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British and Finnish nurses' attitudes, practice, and knowledge on deteriorating patient in-service education: A study in two acute hospitals

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ABSTRACT

Aim: The aim was to assess both nurses' attitudes about in-service education, and the impact had by attending in-service education on nurses' management and knowledge of deteriorating patients.
Background: In-service education cannot reach its best potential outcomes without strong leadership. Nurse managers are in a position of adopting leadership styles and creating conditions for enhancing the in-service education outcomes.
Design: We conducted a comparative cross-sectional study between British and Finnish nurses (N = 180; United Kingdom: n = 86; Finland: n = 94).
Methods: A modified "Rapid Response Team Survey" was used in data collection. A sample of medical and surgical registered nurses were recruited from acute care hospitals. Self-reporting, self-reflection, and case-scenarios were used to assess nurses' attitudes, practice, and knowledge. Data were analyzed by Mann-Whitney-U and Chi-square tests.
Results: Nurses' views on education programs were positive; however, low confidence, delays caused by hospital culture, and fear of criticism remained barriers to post education management of deteriorating patients. Nurses' self-reflection on their management of deteriorating patients indicates that 20–25% of deteriorating patients are missed.
Conclusion: Nurse managers should promote a no-blame culture, mitigate unnecessary hospital culture and routines, and facilitate in-service education focusing on identification and management of deteriorating patients, simultaneously improving nurses' confidence.

1. Introduction

1.1. In-service education for recognizing deteriorating patients

Nurses often encounter clinically deteriorating patients (Leonard-Roberts et al., 2018). Consequently, acute hospitals adopted an intervention strategy for the provision of emergency assistance to deteriorating patients – the Rapid Response System (RRS) (DeVita et al., 2006). Evidence indicates that implementing RRS is accompanied with decreased hospital mortality and in-hospital cardiac arrests (Teuma Custo and Trapani, 2020). Although nurses are satisfied with the quality of RRS assistance (Queiroz and Nogueira, 2019), its application remains suboptimal (Wood et al., 2019). Missing or postponing RRS instigation is linked to alarming adverse outcomes for hospitalized patients such as increased mortality, cardiac arrest, patient length of stay, and unplanned ICU admissions (Lee et al., 2018; Xu et al., 2018).

In-service education or continuing education is defined as all education and training delivered in practice settings and is recognized as crucial for improving nurses' competences (Jackson et al., 2019; Jones-Schenk, 2019). In-service education for nurses became the focus of healthcare settings since 1974 following the publication of the "Standards for Continuing Education in Nursing and ANA Continuing

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Education Guidelines for State Nurses Associations" (ANA, 2020). Equally noteworthy, in-service education has been defined as a necessity in nursing in the United Kingdom since 1979 (Royal Commission on the National Health Service, 1979). Hospital-based education programs adopt approaches to improve nurses' competence in RRS instigation (Liesching and Lei, 2015), focusing on improving nurses' knowledge and skills to recognize and manage deteriorating patients (Currey et al., 2018). However, healthcare innovations – such as RRS education – cannot reach their best potential outcomes without strong leadership (Welch et al., 2020). Empirical evidence indicates a link between the relational leadership styles (i.e., transformational leadership) and promotion of better outcomes for nurses in management of deteriorating patients (Boamah et al., 2018). Nurse managers' leadership styles play an essential role in influencing nurses' attitudes and practice (Institute of Medicine, 2011). The assessment of nurses' attitudes, practices, and knowledge concerning deteriorating patients is warranted so as to provide information to nurse managers – information required for facilitation and development of in-service education programs and choosing the appropriate leadership style to enhance the outcomes.

However, despite the significance of in-service education in improving nurses' competence, a big knowledge gap is how in-service education has an impact on nurses' competence in the recognition and management of deteriorating patients in acute hospitals with different RRS models. Although some studies have assessed the impact of educational interventions such as blended and multimodel education strategies (Chung et al., 2018; Cooper et al., 2016; Duff et al., 2018; Tebbs et al., 2021), multimodel education accompanied by coach support (Duff et al., 2020), simulations (Connell et al., 2016; Elder, 2017; Rutherford-Hemming and Alfes, 2017; Woda et al., 2017), web-based training (Liaw et al., 2016, 2017), and education modality programs (Peebles et al., 2020) on nurses' competence in managing deteriorating patients, but there is little known about the educational interventions regarding RRS models and their effectiveness (Saab et al., 2017; Leppänen et al., 2019).

