Research article

Vital signs and early warning score monitoring: perceptions of clinical staff about current practices and introducing an electronic rapid response system

Ehsan Ullah [a], Mirza Mansoor Baig [b], Hamid GholamHosseini [c], Jun Lu [a,d,e,f,g,*]

[a] School of Science, Faculty of Health and Environmental Sciences, Auckland University of Technology, Private Bag 92006, Auckland 1142, New Zealand
[b] Data Science Team, Orion Health, Auckland, New Zealand
[c] School of Engineering, Computer and Mathematical Sciences, Auckland University of Technology, Private Bag 92006, Auckland 1142, New Zealand
[d] Institute of Biomedical Technology, Auckland University of Technology, New Zealand
[e] Maurice Wilkins Centre for Molecular Discovery, Auckland 1010, New Zealand
[f] College of Food Science and Technology, Nanchang University, Nanchang 330031, Jiangxi Province, China
[g] College of Chemistry, Chemical Engineering and Resource Utilization, Northeast Forestry University, Harbin 150040, China

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ABSTRACT

Aims and objectives: This study investigated clinical staff perceptions of learning about current monitoring practices and the planned introduction of an electronic system for patient monitoring. The aim of this research was to evaluate the perceptions of clinical staff (nurses and doctors) about the perceived strengths and weaknesses of the current state of the rapid response system (RRS) and how those strengths and weakness would be affected by introducing an electronic RRS.
Methods: This research applied a descriptive study methodology. Two detailed sessions on demonstration on the electronic RRS for measuring and recording vital signs and the electronic Early Warning System (EWS) were followed by two structured surveys administered through an online portal (SurveyMonkey) for nurses and doctors working at Taranaki District Health Board. The study was planned and conducted between October 2020 and May 2021 at Taranaki Base Hospital, New Plymouth, New Zealand.
Results: We found that the perceptions of clinical staff were a combination of key practice issues with current manual monitoring, expectations of improved visibility of vital sign charts, better communication between staff and thus improved patient care with the introduction of an electronic system. A majority (24, 60%) of nurses reported that, when called to assess deteriorating patients, the responders arrive at bedside within 5–30 min and an additional 11 (27%) said the responders arrive within 5 min. That is a collective 87% responder arrival within 30 min
Conclusion: Staff believe that an electronic RRS could improve communication, speed up decision making and have a positive impact on patient outcomes.

1. Introduction

This research investigates user perceptions about the vital signs and early warning system (EWS) monitoring on general hospital wards. It also explains the current and future practices of patient monitoring by the rapid response system (RRS) and how it works towards the goal of improving patient outcomes by timely recognition and management of deteriorating patients. This study was conducted to evaluate the perceptions of clinical staff (nurses and doctors) of learning about the perceived strengths and weaknesses of the current state of the RRS and how these users think those strengths and weakness would be affected by

introducing an electronic RRS to measure and record vital signs and EWS. The aim was also to facilitate communication between patients, primary responders (i.e., primary nurses, healthcare assists or other members of general wards), secondary responders (medical staff or senior nurses) and tertiary responders (rapid response teams) and to assist in measuring and recording the overall RRS activities including the type of care delivered as part of the rapid response activations. This study in the planning stage of technology implementation has been advocated to inform feasibility, provide insights for customization and refinement of the technology in an iterative quality improvement process to optimize the tool, and illustrate the improvements better by providing a firm baseline. The RRS is poorly

understood system. There is no published report to suggest a systematic assessment of RRS to identify and mitigate the inherent risks. The perceptions and experiences of the staff who operate the afferent and efferent limbs of RRS are not reported in literature.

1.1. Background and review of similar studies

Bagshaw [1] conducted a cross-section study at a university hospital in Alberta, Canada questioning 275 nurses to assess their beliefs about activation of rapid response activations and found that 15.4% respondents were reluctant to activate the rapid response due to fear of criticism, 15.1% were uncertain about activating the rapid response call, 10.1% stated they would not activate it if they were unable to contact a senior medical colleague, 7.5% said that rapid response calls were needed to overcome the difficulties in escalating the care otherwise and 94% agreed that rapid response calling was valuable.

A small descriptive study from a 400-bed teaching hospital in Athens, Greece conducted by Pantazopoulos et al. [2], investigated the relationship between staff demographics and identification of deteriorating patients including activation of the RRS. They found that study participants' basic qualification and attendance at a cardiopulmonary resuscitation (CPR) course significantly improved their activation of the RRS.

Philip et al. [3], conducted a small-call survey involving 41 ward-based clinical staff from the UK to report that staff had very low confidence in the reliability of vital signs and EWS recordings though recorded vital signs were often estimates rather than actual measurements and perceived lack of time was the commonest explanation for inappropriate assessment.

The above studies were conducted prior to the time of the Royal College of Physicians London (RCPL) recommending a nationally consistent National Early Warning Score (NEWS) in the UK [4] and the studies mentioned below represent the literature in the post-NEWS era.

Jenkins et al. [5], performed a small-scale cross-sectional study at a US hospital and reported that some of the study participants believed that calling the RRS was an indication that they were not able to provide adequate care to the patient. Other participants in Jenkin's study reported that if they activated the RRS, they would not be treated with respect and could also be the subject of a complaint or misconduct from the rapid response team. Half of the participants reported they had not received education or training on the RRS.

