Global Qualitative Nursing Research
Volume 10: 1–11

DOI: 10.1177/23333936231210147
journals.sagepub.com/home/gqn
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Nurses' and Physicians' Ideas on Initiatives for Effective Use of the Early Warning Score: A Participatory Study

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Abstract

Ineffective use of the early warning score (EWS) can compromise recognition and response to patients' deteriorating condition. This study explores nurses' and physicians' ideas on initiatives for supporting the effective use of the EWS in a hospital setting. Participatory workshops were conducted, and data were analyzed using content analysis. Ideas generated for integrating new functions into the EWS protocol to facilitate effective use are described. Also recommended was that all users receive training and an update on how to use the EWS score to support acceptance and confidence using the protocol and thereby increase adherence to the EWS. Further research is needed on the efficiency of incorporating nurses' clinical judgment in the EWS protocol within different specialties and the effect on adherence to the tool.

Keywords

early warning score, clinical judgment, hospital rapid response system, nurses, participatory design, interprofessional collaboration, Denmark

Received June 30, 2022; revised October 7, 2023; accepted October 10, 2023.

Introduction

The early warning score (EWS) is a decision support tool based on systematic observations of patients' vital parameters and predetermined response protocols to support clinicians' decisions to ensure appropriate management of deterioration and prevent adverse events (McGaughey et al., 2021). Although there is international consensus that EWS is advantageous for quality of care and patient safety (McGaughey et al., 2021), systematic reviews examining the effect on patient outcomes report conflicting results (Credland et al., 2021; Downey et al., 2017; McGaughey et al., 2021). Furthermore, nurses do not always perceive the EWS as useful, which may leave patients at risk for harm if they disregard EWS (Winters et al., 2013; Wood et al., 2019). The effectiveness of EWS depends on nurses and physicians collaborating to recognize deteriorating patients and to appropriately intervene to prevent adverse events (Connolly et al., 2017). The purpose of this study was to explore the ideas on initiatives of nurses and physicians about the effective use of EWS in a hospital setting.

Background

The EWS is a rapid response system consisting of an afferent and an efferent component (McGaughey et al., 2021). The afferent component includes measurements of vital parameters: systolic blood pressure, pulse rate, respiratory rate, oxygen saturation, temperature, and level of consciousness, that indicate deterioration and are used by nurses to trigger a team response (efferent component).

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The efferent component of EWS is dependent not only on the nurse's decision to trigger a response, but also on how nurses and physicians collaborate (McGaughey et al., 2021; Winters et al., 2013). Different EWS types exist and are commonly used in Australia, United States, The Netherlands, United Kingdom, and Scandinavia (Credland et al., 2021; Petersen et al., 2017). In this study the term EWS refers to both the afferent and efferent component.

There is limited evidence from randomized controlled trials to support the effects on patient outcomes such as intensive care admission and death after implementing the EWS (McGaughey et al., 2021). However, the EWS supports clinicians in identifying patients who are in low and high risk of dying within the next 24 hours after admission (Haegdorens et al., 2020; Holland & Kellett, 2022). As risk of death increases with higher EWS', early identification of patients in high risk of deterioration is useful to enable responses to prevent further deterioration and potential adverse events (Holland & Kellett, 2022; Smith et al., 2013).

Despite the ability of EWS to help identify deteriorating patients, implementation of the EWS into clinical practice has been found to be inadequate in many contexts (Braun et al., 2022; Connolly et al., 2017; Credland et al., 2021). Variations in adherence to EWS protocol has been related to a variety of factors including lack of understanding about the purpose of EWS, underestimation of abnormal vital signs, nursing workloads, and limited medical and nursing support (Braun et al., 2022; Connolly et al., 2017; Foley & Dowling, 2019; Mølgaard et al., 2022; O'Neill et al., 2021). Adherence with the EWS escalation protocol is critical in supporting appropriate and effective recognition of and response to deteriorating patients and their survival (Braun et al., 2022; Credland et al., 2021; Kolic et al., 2015; Olsen et al., 2019).

However, there is evidence that nurses experience the protocol to be too sensitive toward changes in vital parameters and non-specific to patient deterioration, which is a barrier for nurses' adherence to the escalation protocol (Olsen et al., 2019). This experience often results in alert fatigue among nurses and doubt about the EWS' usefulness, which may reduce the use of the EWS as an integral part of nurses' decision-making (Braun et al., 2022; Connolly et al., 2017; Douglas et al., 2016; Olsen et al., 2019).