Damayanti et al. (2019) study highlighted the positive impact of simulation education (Early Warning Score RRS model) on nurses' practice; however, it did not impact nurses' knowledge. Importantly, different RRS models function differently requiring a different set of knowledge and skills for activation (Agency for Healthcare Research and Quality, 2020; International Society for Rapid Response Systems, 2020; NICE, 2021). In this study, we investigated a population of nurses from hospitals with different RRS models and we focused on three main components of nurses' competence theory including nurses' attitude, knowledge, and practice (skills) (Benner, 1984). We further discussed how nurse managers can translate this study's findings into practice for advancing the outcomes of in-service education in the management of deteriorating patients. Importantly, the findings of this study further highlight that nurse competence is critical for recognizing and managing deteriorating patients. The importance of this study has been emphasized during the continuing Coronavirus disease 2019 (COVID-19) pandemics where high nurse workload with patients at high risk of deterioration is recognized (Choi et al., 2020). Consequently, RRS models are increasingly utilized for the early identification of COVID-19 patients (Su et al., 2021; Zhou et al., 2020).

1.2. Theoretical perspectives

This study incorporates concepts from the "nurses' competence" theory (Benner, 1984), and theory of "transformational leadership" (Bass, 1985). The study also covers the "innovation leadership" style to cultivate leadership strategies that enhance in-service education outcomes on nurses' performance (Porter-O'Grady and Malloch, 2010).

The nurses' competence theory is an integrated holistic approach and is defined as an integration of knowledge, skills, attitudes, thinking ability, and values (Benner, 1984; Fukada, 2018). Registered nurses working in acute care hospitals should have competence for managing deteriorating patients (National Institute for Health and Care Excellence, 2007, 2021). A nurse manager employing innovation and transformational leadership styles aims for better patient and organizational outcomes. The innovation leadership style allows nurse managers to embed a culture that empowers, supports and motivates nurses to manage deteriorating patients effectively (Horth and Buchner, 2014; Porter-O'Grady and Malloch, 2010; Zuraik, 2017), while the transformational leadership style provides nurse managers with the ability to draw a picture of what managing a deteriorating patient and patient safety will look like if the nurses are motivated and committed to in-service education programs (Zuraik, 2017). Healthcare systems are complex, and a combination of internal and external pressures can impact quality of healthcare delivery and patients' outcomes. Nurse managers practicing innovation and transformational leadership styles can facilitate and influence internal pressures on nurses and improve the outcomes of the RRS in-service education (Davidson et al., 2016).

1.3. Purpose

This study focuses on nurses' attitudes regarding education programs concerning deteriorating patients, as offered in acute hospitals in the United Kingdom (UK) and Finland. We further focus on the difference that attending in-service education makes in nurses' management and knowledge of deteriorating patients. This paper aims to:

1. Comparatively assess Finnish and British nurses' attitudes about in-service education on deteriorating patients.
2. Comparatively assess Finnish and British nurses' management of deteriorating patients.
3. Comparatively assess the differences made to Finnish and British nurses' knowledge of managing deteriorating patients after receiving in-service education.
4. Assess the difference had upon on nurses' management of deteriorating patients after receiving in-service education.

2. Methods

2.1. Design

A comparative, quantitative cross-sectional study.

2.2. Settings

Two acute hospitals were chosen from Finland and the UK (one each). We chose acute hospitals that had an established RRS for more than five years, with the availability of medical and surgical wards that could be matched between the hospitals. The hospitals have different RRS models: Finnish hospitals make use of the medical emergency team (MET) criteria, whereas the UK employs the National Early Warning Score (NEWS) criteria. The Finnish hospital is a large teaching hospital with 671 beds and over 4000 staff; the UK hospital is a large, 750-bed National Health Service hospital with 8500 staff.

2.3. RRS models: National Early Warning Score (NEWS) and medical emergency team (MET)

Different countries have implemented various RRS models to assist their ward nurses with proactive identification of at-risk patients for clinical deterioration (Agency for Healthcare Research and Quality, 2020; International Society for Rapid Response Systems, 2020). NEWS and MET are fundamentally on the basis of the idea of defining threshold triggers to trace (National Institute for Health and Care Excellence, 2007, 2021), however, they operate differently. NEWS is a validated scoring system, where each physiological parameter is presented with a score ranging from zero to three. Nurses give points to the level of derangement of the defined parameters. Based on the sum of the scores,

NEWS provides guidance for recognition and management of the deteriorating patient (NEWS E-learning program, 2020). To facilitate its application, a color-coded observation chart is in use (Appendix A). On the contrary, MET operates in a much simpler manner: any derangement in each defined physiological parameter triggers RRS activation (Appendix B).