Radeschi et al. [6], conducted a large-scale multi-site study of 1278 nurses and 534 medical doctors working at a group of ten hospitals located in the Piedmont region of Italy. They reported that 5% of the staff were reluctant to activate the RRS due to being criticized, 12% were reluctant due to fear of making an inappropriate call, 21% would not call if the patient looked well despite vital signs and EWS meeting one of the calling criteria. The majority of the nursing staff (60%) thought it was necessary to activate RRT.

The first UK study from the post-NEWS era was conducted by Kolic et al. [7], who reported that 19.8% of NEWS was incorrectly calculated by the nursing staff, and that the nursing staff escalating the care to the medical team and timely response to those escalations by the medical teams was worse over the weekends compared to week days.

Douglas et al. [8], from Australia conducted a staff survey of 434 nurses and 190 medical doctors to investigate their perceptions about the RRS including perceived barriers to activation of the RRS. They reported that 17.1% of nurses and 7.9% of medical doctors were hesitant to call the RRS due to fear of criticism unless the patient was critically ill; 20% of nurses reported that if patient looked well, they would not activate the RRS; 18% of nursing staff said they had no support from medical staff; nurses thought the RRS had increased their workload; and both medical and nursing staff perceived the benefits and usefulness of the RRS.

Jackson et al. [9], from the US conducted a small-scale staff survey and reported that 71.2% of nursing respondents would contact the on-call medical doctor before activating the RRS; 29.2% of nurses were indecisive about activating the RRS if the patient looked well; and 97.6%

of nurses felt that the RRS was necessary. Jackson et al., also found a statistically significant negative correlation between years of experience and barriers to activating the RRS.

Prgomet et al. [10], performed a small-scale survey at two general wards in an Australian hospital and reported that participants felt satisfied about their ability to identify patients at risk of deterioration using a combination of vital signs and visual assessment. Prgomet's study participants were concerned about the frequency of vital signs observations and the accuracy of the equipment used. Both the nursing and medical respondents believed that implementing an electronic monitoring system would enable early detection of deteriorating patients, could reassure patients, and could speed up the inter-professional communication in the context of deteriorating patients. Prgomet's participants were cautious about an electronic system which could reduce bedside nurse-patient interactions, lead to unnecessary alerts and cause discomfort to patients.

Stolldorf [11] explored the perceptions of nursing staff, rapid response teams and nursing leaders about the RRS. All participants reported that the RRS is beneficial to staff, patients, and organisations. Stollforf reported variations in the benefits of the RRS among the study groups where nursing staff frequently reported the benefits of the RRS to the general ward staff and patients, rapid response team members focused on training and education and nursing leaders focused on organisational and other macro-level benefits.

Astroth et al. [12], conducted a survey of 202 general ward nurses to report that lack of continuing education and an organisational culture of blame were negatively correlated with activation of the RRS whereas the years of experience were positively correlated with activation of the RRS among the study participants.

Quieroz and Nogueira [13] undertook a small-scale study to assess the perception of nurses about the quality or maturity of the RRS in its structure, process and outcomes. They identified that 25 out of 37 items they analysed had a satisfactory positive index. Their findings showed that, according to nurses' perceptions, the process dimension of the RRS was the most vulnerable.

The aim of this study was to investigate clinical staff perceptions of current monitoring practices and the planned introduction of an electronic system for patient monitoring to:

  i) Assess nurses' views and confidence regarding current vital signs monitoring tools and practices
 ii) Gauge doctors and nurses' perceptions regarding the introduction of electronic monitoring of vital signs and EWS through devices and sensors
iii) Obtain staff feedback on issues identified within current and proposed systems

2. Methods

This was a descriptive study comprising of two detailed sessions demonstrating the features of VitalsAssist – an electronic early warning system – followed by a staff survey administered through an online portal (SurveyMonkey) inviting the nurses and doctors working at Taranaki District Health Board (TDHB). The study was conducted between October 2020 and May 2021 at Taranaki Base Hospital (TBH), New Plymouth, New Zealand. The study site employs 510 nurses and 160 doctors, a total of 680 staff in these two staff categories [14].

The sample size was calculated using the method described by Sullivan et al. [15].

- Population size (for finite population correction factor or FPC) (N): 680
- Hypothesized % frequency of outcome factor in the population (p): 10%
- Confidence limits as % of 100 (absolute $+/-$ %) (d): 5%
- Design effect (DEFF): 1

A sample size of 116 was calculated using this method.

Before the staff perception survey, we conducted two demonstration sessions on the electronic system so that staff who routinely work within the existing RRS also got familiar with the electronic RRS. These demonstration sessions were run by EU and MMB as hands-on workshops whereby EU and MMB presented the salient features of the electronic system through a PowerPoint presentation and addressed participants' questions. This was followed by a real-time demonstration of the electronic system with volunteering participants wearing the sensor-devices connected with the electronic system through Bluetooth connectivity with their informed consent. The participants were shown how their vital signs were captured in real-time and an EWS was calculated automatically. The participants, other than those volunteering, could also see the primary nurse view, the ward view, and the secondary responder view of the electronic system. The primary nurse view shows a primary nurse all the patients allocated to a primary nurse. One third of the participants took turns to wear the sensor-devices and have their vital signs captured by the system. In total, 77 participants attended these sessions i.e., 54 nurses and 23 doctors. A summary of these sessions was published for the entire 680 medical and nursing staff.