Nurses' decision making is based on a judgment informed by, for example, observing and interacting with patients, experience, knowledge stemming from research, and theory (Higgs & Turpin, 2019). The EWS is a tool that can assist nurses in making judgments about a patient's condition before deciding on interventions (Connolly et al., 2017; Higgs & Turpin, 2019). Consequently, it is a dilemma that the nurses experience limited usefulness of the EWS and may neglect its contribution to decision-making.

Collaboration between nurses and physicians is required for effective use of the EWS, in that collaboration supports advanced problem solving and clinical decisions that optimize patient management to prevent further deterioration (Allen et al., 2017; Douglas et al., 2016; Olsen et al., 2019). However, limited communication between nurses and physicians about patients' EWS is a barrier for nurses' adherence to the EWS protocol and may result in delayed recognition and response (Foley & Dowling, 2019; Wood et al., 2019). Delays in physicians' response times and different opinions of how to use the EWS contributes to inconsistencies in nurses' response and escalation strategies, which may affect patient safety (Connolly et al., 2017; Foley & Dowling, 2019; Petersen et al., 2017; Wood et al., 2019).

To achieve effective recognition and responses, mutual understanding between nurses and physicians of their collaboration roles is suggested (Connolly et al., 2017; Mølgaard et al., 2022; O'Neill et al., 2021). However, knowledge on nurses' and physicians' needs and collaboration for using the EWS is sparse (Douglas et al., 2016; Olsen et al., 2019).

Methods

This study is part of a multiple method qualitative study with the aim to investigate nurses' use of the EWS and to explore nurses' and physicians' ideas on initiatives that can support nurses' use of the EWS (Mølgaard, 2023; Mølgaard et al., 2022). The first study, a focused ethnographic study, found that the nurses' use of the EWS was influenced by the value nurses attributed to clinical judgments irrespective of EWS scores, and differences between nurses' and physicians' perceptions of and expectations for use of the EWS (Mølgaard et al., 2022). The focused ethnographic study provided important insights into the context of EWS use and issues influencing effective implementation of the EWS in clinical settings. Based on the value of user-driven innovation (Kanstrup & Bertelsen, 2016), the aim of this follow-up study was to engage in a participatory process with nurses and physicians to generate ideas on initiatives to support the effective use of the EWS in a hospital setting.

Study Design

This study applied a participatory design. The aim of participatory design is to secure an engaging and cooperative process of data collection based on the participants' expertise within the specific focus area (Robertson & Simonsen, 2013). The motivation in participatory design is to foreground participants' contributions in the design process to achieve successful implementation (Robertson & Simonsen, 2013). Efforts to achieve genuine participation through engagement of users in the process is pivotal for establishing changes within the specific practice (Robertson & Simonsen, 2013).

Principles of participatory design were used to engage nurses and physicians in discussing their practice and to explore their ideas on initiatives for using the EWS in their shared practice (Kanstrup & Bertelsen, 2016; Robertson & Simonsen, 2013). Our study is reported in accordance with the Consolidating Criteria for Reporting Qualitative Research (COREQ) guideline.

For structuring the participatory process, the "User Innovation Management" method described by Kanstrup and Bertelsen (2016) was used. This method guided the participatory process around the steps: *select*, *plan*, *insight*, *vision*, and *sketch* (Kanstrup & Bertelsen, 2016). The method provided a structure for selecting participants *(select)* and planning the participatory process including methods to use for the data collection *(plan)*. The method was used for eliciting participants' needs and motives deriving from practice to use the EWS *(insight)* as a basis for exploring their visions for future use in practice *(vision)*. The explored visions are the foundation for development of ideas on initiatives to use the EWS in clinical practice *(sketch)*. The first author planned the process following these steps. Subsequently, the planned process was discussed with the fourth author and refined according to the discussions. The *select* step is reported under the heading "Sampling and participants." The remaining steps are elaborated in the "Data collection" section.

Setting

The participatory process was conducted with nurses and physicians employed in one surgical and one acute ward at a Danish University Hospital. The surgical ward employs 24 nurses, 3 health care assistants, and 10 physicians. The acute ward employs 70 nurses, 6 health care assistants, and 35 physicians. When staff shortages occur, both wards are assisted by agency staff such as nursing students, health care assistants, and occasionally staff with a non-healthcare background. All nurses in Denmark (since 2001) hold a bachelor's degree in nursing. The EWS used at this Danish University Hospital is developed on the basis of the British NEWS (Royal College of Physicians, 2017) and modified with inspiration from the New Zealand Wellington EWS (Health Quality & Safety Commission New Zealand, 2016). The EWS is to be used at set times in general or acute wards among patients aged 16 years and above. An EWS of >5 mandates nurses to call for medical assistance.