RRS education was a policy priority in both hospitals, with Finnish nurses receiving annual or bi-annual education regarding RRS, depending on the type of ward where the nurses worked; for example, nurses working in intensive care units or emergency wards generally receive more RRS education. The education for all nurses included theoretical aspects and simulation scenarios. The UK hospital offered annual Acute Life Threatening Events Recognition & Treatment (ALERT) courses, complimented by periodic RRS education.

2.4. Participants

The inclusion criteria were registered nurses (RN) in Finland and registered Band 5–7 nurses in the UK. Band 5 represents a recently RN, Band 6 a RN >1 year, and a RN with considerable registered experience represents Band 7. The exclusion criteria included wards not applying the NEWS or MET criteria for adults, or those that took care for patients with depressed levels of consciousness that might get confused with the RRS criteria/score.

2.5. Study size

Through power analysis, it was estimated that 60 respondents were required from each site, assuming a moderate effect size ($x = 0.5$), where $\alpha = 0.05$ and power$= 0.80$. Of 388 initially distributed surveys, 180 responses were collected.

2.6. Data collection, instruments, and variables

Data-collection was on the basis of a valid "Rapid Response Team Survey," as adopted from Brown, Anderson, and Hill (2012). For this study, the research group made modifications based on findings from the literature. Data were obtained in 2017 for one-month periods at each site. For reporting purposes, we followed the STROBE guideline (Von Elm et al., 2007).

The questionnaire consisted of four main sections. Section one contained demographic data including age, gender, work experience, educational level, and country of education. Section two included six case scenarios with multiple-choice responses; the responses assessed nurses' knowledge of RRS, whereby the association between undertaking the RRS education and the participants' knowledge was assessed. Four case scenarios were selected from the primary instrument by Brown et al. (2012). Two further case scenarios – developed by Paul and Lane (2014) – were also used. Multiple-choice responses were added based upon previously known barriers for RRS-application (Braaten, 2015). questionnaire's third section consisted of 13 multiple-choice questions based on the literature review conducted by our international multi-disciplinary research group. The questions were designed to assess nurses' attitudes towards in-service education concerning RRS. The final section of the questionnaire included two multiple-choice questions. These questions assess nurses' strength to identify and manage deteriorating patients based upon a reflection on their experiences during events involving deteriorating patients. The questions further assess nurses' ability when experiencing an event involving a deteriorating patient who they were/were not directly caring for. In both questions, nurses were offered 10 roles, including: acting as an observer, reacting as first responder, initiating the RRS call, documenting the data, administering medication, monitoring vital signs, directing other team members, updating family members, facilitating a patient's move to high level of care, and relaying patient history.

2.7. Participant selection

Candidate participants who fulfilled the inclusion criteria were identified and approached by nurse managers. Additionally, posters were exhibited in wards encouraging volunteers to acquire questionnaires from their nurse manager. A paper-based questionnaire was used for data collection. The information sheet made it clear that participation was completely voluntary, and participant's evidence of consent to the research was determined by returning completed questionnaires in the assigned boxes.

2.8. Validity and reliability

The original "Rapid Response Team Survey" is a valid instrument, as adopted from the literature (Brown et al., 2012). An international multi-disciplinary research group provided the face validity of the modified instrument. Furthermore, the modified instrument was piloted in both countries. In Finland, a sample of 10 registered surgical nurses, and in the UK a sample of three registered medical nurses, piloted the questionnaire. The instrument was expressed in English. A professional native translator translated it into Finnish. The cross-cultural validity of the translation was secured by a back-translation into English.

2.9. Statistical analysis

Data were analyzed using the IBM SPSS Statistics 23. Descriptive statistics were presented as frequencies, percentages, means, and standard deviations. The Mann-Whitney U and Chi-square test analysis were used to assess differences between the countries. P-value significance was set to less than 0.05.

3. Findings

3.1. Participants

A total of 388 nurses were asked to take part in the study (Finland: n = 180, UK: n = 208). Altogether, 180 nurses responded to the questionnaire – 94 Finnish nurses and 86 UK nurses (total response rate: 46%, Finland: 52%, UK: 41%).