The first draft of the survey questionnaire was developed by the researchers (EU and MMB) based on the previous studies [3, 10, 16, 17] examining staff perceptions about patient monitoring practices. The questionnaire was assessed by a panel of senior medical and nursing professionals at Taranaki District Health Board for validation and approval. The panel nominated two reviewers (JA, an intensivist and CM, a senior nurse) who checked and validated the survey questionnaire from a medical and nursing perspective. The reviewers completed their assessment on 27 January 2021. The final questionnaire was approved by the panel on 28 January 2021 as shown in Table 1.

This questionnaire explores the perceptions of nursing and medical staff regarding their interactions with RRS e.g., assessing workload involved in measuring vital signs, how long it usually takes nurses to escalate patient's care to a secondary responder. The questions are formulated with existing RRS processes at the study site as well as the differences between the existing RRS processes and the demonstrated model of the electronic system. The survey was run through the study site's official online survey platform on Monday 01 February 2021. There were organization-wide communications through newsletters, intranet posts and direct emails targeting nursing and medical staff. These communication channels included a summary of the demonstration sessions. This

summary was also included at the beginning of the survey to refresh participants' memories, thus ensuring the survey respondents were aware of the electronic RRS. The survey remained active for a period of three weeks until Monday 22 February. The survey was open to any medical and nursing staff who attended the demonstration sessions or read the information about the electronic system and were volunteering to participate in the study. Other clinical and administration staff were excluded from the survey.

The survey results generated by the survey platform were presented as graphs and tables as numbers and percentages. The study was approved by the institutional Ethics Committee of Taranaki District Health Board on 5 January 2021.

3. Results

The electronic survey was responded to by 121 participants, 18% of the total medical and nursing staff. The survey respondents included 84 nurses (general hospital ward nurses, PaR nurses and other senior nurses) and 37 doctors (specialists, registrars, and house officers). The survey was run anonymously, and no demographic data was collected as it was considered a potential identifier along with staff's professions and job titles.

3.1. Perceptions of nursing staff

3.1.1. How nurses ensure they undertake the vital signs measurements in a timely manner

A total of 40 nurses responded to this question. The most common means/reminder used by 21 (52.5%) respondents was the shift planner followed by personal diary or mobile phone reminders (6, 15%), going by a routine of undertaking vital signs every 4 h (6, 15%), going by the time indicated by last set of vital signs (5, 12.5%) and use of other ways of personal checklist keeping (2, 5%) as shown in Figure 1.

3.1.2. Tools and technology used by nurses to communicate with responders when needed

Forty nurses (47.6% of nursing survey respondents) opted to answer the question about the tools and technology they use to inform about deteriorating patients when one of the calling criteria is met. The most frequent tool used by nurses was Pager (15, 37%), followed by Task Manager (11, 28%), Cellphone (8, 20%) and Landline phone (6, 15%).

3.1.3. Time required to convey the clinical information to responders when a 777-call is not indicated

This question explored the perception of nurses about the time required to communicate with responders such as Patient at-risk Nurse, Resident Medical Officers, or rapid response team to convey clinical information about deteriorating patients. A third (13, 32.5%) of nurses reported this takes less than 5 min and 18 (45%) reported it takes 5–30 min. Only three (7.5%) said it takes over 30 min and six (15%) reported this time was variable in their experience.

3.1.4. Timelines of responders to arrive at bedside to assess deteriorating patients

A majority (24, 60%) of nurses reported that when called to assess deteriorating patients, the responders arrive at the bedside within 5–30 min and an additional 11 (27%) said the responders arrive within 5 min while a few nurses reported variable times or longer than 30 min for responders to arrive at the bedside as shown in Figure 2.

3.1.5. Nursing staff's perceptions about key issues with the current RRS

Nursing participants were asked to pick one or two key issues with current manual vital signs monitoring through NZ-EWS charts. The most (81, 98.8%) picked one to two issues out of seven choices and two nurses opted to use the free text field to report that the system in place was good but organizational compliance was poor. A total of 140 selections were made by 81 participants as shown in Figure 3.
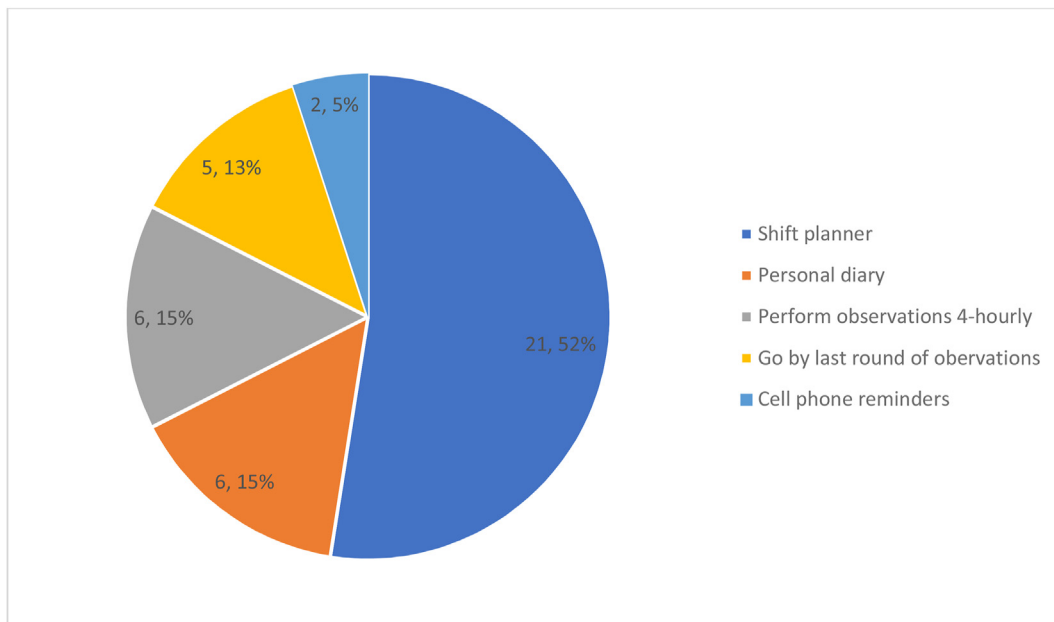
Table 1. Staff survey questions.