The process of collecting data was held in a location outside the hospital. This was done to facilitate an undisturbed, stable, and dynamic environment for the participants during the participatory process (Muller & Druin, 2012).

Sampling and Participants

Five nurses and four physicians from the first study (Mølgaard et al., 2022) were contacted by email and informed about the study and time and place for the process. Two physicians were unable to participate while five nurses and two physicians volunteered to participate. Seven participants were adequate to enable in-depth and nuanced discussions of the topic of interest (Kanstrup & Bertelsen, 2016).

The nurses' clinical experience ranged from 10 to 37 years and the physicians had 15 and 16 years of experience, respectively. Four nurses and one physician had experiences from other specialties than their current. One nurse and one physician had received formal introduction to the use of the EWS. The remaining participants had not received formal introduction. See Table 1 for participants' characteristics.

Table 1. Participants' Characteristics.

Participant	Sex	Ward	Years of work experience	Years of experience from another specialty	Received introduction to the use of the EWS
Nurse 1	Female	Surgical	37	11	X
Nurse 2	Female	Acute	24	16	Did not remember
Nurse 3	Female	Acute	10	4	—
Nurse 4	Female	Acute	10	0	—
Nurse 5	Female	Surgical	11	1	—
Physician 1	Male	Surgical	16	0	X
Physician 2	Male	Acute	15	7	—

Data Collection

For collecting data, principles of participatory design were combined with the workshop method and framed by the "User innovation Management." The intention was to create a hybrid space for the participants and the researchers to communicate and share insights (Muller & Druin, 2012). The insights were gained from the participants' experiences with using the EWS, and the sharing of these created new perspectives of needs, motives, visions, and initiatives for use of the EWS (Muller & Druin, 2012). Workshops as a hybrid space is obtainable when researchers and participants work in joint action to discuss and negotiate common ground (Muller & Druin, 2012).

The two workshops were conducted on March 16th and May 11th, 2021. The workshops were facilitated by an experienced researcher and facilitator of participatory workshops (fourth author) within health care settings. During the workshops, the first author co-facilitated the discussions. The workshops were audio-recorded. The workshops are described in detail in the "Supplemental File 1."

Workshop 1. The aim was to explore participants' needs, motives, and visions for use of the EWS. Hence, Workshop 1 covered the *insight* and the *vision* step. To spark the discussions the workshop was initiated with a presentation of findings from the preceding ethnographic study (Mølgaard et al., 2022). Following the presentation, the participants were asked in two groups to identify needs and motives for using the EWS in their practice. Subsequently, participants were asked to envision future use of the EWS (see Table 2 for elaboration). The discussions in the workshop provided a basis for exploring ideas on initiatives for using the EWS in clinical practice in Workshop 2. Workshop 1 lasted 3 hours.

Workshop 2. The aim was to explore ideas on initiatives for using the EWS. Workshop 2 covered the *sketch* step. The

Table 2. Methods Used in the Workshops.

Method	Description of method	Use of method
Envisioning future use of the EWS by initiation of sentences through "How it could be" (Kanstrup & Bertelsen, 2016)	The initiation sentences served to facilitate the exploration of possible futures for using the EWS by thinking about how it could be.	The three sentences were: What if . . . The problem is solved by . . . Going forward, the EWS enables. . .
Personas (L. Nielsen, 2013)	A persona is a description of a fictitious person from a given context and who is recognizable to others in the context. Developed from data about real people. The content of the personas was personal data (name, age, profession, and level of experience), experiences with using the EWS in the clinical setting and insight and knowledge about the EWS (needs and motives from the focused ethnographic study and Workshop 1) and the persona's vision.	This method was used to provide a shared starting point for the participants' discussions. Moreover, to enable integration of insights achieved in the ethnographic study and the needs, motives, and visions identified in Workshop 1.
Template with guiding questions (L. Nielsen, 2013)	The template with guiding questions was related to the used personas. The template comprised eight questions such as, for example, how their initiative could be described, what the purpose was with the initiative, what could impede use of the initiative in practice.	The questions provided guidance for the participants' discussions of ideas on initiatives for using the EWS in practice.

workshop commenced with a presentation of the visions with associated needs and motives identified in Workshop 1. This allowed for a mutual understanding of the process to this point and prepared participants for moving on from abstract visions to the step of exploring initiatives supporting EWS practices (Kanstrup & Bertelsen, 2016). A mutual starting point for the participants' discussions was provided as personas (see Table 2 for elaboration), which was created from the needs, motives, and visions from Workshop 1 and supplemented with insights from the focused ethnographic study (Mølgaard et al., 2022). Moreover, guidance was provided in form of eight guiding questions (see Table 2 for elaboration), aiming to facilitate thorough discussion of every aspect of their ideas on initiatives. Participants were divided into two groups and were asked to explore initiatives for two personas each encompassing a vision with associated needs and motives. The abstract visions were transformed into ideas through discussion to communicate concrete initiatives (Kanstrup & Bertelsen, 2016). Ultimately, the explored ideas on initiatives were presented in a plenary discussion and allowed for mutual reflections and alterations. Workshop 2 lasted two hours.

