signs was 31%. This was one of the key drivers that led us to undertake a pilot study to evaluate whether electronic recording of vital signs was a potential solution to these problems.
Conducting the study

Electronic systems can help hospitals deliver safer care by making sure that vital signs and assessment protocols are carried out correctly and consistently. For our trial, we chose to use an electronic system called Patientrack. It automatically calculates a patient’s NEWS as a composite of seven vital signs and also alerts clinicians when patient assessments, reviews, and potential planning and clinical interventions are needed by sending messages to their telephones or pagers. Patientrack has more than 40 patient assessments, each supporting a particular clinical workflow – for example, to assess for malnutrition, sepsis, acute kidney injury, and venous thromboembolism.

We carried out the pilot study in four acute care wards in a Scottish district general hospital. Our aim was to assess ward nurses’ experiences of using Patientrack to measure and calculate patients’ NEWS.

Study stages

The study was split into several stages.

Stage 1. The pre-pilot audit of NEWS measurement was completed by the HECT. This included assessing whether a full set of observations was recorded on each patient’s paper NEWS chart with appropriate frequency, mathematical accuracy and completed documentation. To ascertain this, we distributed a pre-pilot questionnaire to hospital-wide advanced practitioners and to the nurse consultant in critical care.

Stage 2. The four pilot areas were identified. Two medical wards and two surgical wards were chosen for a variety of reasons, such as wards that historically made a high number of referrals to the HECT.

Stage 3. This stage was conducted before the electronic system was implemented and involved coaching all staff on the pilot wards. Although NEWS is an effective tool, it does not replace the need for a systematic assessment to identify, prioritise and respond to a patient who is deteriorating (Resuscitation Council UK, 2016), so we coached the staff in small groups on how to conduct an airway, breathing, circulation, disability, exposure (ABCDE) assessment at a patient’s bedside. We also provided training on electronic recording and the system’s workflow.

Before implementation, the system was installed in the hospital’s operational command centre (a room used as hub for real-time patient flow activity and communication with ward teams) to allow high-risk patients to be identified during hospital-wide safety huddles. HECT staff also had remote access to the system to support the early identification and management of patients who were deteriorating.

Stage 4. Patienttrack was implemented on all four pilot wards. An opt-out clause existed in case of electronic failure; in such circumstances, staff could record NEWS on paper.

Stage 5. An anonymous questionnaire was distributed to the pilot areas to find out nurses’ and clinical support workers’ perceptions of using the electronic system; this took place 10 weeks after Patientrack was implemented. The questions were developed following discussion with, and feedback from, nursing staff in the pilot wards and by using the feedback from the pre-pilot questionnaire. The questionnaire was tested for acceptability by a group of non-pilot ward nursing staff with both high and low levels of clinical experience; they were asked how appropriate they felt the questions were in relation to their length of experience, a process known as group techniques (Polit and Beck, 2008).

Results

We distributed 118 questionnaires and 59 were returned, giving a response rate of 50%; however, some questions were not answered in full. Of the respondents, 85% said they had more than three years’ experience. Fig 1 shows the banding reported by the staff across the four pilot wards but 44% of respondents did not answer this question, which limits our ability to compare and contrast the experiences of different team members.

We were supported by the quality and effectiveness team in collating the results. We then conducted an independent analysis of all staff responses and identified three main themes:

- Ease of use;
- Individual system functions;
- Electronic NEWS compliance.

Ease of use

Most respondents who answered the question on ease of use agreed or strongly agreed that Patientrack was easy to use (Fig 2). However, 47% (27 out of 57) reported that using the system took longer than the paper version; this finding has been explored further in a subsequent study, which is yet to be published. It appears staff valued Patientrack, as 66% of respondents (36 out of 54) felt it should be rolled out to the rest of the hospital.

Clinical areas that frequently use bank or agency staff reported finding it challenging, at times, to ensure appropriately trained staff were available to record patients’ vital signs on the electronic system. Technical challenges (for example, passwords expiring and problems accessing log-in details) were also reported; these prevented some staff members from electronically recording vital signs.

Individual system functions

In Patientrack, specific flags can be applied to a patient’s record to highlight areas of care or concern, such as malnutrition or
Do Not Attempt Cardiopulmonary Resuscitation (DNACPR). The end-of-life DNACPR flag was reported as being helpful by 66% of respondents (36 out of 54); it was also found to be visible and useful in the command centre when patients were being discussed. The nurse who applies the DNACPR flag liaises with the medical team on the ward round following medical review; this meant the flag was also beneficial to the HECT - specifically, when a patient with a high NEWS was identified - as it meant an escalation plan was already under way.

Some staff members identified the possibility of developing more flags, for example, for patients with a high risk of falls. However, others felt more training was required on applying patient flags.

Electronic NEWS compliance

Up to the point at which questionnaires were distributed, a total of approximately 56,000 electronic observations had been recorded in the four pilot wards. Due to the implementation of Patientrack, the recording of complete sets of observations and the mathematical accuracy of NEWS scores was greatly increased. NEWS compliance for recording vital signs was 31% for ward staff before the pilot and 100% for the four pilot wards during the trial. This improvement was guaranteed, because Patientrack only allows for complete sets of vital signs to be entered.