Part 1: Questions for nursing staff	Part 2: Questions for medical staff
Q1: What do you do to remind yourself about the time when the vital signs/ observations are due for the patients allocated to you?	Q1. Do you support the concept of an electronic RRS machine that detects, and records vital signs can also calculate the EWS score?
Q2. Describe in your own words the tools (phone, pager) and the mechanism (voice call, text message) by which you would escalate the care of a patient whose EWS is higher e.g., 6–7?	Q2. Do you see benefit in an electronic RRS that allows you to access patient's vital signs EWS score, enter your review and communicate that with the bed-side staff remotely?
Q3. How long it does it usually take you to reach someone by phone call/pager, and to convey the clinical concerns such as raised EWS or critically deranged specific vital signs when required?	Q3. Do you prefer automatic calculation and communication of EWS scores straight to the relevant clinician(s)?
Q4a. How long it does it usually take to get the patient seen by a Patient-At-Risk nurse? Q4b. How long does it usually take to get a patient seen by a junior doctor?	Q4. Would you prefer manual validation of vital signs and EWS by nursing staff?
Q5. What are one or two key issues with current EWS charts (paper-based), in your view (if any)?	Q5. What are one or two key issues with current EWS charts (paper-based), in your view (if any)?
Q6. What benefits or issues do you anticipate of such electronic RRS?	Q6. What benefits or issues do you anticipate of such an electronic RRS system?

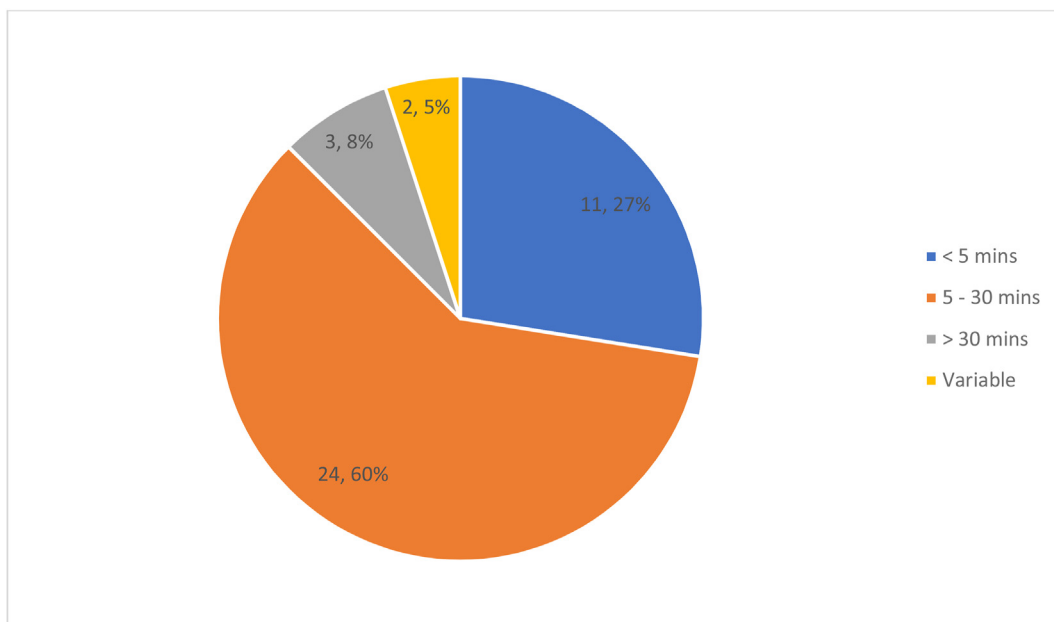**Figure 1.** Reminders used by nurses to undertake vital signs measurement in a timely manner.

Figure 2. Timeliness of responders to arrive at bedside to assess deteriorating patient when called for review by nurses (excluding 777-calls).

3.1.6. Expectations from electronic system

Over two-thirds (n = 29, 71%) of nursing participants expected that the electronic system for vital signs would improve the accessibility of data, communication between teams and patient outcomes when asked on a Likert scale as shown in Figure 4.

3.2. Perceptions of medical staff

3.2.1. Expectations from electronic system

Over three quarters (24, 77%) of medical staff expected that the electronic system for vital signs would improve accessibility of data, communication between teams and patient outcomes when asked on a Likert scale as shown in Figure 5.