Analysis

The data were analyzed using qualitative inductive manifest content analysis (Graneheim et al., 2017; Graneheim & Lundman, 2004; Lindgren et al., 2020). This method was chosen because it enabled analysis of data by elucidating what is said through concrete descriptions of the visible content and with minimal interpretation (Graneheim et al., 2017; Graneheim & Lundman, 2004; Lindgren et al., 2020). This analytical approach rendered descriptions of the findings easily recognizable by participants and supported their engagement in the participatory process.

The first author listened to the audio recordings of workshops 1 and 2 that were transcribed. Workshop 2 was transcribed verbatim. The transcriptions were read several times to achieve an overall sense of the data (Graneheim et al., 2017). The data were subsequently sorted into meaning units that expressed participants' needs, motives, visions (Workshop 1), and initiatives (Workshop 2) related to the aim (Lindgren et al., 2020). The identified meaning units were condensed to present the core of the meaning unit (Graneheim & Lundman, 2004; Lindgren et al., 2020). Codes explicating content close to the text were ascribed to meaning units (Graneheim & Lundman, 2004; Lindgren et al., 2020).

In the analysis of data from Workshop 1, a search for patterns of similarities and differences in needs, motives, and visions within meaning units and codes was conducted (Graneheim et al., 2017; Graneheim & Lundman, 2004; Lindgren et al., 2020). The process elicited four categories each explicating a vision with underpinning needs and motives (Graneheim et al., 2017). The four categories are shown in Table 3.

In the analysis of data from Workshop 2, the coding process was followed by a grouping and condensation of meaning units, and codes into categories expressing initiatives (Lindgren et al., 2020). To allow patterns from data to occur

Table 3. Categories From Workshop 1 Explicating the Four Visions.

Permanent staff have knowledge about the evidence behind the use of the EWS and are trained to use the EWS
Nurses' clinical judgment influences the EWS
The EWS protocol is flexible and simple in its composition
Agency staff understand their role related to use of the EWS and are trained to use the EWS

Table 4. An Example of the Qualitative Manifest Content Analysis.

Meaning unit	Condensation	Codes	Category
Nurse 5: I was thinking if one needs to integrate the clinical gaze, like an expanded EWS Nurse 3: That one can document in the system what has been done in relation to the EWS. One of my patients had an EWS of zero but was bleeding [from the rectum]. I would like to write a comment in relation to that Nurse 5: one can write a comment, that the patient got an epidural [pain medication] and the nurse does not react upon it, in such case I don't feel bad not to call a physician Nurse 3: No, because the EWS would tell you differently Nurse 5: Yes, it [the EWS] would define it as a critical condition Nurse 5: [the comment] should be an explanation of the cause [of the deviating parameter]	Initiative that nurses write comments to the EWS value about initiated interventions or about explanations or judgments of values	Revisions of the EWS Comment box	Integrating new functions into the EWS protocol

and elicit categories explicating concrete descriptions of initiatives the process of analysis encompassed low levels of abstraction and interpretation (Lindgren et al., 2020). Five categories were elicited from the process.

The analysis and the derived findings from workshops 1 and 2 were discussed with the fourth author and subsequently discussed in the team of co-researchers to achieve consensus (Graneheim & Lundman, 2004). An example of the qualitative manifest analysis is shown in Table 4.

Ethical Considerations

The research adhered to the principles of the Helsinki Declaration (World Medical Association, 2013). The written information about the study was elaborated orally as part of the introduction to the process of Workshop 1. Participants signed the consent form when they arrived at the location for the workshops. The consent form underlined the participants' anonymity in the reporting of the study and that withdrawal from the study was feasible at any time. Ethical approval was sought for the larger qualitative study comprising the ethnographic study and the participatory study. According to Danish law and the local Ethical Committee, the studies did not need approval by an Ethics Committee. The studies were approved by the unit of Information Security at Aalborg University (number 2018-899/10-0516) to ensure alignment with the General Data Protection Regulation (GDPR).