NEWS frequency also improved, but remains a challenge. This is unsurprising, as only 48% of staff (26 out of 54) reported that Patientrack’s ‘NEWS due’ reminder helped them coordinate the recording of observations; however, it is unclear why this failed to improve frequency, as staff were trained on this function at the start of the pilot. This issue should be explored further, as many factors could be involved, such as ward activity, patient acuity and staffing levels.

The mean NEWS frequency reliability - showing observations completed on time - was 31% using the pre-pilot paper system and 74% for the four wards using Patientrack during the pilot (reliability was 60% for Ward A, 71% for Ward B, 86% for Ward C, and 79% for Ward D). These findings are similar to those of a study conducted by Gale-Grant and Quist (2018), but those results were achieved over a seven-month period; the data in our study was extrapolated over a 10-week period.

Challenges

Although many staff members identified positive aspects of the pilot, challenges were also identified - both in implementing and running the system – that could potentially affect patient safety. The existing IT infrastructure was frequently mentioned on questionnaire responses: staff members had problems with the log-in and log-off process, which increased the risk of missed or delayed observations.

The issues of missing or delayed observations and the associated risk to patient safety were highlighted by Vincent et al (2018). They reported that it was not uncommon for several hours to pass between observations, with some being delayed, and patient deterioration could go unnoticed as a result of this. Furthermore, correctly interpreting the information generated through these observations remains highly dependent on clinical judgement. Having a system that identifies delayed observations and the patient who is deteriorating may help combat this.
Some staff reported that log-in was too slow, particularly when they were caring for a patient who was deteriorating: “The system is not sick-patient friendly [because it] takes time to start up.”

A concern was also raised that, once logged in, the automatic log-off occurs too quickly.

The need for additional training was also identified by several respondents.

Perceived increased length of time taken for the electronic observations may have been affected by internet connectivity issues and teething problems, such as monitoring challenges and system learning. However, there was conflicting feedback from respondents: some felt it took longer to complete the vital signs observations using Patientrack as opposed to doing so on paper, while others felt it did not. Some staff noted that scoring systems should support clinical experience and judgement.

In response to the issues raised in the questionnaires by staff, changes were made to improve patient safety. To help with log-in or training issues, staff were given additional training to allow for higher-level access to resolve these problems, administrative support and project support. A bypass log-in was also created to ensure all staff had access to patient observations in an emergency. In response to concerns about staff being logged off early, we increased the amount of time before users were automatically logged off the system.

Surveys about the wifi were also arranged to assess the capacity of the IT infrastructure; this allowed us to identify areas for improvement to support a wider roll-out of this service.

Discussion
Staff members appeared to value Patientrack; Gale-Grant and Quist (2018) found a similar response in their work and planned on widespread implementation of the electronic system. However, through thematic analysis, they also found common themes – such as, IT facilities, training and communication – that challenged the success of implementation of electronically recording observations. Good IT support and infrastructure are vital for electronic observations to be achieved (National Institute for Health and Care Excellence, 2020). This support is also essential to minimise the risks to patient safety while the new system is implemented.

Our pilot was supported financially and the overall cost of the project was met through a business tender process. There is a significant financial implication for installing a system such as Patientrack, and clinicians need to be confident the organisational infrastructure will be able to deliver to the standard and efficiency required to enable hospital-wide electronic recording and pager alerts.

“A few staff members highlighted that electronically recording vital signs did not replace the need for critical thinking and clinical assessment when dealing with a patient who was deteriorating. This needs to be acknowledged if the system is rolled out further, as staff must be trained, not only in the new skills required to use the electronic system, but also in completing a competent ABCDE assessment. In addition, in their study, Downey et al (2018) found that, although patients acknowledged the potential benefits of vital signs being recorded electronically, they also had concerns that it may result in less interaction with nurses. It is important to be mindful of this.

From a patient-safety perspective, remote access to Patientrack was extended to allow the senior team and clinical leaders to review patient acuity; as this is highlighted by the system, it aided decisions relating to staffing levels and patient flow. The system was also used to help promote patient safety at hospital-wide safety huddles, which support clinical decision making such as patient escalation.

Conclusion and recommendations
Overall, nurses found the electronic system easy to use and helpful. Mathematical accuracy and completion of vital signs was 100%. There was a perceived improvement in patient safety due to the availability of timely and accurate vital signs, which would suggest an increased likelihood of earlier identification of those patients who are deteriorating. NEWS reliability and accuracy increased significantly and remote overview and handover were clearly supported.

To implement such a large-scale change and reduce the possible risk to patient safety, we suggest the following:
- Clinically test the system in a small, well-defined area;
- Learn from the experiences;
- Feed back to those involved before planning further testing and training.

Quality-improvement methodology could be used to test this system.

The importance of sustained project support is essential to minimise risks to patient safety. During this pilot, project leadership was transferred between staff; this caused challenges that will be addressed by recruiting a project team if the system is rolled out further. A robust IT infrastructure is also essential, as implementing electronic recording is a step towards developing a digital hospital. However, electronic scoring systems should be used in conjunction with clinical skills and experience.

Since undertaking this pilot, we have completed a study into whether there is a mean time difference between recording NEWS on paper and electronically, which is yet to be published. This has implications for practice in terms of freeing up time spent on recording vital signs to allow more time for caring; if this time can be spent with patients, it may alleviate their concern about reduced interaction with nurses.

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