3.2.2. Willingness and support for implementation of electronic RRS

Two third of the medical staff (20/31, 64.5%) responding to the survey supported the idea of implementing electronic RRS whereas 9 (29%) strongly agreed with this, and 11 (35.5%) agreed. Only 4 (12.9%) disagreed and none strongly disagreed with this idea. Seven (22.8%) were unsure whether the electronic RRS would be beneficial in the management of deteriorating patients as shown in Figure 6.

3.2.3. Automated escalation of deteriorating patients (higher EWS) to relevant clinician

Responding to the question about auto-calculation of EWS and automated communication and/or alert to relevant clinicians directly by the electronic RRS application, half (17 out 36, 47.2%) of the
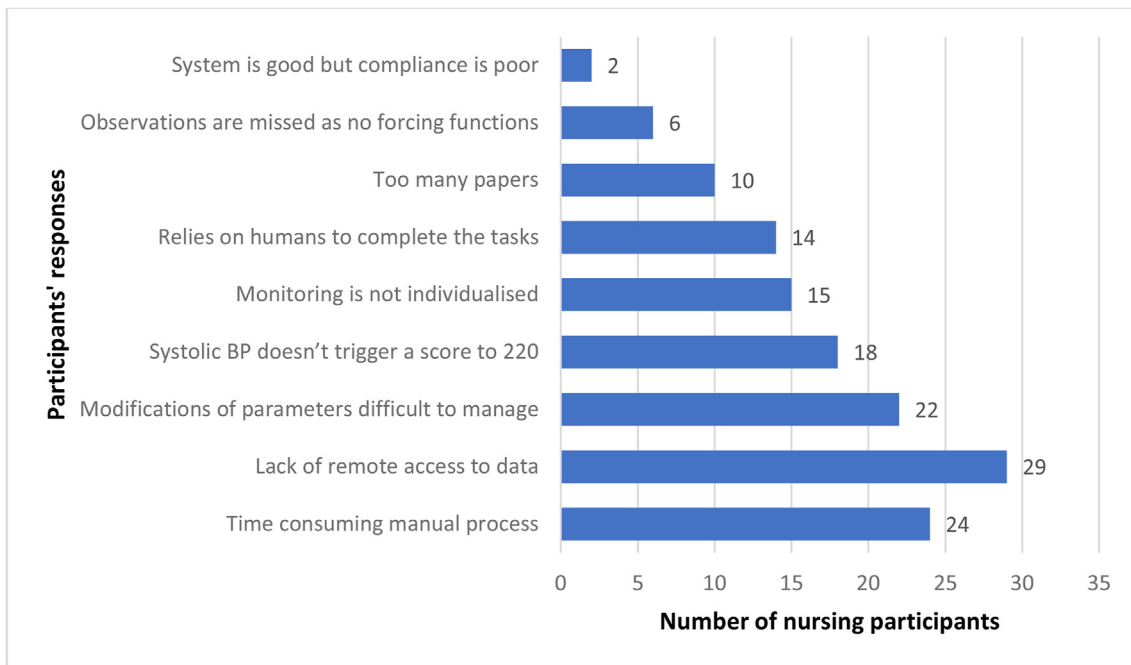
Figure 3. Key issues with current RRS processes according to nursing staff, x-axis showing number of participants per each section and y-axis showing sections with participants response for each.
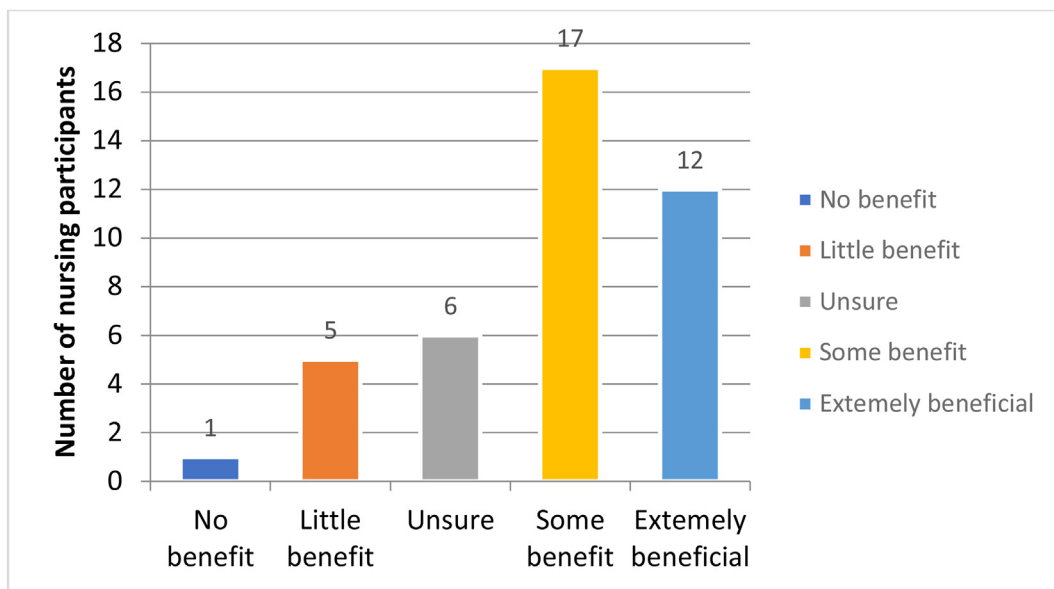

Figure 4. Nursing staff's expectations/perceived benefits of electronic system (number of nursing participants in y-axis).

medical staff agreed or strongly agreed with the usefulness of this function of the electronic RRS. Six (16.7%) disagreed and one (2.8%) strongly disagreed with auto-escalation of deteriorating patients by the electronic RRS whereas 12 (33.3%) were unsure about this, as shown in Figure 7.