3.2. Sample characteristics

The majority of the participants were 26–35 years of age (41.1%), with less than five years work experience (52.6%). Most participants had a bachelor's degree in nursing, or equivalent (67% in Finland, 58.6% in the UK). Finnish nurses all trained in Finland while 29% of British nurses trained outside the UK (Appendix C). Some nurses (35.6%) had received RRS education during their program. Of these, most received them in the UK (Finland: 22.6%, UK: 77.4%, P-value: 0.001). Almost all participants (98.3%) were familiar with the concept of RRS. Two-thirds (66.3%) received an introduction on RRS during their hospital induction. UK nurses were more familiar with RRS from their induction when compared to the Finnish nurses (P-value: 0.001).

3.3. Nurses' attitudes on "deteriorating patient in-service education" in Finland and the UK

Most of the participants (96.7%) found in-service education effective (very effective: 63.8%, somewhat effective: 32.9%). The most preferred education methods were simulation scenarios (57.9%) and classroom lessons or lectures (37.1%) (Fig. 1). Nearly all subjects either (98%) definitely-agreed or agreed that in-service education contributed to better understanding and responses to deteriorating patients. The majority (88.6%) found that it sped up decision-making for RRS-application, with no statistically significant difference between countries. However, several factors prevented nurses from applying RRS after

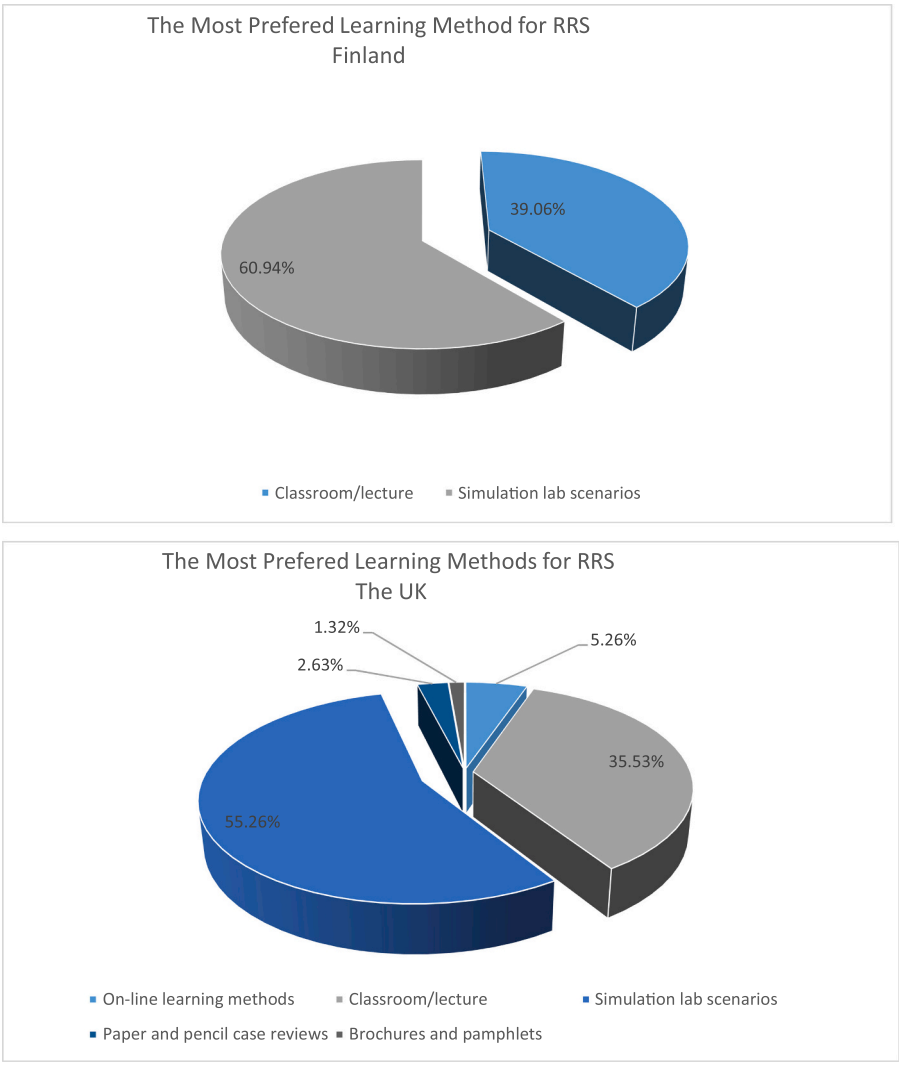

Fig. 1. The Most Preferred Learning Method for RRS.