Findings

The analysis of the data elicited five categories describing participants' suggested initiatives for using the EWS: "Integrating new functions into the EWS protocol," "Balancing a structured EWS protocol with nurses" "clinical judgment," "Informing and involving clinical staff in the development of the EWS protocol," "A twofold introduction course for newcomers," and "Certifying agency staff to monitor the EWS."

Integrating New Functions Into the EWS Protocol

The participants suggested that two additional functions be integrated into the current EWS. These additional functions were based on the visions that nurses' clinical judgment influences the EWS and that the EWS protocol is flexible and simple in its composition. The first additional function was based on a discussion of how nurses' concern should be influential on the EWS. This discussion led to proposing an initiative that allows nurse to up-or downgrade the EWS based on nurses' understanding of the patient context and clinical judgment:

> Physician 2: *Let's say the nurse can upgrade the EWS with 3 steps, or the nurse downgrades the EWS with 3 in awaited conditions [referring to situations such as chronic illness or surgical stress where elevated EWS*

is expected]. The nurse influences the score with 3 steps up or down.

Nurse 1: *So, the concern would be ascribed a value that could fit into the* [EWS] *system*.

The participants' motive for the initiative was that an elevated EWS might be expected in some situations and could therefore safely be downgraded by the nurses. In other situations, the EWS needed to be upgraded based on the nurses' concern for the patients' condition. Following this, the second initiative suggested by participants was to add a comment box in the EWS protocol where the nurses' clinical judgment and decisions could be noted. The participants emphasized that the purpose of the comment box could be twofold and either expand the information related to the EWS or explain deviations in the EWS:

Nurse 5: *I was thinking if one needs to integrate the clinical gaze, like an expanded EWS.*

Nurse 3: *That one can document in the system what has been done in relation to the EWS. One of my patients had an EWS of zero but was bleeding [from the rectum]. I would like to write a comment in relation to that.*

Nurse 5: *One can write a comment, that the patient got an epidural [pain medication] and the nurse does not react upon it, in such case I don't feel bad not to call a physician.*

Nurse 3: *No, because the EWS would tell you differently.*

Nurse 5: *Yes, it [the EWS] would define it as a critical condition.*

Nurse 3: *[the comment] should be an explanation of the cause [of the deviating parameter].*

The purpose of the comment box would be to communicate about actions taken to deviating parameters, or to explain the reason for the deviating parameter based on the nurses' clinical judgment of the patient's situation. The nurses' potential disregard of the EWS would be explained and justified in the comment box and thereby served as a motive for the need to communicate in the comment box.

Balancing a Structured EWS Protocol With Nurses' Clinical Judgment

The participants discussed differences in nurses' and physicians' use of the EWS that influence the collaboration around the EWS. The differences in use influenced when and how nurses reacted to an EWS and how physicians responded when summoned. Despite the vision that the EWS protocol is flexible and simple in its composition, the participants pointed out that the EWS protocol needs to be rigidly structured due to perceived differences in use:

Nurse 1: *Will it be problematic to you to be summoned from a nurse that says, 'his EWS is close to normal, but I think he is in discomfort,' or 'I am concerned'?*

Physician 1: *That depends on who it is. It depends on what type of a physician one is. You know, some physicians perceive that if his [the patient's] EWS is not elevated, then he will be fine*.

Nurse 1: *Then it [the EWS] suddenly becomes uncertain to work with.*

Nurse 2: *Will it make a difference to you to know that it's the nurse who started 14 days ago compared to the nurse who has 20 years of experience?*. . .

Physician 1: *Yes.*

Physician 2: *Yes, there's a big difference.*

Nurse 1: *Maybe that's why it [the EWS]* . . .

Physician 2: *Yes, was implemented.*

Nurse 1: *Yes, that it's necessary to be rigid in a way.*

The participants agreed that nurses and physicians respond differently to the EWS, and that this increases the risk that the protocol is implemented randomly because it is dependent on the individual nurse or physician involved. Thus, the participants acknowledged a need for an EWS protocol that balanced retaining a structure with support for flexible use to enable nurses' upgrading or downgrading the need to trigger a response based on the EWS. It was thought that achieving this balance could accommodate nurses' different levels of experience that influence their clinical judgments as well as variations in physician responses dependent on the "*type of physician*" as physician 1 explained. Obtaining such balance upheld the visions of the EWS as needing to be flexible and simple in its composition and that nurses' clinical judgment be recognized as an important component in the use of the EWS. Obtaining this balance was a motive for suggesting a revision to the criteria for summoning a physician:

Physician 1: *It may be that the criteria to summon the physician need a review, to allow room for independent thinking.*

Nurse 1: . . . *we [nurses] are capable to intervene to a certain point, and sometimes we say, 'now we need some help here'.*

Revising the criteria mirrors a need to trust the nurses' competencies to assess patients' condition and indicates a need for collaboration in situations where nurses' ask for help from the physicians. Physicians would be expected to respond when nurses summon a physician because this would reflect the nurses' request for help to manage the situation.