3.2.4. Perceived issues with current RRS

Medical staff were asked to describe in their own words at least one issue they face using current RRS through paper based NZEWS charts and escalation of deteriorating patients through telephone and pagers. Similar responses were grouped together into broader ideas/topics as shown in Table 2.

3.2.5. Perceived benefits from implementation of electronic RRS application

The medical staff were asked to describe in their own words one or more benefits of implementing an electronic RRS application after having the demonstration of the electronic RRS application. Similar responses were grouped together into broad ideas/topics as shown in Table 3.

4. Discussion

Our findings provide staff perceptions on the key issues associated with the paper based RRS as well as the perceived benefits of the electronic RRS. A primary issue with the current RRS is the lack of reinforcing function or reminder mechanism for the primary nurses about the
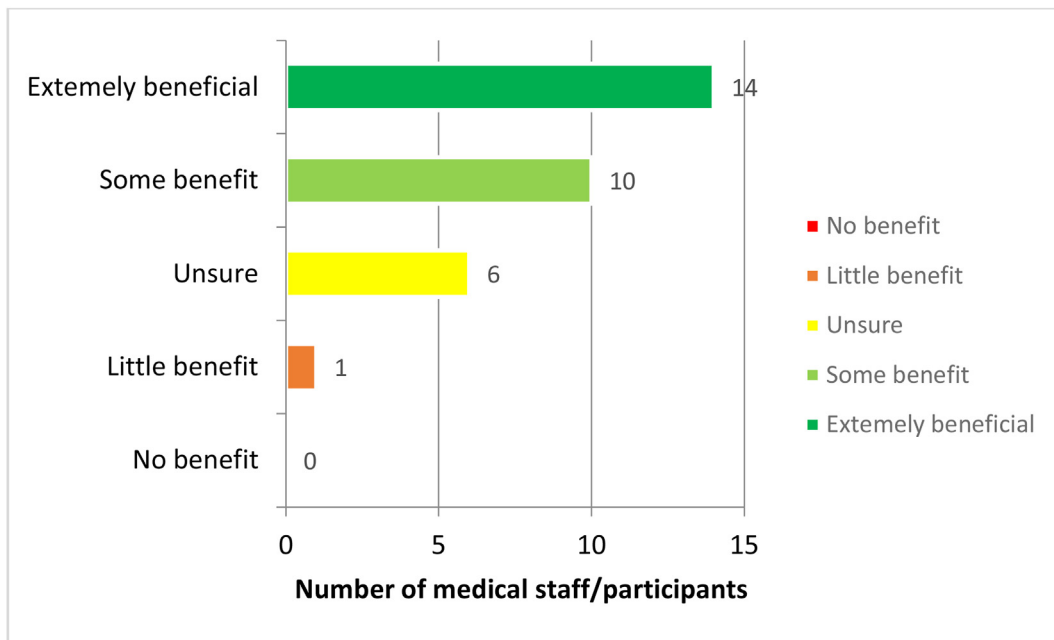
Figure 5. Medical staff's expectations/perceived benefits of electronic system (x-axis – medical staff/participants).
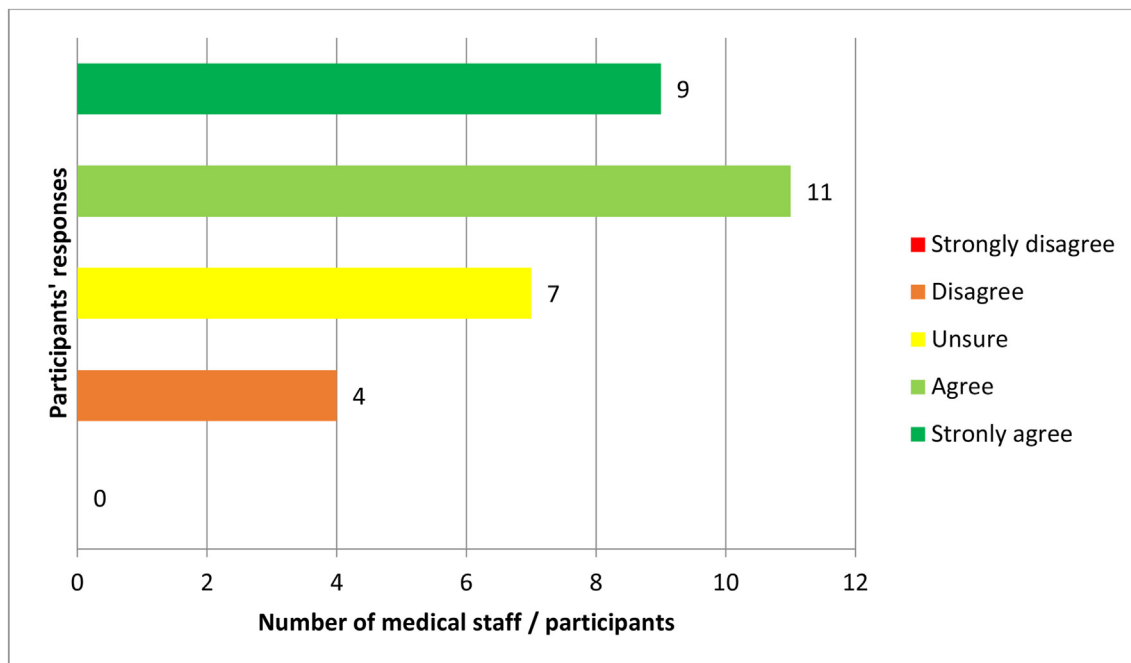