receiving in-service education. The most common factor was a "patient's subtle changes and having self-doubt" (37.2%), followed by "hospital culture and routines" (29.5%). Finnish nurses perceived the former as the major preventing factor, while British nurses perceived the latter as more confining. Thus, in Finland, confidence was a major barrier, whereas hospital culture and routines were barriers for UK nurses. There was a significant difference between nurses' attitudes concerning preventative factors (among the two countries – P-value: 0.001) (Table 1).

The nurses surveyed believed in-service education mostly enhanced their understanding about "decision making for RRS-application" (32.1%), "self-confidence in recognizing the need for RRS-application" (27.6%), "recognizing the need for RRS-application" (23.1%), "recognition of obstacles for immediate RRS-application" (11.9%) and "teamwork" (5.2%). There was no significant difference between the countries.

According to our results, 40.3% of nurses felt more education on RRS was required, with Finnish nurses expressing a greater need than the UK nurses (Finland: 49.5%; UK: 30.6%; P-value: 0.01).

3.4. *Nurses' practice concerning deteriorating patients in Finland and the UK*

The majority of nurses (94.4%) had cared for patients who needed RRS, or had attended an RRS event for a patient not directly under their care (87.8%). During either event, nurses enacted different roles.

Table 1
Nurses' attitudes on "deteriorating patient in-service education" in Finland and the UK: Preventing factors for RRS instigation after receiving in-service education.

	Finland n (%)	UK n (%)	Total n (%)
Preventing Factors (P-value*= <0.001)			
Hospital culture and routines	12 (19.0%)	26 (39.9%)	38 (29.5%)
Patient's subtle changes and having a self-doubt	33 (52.3%)	15 (22.7%)	48 (37.2%)
Being concerned but lack of confidence in recognizing the need	10 (15.8%)	5 (7.5%)	15 (11.6%)
RRS team behavior to the possible false activation	2 (3.1%)	13 (19.6%)	15 (11.6%)
Miscommunication and weak teamwork	6 (9.5%)	7 (10.6%)	13 (10.1%)

UK= United Kingdom
RRS= Rapid Response System
* Chi-square analysis test.

Initiating the RRS-call was the most common practice for nurses of patients under their direct care (82.7%). It was followed by "acting as first responder: the person who detects the RRS criteria" (76.5%), "monitoring vital signs" (72.1%), "administering medication" (64.4%),

"keeping family members updated" (63.1%), "facilitating a patient's move to a higher level of care" (61.7%), and "relaying patient history" (61.5%). The role of "monitoring vital signs" was the most common role engaged in by nurses of patients under others' care (68.9%). We note that the two countries presented statistical differences in some roles (Table 2).

3.5. Attending in-service education and nurses' knowledge and practice concerning deteriorating patients in Finland and the UK

The majority of nurses (81.7%) had attended in-service education, demonstrating a significant difference between the countries (Finland: 73.4%; UK: 90.7%; P-value=0.003). However, there was no difference observed between nurses' attendance of in-service education and their knowledge about deteriorating patients (Table 3).

Nurses who had received in-service education took on almost all roles during an RRS event (when the patient was under their direct care), as compared to nurses who had not received in-service education (Table 4).

4. Discussion

In this comparative study, we focus on nurses' attitudes, practices, and knowledge concerning in-service education on the topic of deteriorating patients, together with a discussion and emphasis on the importance of appropriate leadership styles for nursing management to improve the outcomes. As Benner (1984) advocates, attitudes, practice (skills), and knowledge are components of nurse competence, thereby influencing the outcomes of in-service education for recognizing and managing deteriorating patients. In this study, we investigated a population of nurses from hospitals with different RRS models (NEWS and MET). Although both models are fundamentally similar, but they operate differently requiring a different set of competencies for activation (Agency for Healthcare Research and Quality, 2020; International Society for Rapid Response Systems, 2020; NICE, 2021). According to our findings, British and Finnish nurses' perceptions of the barriers for RRS activation differed following in-service education. British nurses found hospital culture and routines as the most preventive factor for RRS activation, whereas Finnish nurses found subtle patients changes and self-doubt were stronger barriers for RRS activation. There is a lack of evidence-based knowledge to identify the best RRS model, therefore RRS models are recommended to be set locally and tailored to the local needs (NICE, 2021). However, studies by McNeill and Bryden (2013) and Smith et al. (2013) found that an aggregated weighted scoring system such as NEWS may have a superior capability in identifying small changes and discriminating patients at-risk as compared to a single parameter system such as MET. Additionally, based on our study, documentation of NEWS scores were more commonly documented compared to MET. This may be related to having a color-coded observation chart for NEWS and further research is needed to explore what influences nurse documentation.