Informing and Involving Clinical Staff in the Development of the EWS Protocol

Participants discussed their interest in being involved and informed related to the vision that permanent staff should have knowledge about the evidence for use of the EWS and are trained to use the EWS. Participants requested that the steering group responsible for the EWS in the hospital

involve staff from the wards in further development of the EWS protocol:

> Nurse 2: *Because it's relevant that staff who uses the EWS in the everyday hospital life should be engaged in making changes. Changes may otherwise be made away from where things are used.*

Involving users of the EWS was considered obvious when making changes to the EWS. The participants expressed that if changes were made without involving the users, the changes might not derive from the needs in clinical practice and thus not promote adherence to using the EWS. Therefore, this motivated an initiative that the steering group and the clinical users should be mutually engaged in the discussions and development of the EWS protocol:

> Nurse 1: . . . *it's also about how this [the EWS protocol]is outlined, how it's presented, how it's used. . . . Do we choose a positive approach; do we choose to say that this system has some built-in challenges? 'Let's [the EWS steering group] hear them, and we'll consider them further.' Instead of just being told that this is how it's going to be, end of story. Because then staff builds resistance.*

Participants emphasized that collaboration with the steering group in developing the EWS protocol facilitated an open-mindedness toward changes that would increase adherence to how EWS is operated and decrease resistance. Furthermore, participants' initiative was that staff should be updated on new knowledge about use of the EWS:

> Nurse 1: *one thing is to be introduced to the [EWS] tool and how one works with it. A different thing is to update the staff continuously on new knowledge. . .*

The participants underlined that it is insufficient to be introduced once to use the EWS, which suggests a need for these updates to be established as a routine in the hospital. New knowledge may motivate alterations on how the EWS should be operated in clinical practice, which needs to be communicated.

A Twofold Introduction Course for Newcomers

The participants also suggested an initiative to establish a twofold introduction course for newcomers to the use of the EWS comprising of a mandatory start-up course and a ward specific introduction. The initiative related to the vision that permanent staff have knowledge about the evidence behind the use of the EWS and are trained to use the EWS. A mandatory program would enable every staff member to obtain insight and knowledge on the intended use of the EWS in the wards. It was suggested that the course could focus on cases derived from practice:

> Physician 2: *The teaching or introduction should be practice-oriented like cases from practice. Then it can be discussed 'when' [to use the EWS], instead of just being told [to use the EWS as protocolled]. That would be more meaningful as to how it can be used . . .*
>
> Nurse 1: . . . *see this case, this and that happened, then one did this. . . . Suddenly one can see that it's meaningful. Also, one can use a case where it wasn't meaningful. To show both perspectives.*

Participants agreed that the EWS is useful in some clinical situations and less useful in others, which motivated that both perspectives should be outlined in the introduction. Working with practice-oriented cases would provide clinicians with insight on how the EWS should be operated within the clinical context. Another initiative addressing this need was to concretize the specific use with introductory examples in the individual wards:

> Nurse 1: . . . *Introduce it [the EWS] in a proper way. That's what we use at this moment. It has advantages, and it has some disadvantages. For the moment, we use it in this way . . .*

The participants underpinned that the newcomers' introduction to the EWS should highlight that the EWS protocol requires adaptation to the specific clinical context to ensure feasible use of the EWS.

Certifying Agency Staff to Monitor the EWS

The participants discussed what role agency staff could have in using the EWS as they are a part of the daily practice in the wards. This was related to the vision that agency staff understand their role related to the use of the EWS and are trained to use the EWS. The participants highlighted that they depended on the agency staff to conduct the EWS monitoring in the wards:

> Nurse 2: *I mean, if you can't do the EWS, we need to use agency staff . . ., what help are they if they don't provide the help that we [nurses] actually need . . .*

Agency staff's monitoring of EWS provided appreciated help to the nurses to accommodate the shortage of staff. However, participants underlined that competencies in using the EWS are required to provide effective EWS monitoring. The participants discussed that agency staff should be able to assess in which situations the nurse needs to be summoned:

> Nurse 3: *Isn't it most realistic for the agency staff if he/she knows when to prompt a nurse and say that this patient requires further assessment.*

Nurse 4: *It'll be both that she [agency staff] is familiar with it [EWS monitoring] and that she [agency staff] can react, not intervene, so that we feel assured.*