Figure 6. Willingness and support from medical staff about implementation of electronic RRS (x-axis – Number of medical staff/participants).

timeliness of the vital signs observations. This issue means the current RRS relies heavily on the nursing staff's vigilance on the timely collection of the vital signs observations, which are the fundamental step in the entire cascade of the RRS. Studies show that with varying patient acuity, staffing levels, and multitude of the tasks nursing have any time [18, 19, 20], this is a fallible mechanism. Similarly, when primary nurses escalate the care to the primary or secondary responders, it is not always possible for the responders to timely review the patients [21, 22] merely because they need to visit the patient in-person as the current RRS doesn't allow them to review patient's vital signs and EWS remotely. In our study, about two-thirds (26, 65%) of the nursing survey respondents reported use of the pager system to send brief text messages and use of the in-house task management desktop application called 'TaskManager' to contact primary responders for deranged vital signs or elevated EWS. This highlights that sometimes the current RRS communications do not follow the expected use of tools and technology whereby the applications such as TaskManager, which are designed for tracking and management of after-hours tasks of low urgency, and categorically use of this application is discouraged for the purposes of the RRS. Such inconsistency in the use of communication tools in the existing RRS, could make the RRS prone to errors, delays and failures in recognition and response to deteriorating patients [15, 16, 17].
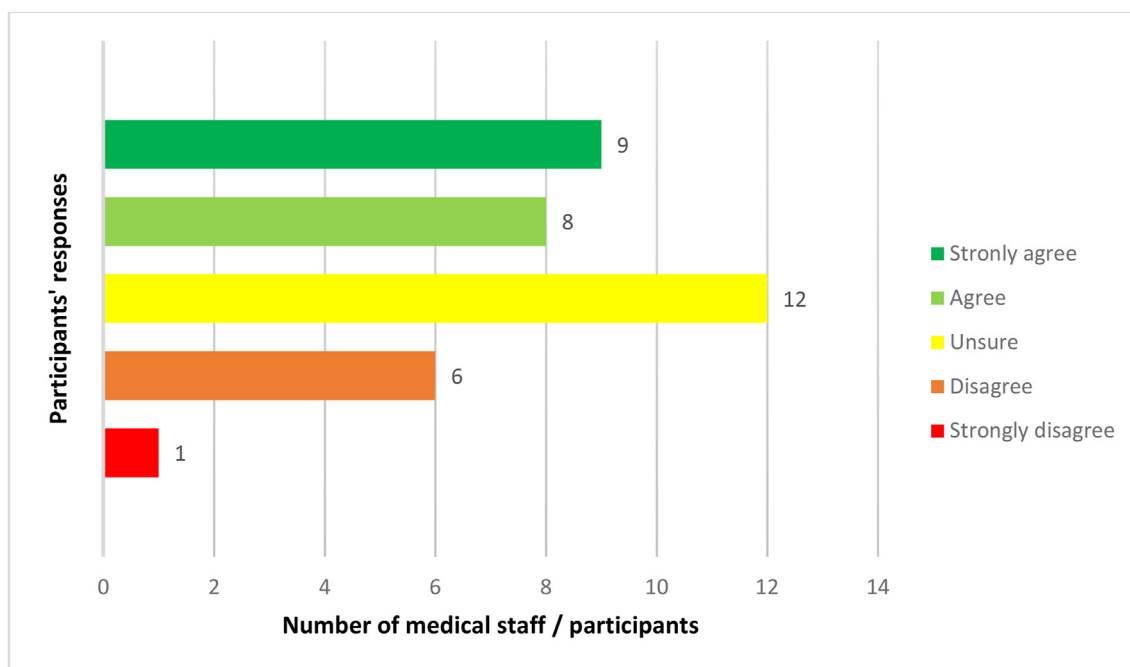
Figure 7. Perceptions of medical staff about auto-escalation of deteriorating patients by electronic RRS (x-axis – Number of medical staff/participants).

Table 2. Key issues with current RRS perceived by medical staff.

Key issues with current RRS as perceived by medical staff	N	%
Failure in triggers due to errors and omissions in monitoring, or nursing staff unsure about deterioration	9	29.0
Doctors do not always fill modified EWS criteria resulting in unnecessary calls and extra work for nursing and medical staff	8	25.8
Tracking of trends in vital signs is sometimes lost due to incorrect order of paper charts	7	22.6
Paper-charts may not always be easily accessible at bedside, as needed by other staff from time to time	4	12.9
No triggers for pain, high systolic BP (<220) & hypothermia	3	9.7
Total	31	100

Table 3. Key Benefits of electronic RRS application perceived by medical staff.