The participants believed it was unrealistic to expect agency staff to independently assess patients and subsequently to intervene appropriately. They underlined the need for agency staff to be trained to prompt nurses for further assessment when deviations in patients EWS were observed. To accommodate this, participants suggested an initiative to certify all agency staff in the use of EWS before being sent to the wards:

Nurse 3: *Just like we are required to attend a fire course or CPR [cardiopulmonary resuscitation], then they [agency staff] can attend a EWS course . . ., they [management]are occupied with us being certified for blood glucose monitoring devices, why don't you need certification to monitor the EWS? That's [largely] what the agency staff do.*

The participants questioned the current practice in which no specific requirements were sanctioned for agency staff to conduct the EWS monitoring. The motive for this participant initiative was related to that suggestion, that requirements for agency staff should be equivalent to the requirements for the permanent staff and, therefore, training for use of EWS be included alongside other requirements such as certification in advance of managing certain actions such as glucose monitoring.

Discussion

This study explored nurses' and physicians' ideas on initiatives for supporting effective use of the EWS in a hospital setting. Nurses' concerns about a patient's condition and their need to actively use their clinical judgment in combination with the EWS were mentioned as reasons for the need to up- or downgrade the EWS. Allowing the nurses, the flexibility to up- or downgrade the EWS was thought to ensure that nurses' responses to the aggregated score were reflective of the patients' clinical condition. Studies underline that clinicians fear that using decision support tools results in mechanical decision-making that excludes independent thinking (Castillo & Kelemen, 2013; Kilsdonk et al., 2017). As a result of fear for mechanical decision-making, clinicians do not adhere to decision support tools if they experience the decisions are based on insufficient patient information (Castillo & Kelemen, 2013). The participants' idea for an initiative where nurses can up- or downgrade the EWS reflects a need for nurses' clinical judgment to be integrated into the EWS to avoid mechanical decision-making based on insufficient clinical information. Evidence from a cluster randomized study showed that incorporating space in the tool for nurses' decisions to up- or downgrade the EWS was not inferior to the standard use of the EWS when 30-day mortality rates were compared (P. B. Nielsen et al., 2022). Arguably, there seems to be a potential for nurses' clinical judgment safely to be integrated into the EWS protocol and thereby sustaining adherence to the EWS tool (Castillo & Kelemen, 2013; Olsen et al., 2019). However, P. B. Nielsen et al. (2022) report that further research is warranted to explore if nurses' clinical judgment influences the escalation responses within different specialties.

Another initiative was to integrate a comment box into the EWS protocol where supplementary information on the patients' condition based on the nurses' clinical judgment could be noted. This initiative is in keeping with research in decision support tools showing that adherence to recommendations increases when clinicians are mandated to note why they disregard recommendations (Kwan et al., 2020). A comment box may enable nurses' independent thinking and decisions to be accounted for (Braun et al., 2022; Castillo & Kelemen, 2013), although requiring additional interaction time to use a decision support tool may impede use (Kilsdonk et al., 2017). Further research is needed on the appropriate balance for providing accounts in such a comment box without impeding use of the EWS.

The participants emphasized that nurses' different levels of experience influence how they responded to the EWS. As a result, participants suggested that retaining a structured EWS protocol should be balanced with sufficient flexibility to support nurses' adjustment of their response to EWS. This is supported by Langkjaer et al. (2021) who emphasized that some nurses fear making erroneous decisions when individual adjustments to the EWS were allowed. On the one hand operational local policies should clearly instruct how and when the adjustments are made to ensure the nurses make confident decisions regardless of level of experience (Braun et al., 2022; Olsen et al., 2019). On the other hand, providing too much guidance for clinicians may pose a risk to patients as clinicians may be overdependent in the tool at the expense of clinical judgment (Castillo & Kelemen, 2013; Douglas et al., 2016; Wood et al., 2019). Building nurses' acceptance of and confidence in using the EWS regardless of level of experience require maintenance of nurses' control to influence decisions (Braun et al., 2022; Kilsdonk et al., 2017). Also, sufficient guidance or training for how to manage the influence on the EWS is required to achieve the nurses' trust in using the EWS tool and thereby to enable their effective use of it (Braun et al., 2022; Kilsdonk et al., 2017).

Participants suggested a revision of the criteria for summoning a physician. This revision was motivated by the need to achieve a flexible and simple composition of the EWS protocol, and a need to facilitate collaboration between nurses and physicians in their use of the protocol. This initiative is supported by O'Neill et al. (2021) who found that unambiguous EWS protocols and clinicians being aware of the escalation policies increase the clarity of one's role. Having clarity of one's role reduces interprofessional

conflicts related to use of the protocols (O'Neill et al., 2021). Thus, revising the criteria for summoning physicians may help ensure feasible practices of EWS response strategies and improve collaboration between nurses and physicians (Haegdorens et al., 2020; O'Neill et al., 2021). Feasible practices for response strategies facilitate adherence to the escalation protocol, which is beneficial for quality of care (Olsen et al., 2019; Padilla et al., 2018).

The participants suggested an initiative for newcomers to be introduced to ward-specific advantages and pitfalls of the EWS to support its effective use. This is in line with Higgs and Jones (2019) who emphasized that clinical judgment appears within a context of codes of conduct, norms, and cultures. Therefore, the individual's knowledge base is dynamic and referential. Newcomers need to adapt to the new context and culture and obtain knowledge and insights on how to use the EWS in relation to the development of their clinical judgment (Allen et al., 2017; Wood et al., 2019). Erroneous decisions are more likely to occur if the clinician applies rigid pattern recognition instead of including the possibility of variations or alternatives when assessing patients (Higgs & Jones, 2019). Increasing newcomers' reflective assessments of variations in patients' EWS and clinical symptoms may enhance their clinical judgment and decision-making (McGaughey et al., 2017; Padilla et al., 2018).

The participants proposed an initiative that all agency staff regardless of background should be certified before conducting the EWS monitoring. This initiative corresponds to studies underpinning training in and knowledge of the use of the EWS as significant for appropriate and timely clinical responses (Credland et al., 2021; O'Neill et al., 2021; Olsen et al., 2019). Only two participants in our study received formal introduction to the EWS. It is concerning that educational activities and training in using the EWS is not sanctioned for all users of the EWS.

Limitations and Strengths

We included five nurses and two physicians from two wards that had participated in the first study. Inclusion of participants from other hospitals may have elicited different or additional perspectives in case of a largely different EWS (e.g., a single weighted parameter system or different, e.g., thresholds for summoning a physician) or specialty. However, involving more participants could have hampered the depth of the discussions and resulted in disproportionate opportunities for voicing viewpoints (Kanstrup & Bertelsen, 2016).

Although from an international perspective EWS protocols are all developed with the same purpose, there are important difference in predetermined thresholds and response times and strategies as well as resources to support the use of EWS (Downey et al., 2017). Given that within healthcare settings it is impossible to engage all potential users in participatory processes to support user-driven innovations to improve care (Kushniruk & Nøhr, 2016), a limitation of participatory design is that the proposed initiatives for practice may not be suitable to all contexts. From this perspective, involving only seven participants may be a limitation and should be considered when assessing the transferability of the ideas on the initiatives proposed by study participants.

In conducting workshops, pilot testing of materials (such as persona descriptions and template with guiding questions, and the time schedule) is suggested (Sanders and Stappers, 2012). The materials and time schedule developed for the workshops were not pilot tested. However, the first author continually discussed the material and time schedule with the research team and revised accordingly.

Conclusion

The use of a user-driven innovation approach and participatory processes provided nurses and physicians the opportunity to generate important ideas for initiatives to support effective use of the EWS in their hospital setting. Initiatives related to introducing sufficient flexibility to recognize and accommodate the importance of nurses' clinical judgments, facilitating collaborative practices, involving clinical staff in future protocol development, and ensuring adequate training and continuing updates on the use of EWS. These initiatives hold potential for improving adherence to protocols and clinical outcomes associated with the use of EWS.

Relevance to Clinical Practice

The needs, motives, visions, and initiatives derived from this study could support hospital managements, ward managers, nurses, and physicians in bringing forward discussions on how to use the EWS to ensure quality in care using the EWS. The needs, motives, visions, and initiatives mirror that nurses and physicians agree that changes are necessary to increase adherence to the EWS. Involving clinicians in the development of specific EWS protocols contributes to changes based on clinicians' specific experiences and helps clarify nurses' and physicians' role and responsibility in the use of EWS. Making changes based on the initiatives may increase staffs' acceptance of using the EWS and can potentially increase patient safety. Furthermore, there is a need to consider if and how agency staff that hold no specific or formalized training on how to use the EWS should contribute to using the EWS.

Acknowledgments

The authors wish to thank the participants for their time and efforts in the study by engaging in the workshops and the activities that were presented to be carried out.

Data Availability Statement

Research data cannot be shared as it contains personal information about the participants. Moreover, participants were guaranteed anonymity.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

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Supplemental Material

Supplemental material for this article is available online.

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