Key Benefits of electronic RRS as perceived by medical staff	N	%
Information becomes accessible easily (onsite and remotely)	10	32.2
Staff will get more time to interpret the observations and other aspects of patient care when the electronic RRS replaces manual VS measurements and documentation	7	22.5
Remotely accessible information should help quick decision making and quicker response to deteriorating patients by specialist resources such as senior clinicians and PaR nurses who would not need to first reach the bedside to find out actual VS and EWS trends and values	5	16.1
Single system removes the need for multiple telecom tools and thus should reduce communication issues	5	16.1
Trends and personalized readings for VS and EWS would become possible with electronic RRS application	4	12.9
Total	31	100

A majority (24, 60%) of nurses reported that, when called to assess deteriorating patients, the responders arrive at bedside within 5–30 min and an additional 11 (27%) said the responders arrive within 5 min. That is a collective 87% responder arrival within 30 min.

There are several studies reporting staff perceptions about patient monitoring through vital signs, categorising deteriorating patients by applying one or the other model of early warning score and escalating the care for a rapid response. However, most of these studies focused on one or two aspects of the rapid response system.

A survey from the UK by Donohue and Endacott [23] studied perceptions of ward nurses and those of the specialised critical care outreach staff (New Zealand equivalent of COO is Patient-at risk or PAR nursing service) to report that staff didn't use their version of EWS to assess the

deteriorating patient, rather they used it to triage deteriorating patients using EWS.

Another study from Europe by Ludikhuize et al. [24], reported that EWS was used by 11% of nursing staff in the Netherlands to notify medical colleagues about deteriorating patients.

Wynn (2009) conducted a small-scale survey at a US hospital using self-reported questionnaires by 75 nursing staff. They reported that nursing knowledge and experience was associated with their actions towards patient monitoring and rapid response activities. They also found that in 34% of cases, over 2 h had elapsed since the first documented abnormality in the vital signs before a rapid response call was activated.

A recent study by Azimirad et al. [20], comparing English and Finnish rapid response systems demonstrated that in 50% of cases,

nurses failed to activate the rapid response system in a timely manner, a finding which consistently prevailed in the sample population of nurses from both counties. Azimirad et al., reported that nurses didn't perceive disagreement of medical colleagues as a strong barrier to activating the RRS. Doctor's disagreement was less important according to Finnish nurses' perception than their British counterparts. Azimirad et al., recommended nurses needed education towards the identified gap in their knowledge about timely activation of the RRS.

McNeill et al. [25], studied the perceived benefits of the RRS and the timeliness of the RRS activations, to report that staff perceived the RRS creates a supportive and learning environment conductive to teamwork in an effort to improve patient outcomes. They also reviewed 120 vital signs charts to find out a total of 15 RRS activations, over half of which were related to a respiratory problem. Mean length of the RRS calls was 39 min, where 12/15 calls were made within 30 min.

Burrell et al. [26], reported that, despite RRS having come a long way to becoming a routine part of clinical practice to detect and respond to deteriorating patients, many RRS activations do not occur when indicated. Burrell et al., reported that ward nurses may still be reluctant to activate the RRS due to fear of reprimand, but introducing a proactive, dedicated team of rapid responder nurses would facilitate inter-professional communication, increase the RRS activations to allow early detection and management of deteriorating patients, reducing ICU admissions and patient adverse events.

The main limitation of this study is that we surveyed at a single centre where only paper-based vital signs and EWS charts are used to drive the RRS. There are centres within New Zealand and overseas where paper based and electronic RRS or electronic RRS alone are deployed. We made our best efforts to familiarise the survey respondents with both types of RRS to overcome this limitation. Our findings are also supported by another study conducted by the authors utilising Failure Mode and Effect Analysis (FMEA) to identify failure modes within the existing paper based RRS [27]. This recent FMEA also supports that an electronic RRS could address a majority of the issues perceived as key problems within the paper based RRS. Therefore, we support that the findings are applicable to the New Zealand context and abroad.

5. Conclusions

Staff believe that an electronic RRS could improve communication, speed up decision making and positively influence patient outcomes. Our results provide a baseline for future comparisons when an electronic system is adopted such as described by Baig et al. [28].

Our findings suggest a need for further research into staff perceptions about the RRS and involving RRS users right from the patients and their families and general ward nurses most closely monitoring the patients, through all types of rapid responders, to the organizational leadership in future re-designs and refinements of the RRS, as part of the quality improvement limb of the mature RRS as suggested by recent studies [11, 16, 29]. Padilla et al. [29], reviewed the structured instruments available to study staff perceptions related to the RRS and suggested using Rapid Response Team Facilitators and Barriers Survey (RRT-FBS) developed by Astroth et al. [30], and a few other survey questionnaires. We endorse suggestions made by Padilla et al. [27].

Declarations

Author contribution statement

1 - Conceived and designed the experiments: Ehsan Ullah, Mirza Mansoor Baig, Hamid GholamHosseini, Jun Lu

2 - Performed the experiments: Ehsan Ullah

3 - Analysed and interpreted the data: Ehsan Ullah

4 - Contributed reagents, materials, analysis tools or data: Mirza Mansoor Baig, Hamid GholamHosseini, Jun Lu

5 - Wrote the paper: Ehsan Ullah, Mirza Mansoor Baig, Hamid GholamHosseini, Jun Lu

Data availability statement

Data will be made available on request.

Declaration of interest's statement

The authors declare no conflict of interest.

Additional information

Supplementary content related to this article has been published online at https://doi.org/10.1016/j.heliyon.2022.e11182.

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