4.1. Nurses' attitudes

4.1.1. Remaining barriers for managing deteriorating patients following in-service education

Perhaps one of the important findings of this study was uncovering the remaining barriers for managing deteriorating patients following in-service education. Although the critical role of in-service education in improving nurses' competences has been emphasized (ANA, 2020; Connell et al., 2016; Jackson et al., 2019; Jones-Schenk, 2019; Royal Commission on the National Health Service, 1979), limited studies have examined nurses' perceptions about the remaining barriers for managing deteriorating patients following in-service education.

Based on our findings, nurses' low confidence, delays caused by hospital culture, and fear of criticism remained barriers to post education management of deteriorating patients. When a patient presents drastic changes in their vital signs, nurses are more confident to activate the RRS. However, subtle changes make it challenging for nurses to decide on RRS activation. Evidence indicates that transformational leadership greatly influences nurses' performance (Boamah et al., 2018). Nurse managers employing transformational leadership can motivate nurses by envisioning better outcomes for deteriorating patients (Zuraik, 2017) and thereby improve their confidence.

Fear of being wrong, along with criticism by the RRS team, are risks that nurses encounter when applying RRS (Braaten, 2015). Of note, the sociocultural and organizational aspects of the practice environment could act as barriers for RRS-activation. The organizational culture and hierarchical structures create internal pressures within hospital settings and, along with external pressures, impact the management of deteriorating patients (Davidson, et al., 2016). Innovation leadership demands that nurse managers encourage their personnel to be challenged and feel comfortable with taking risks (Porter-O'Grady and Malloch, 2010). In addition, a component of innovation leadership is building an environment without organizational impediments (Horth and Buchner, 2014). Hence, a nurse manager practicing innovation leadership should actively remove the organizational barriers to RRS-activation. In noting that there were some differences between the perceptions of the two countries' nurses about hospital culture and routines, nurse managers applying the innovation leadership style should actively remove the unnecessary routines where it is applicable. We hypothesize that the hierarchical differences between the two settings has affected the

Table 2
Nurses' practice concerning deteriorating patients in Finland and the UK; when experiencing an event involving a deteriorating patient who they were/were not directly caring for.

	If a nurse was attending a RRS-call for a patient who he/she was directly caring for				If a nurse was attending a RRS-call for a patient who he/she was not directly caring for			
Nurses' roles during a RRS-call	Finland n (%)	UK n (%)	P-value*	Total n (%)	Finland n (%)	UK n (%)	P-value*	Total n (%)
Observer	22 (37.3%)	37 (62.7%)	0.005	59 (32.8%)	39 (52.7%)	35 (47.3%)	0.914	74 (41.1%)
First responder	71 (51.8%)	66 (48.2%)	0.739	137 (76.5%)	18 (42.9%)	24 (57.1%)	0.165	42 (23.3%)
Initiating the RRS-Call	76 (51.4%)	72 (48.6%)	0.496	148 (82.7%)	36 (49.3%)	37 (50.7%)	0.519	73 (40.6%)
Documenting the RRS data	19 (24.1%)	60 (75.9%)	0.001	79 (43.9%)	8 (19.0%)	34 (81.0%)	0.001	42 (23.3%)
Administering Medication	49 (42.2%)	67 (57.8%)	0.001	116 (64.4%)	37 (40.7%)	54 (59.3%)	0.002	91 (50.6%)
Monitoring vital signs	54 (41.9%)	75 (58.1%)	0.001	129 (72.1%)	60 (48.4%)	64 (51.6%)	0.125	124 (68.9%)
Directing other Team members	3 (7.0%)	40 (93.0%)	0.001	43 (23.9%)	4 (12.9%)	27 (87.1%)	0.001	31 (17.2%)
Keeping family members updated	52 (46.0%)	61 (54.0%)	0.023	113 (63.1%)	6 (17.1%)	29 (82.9%)	0.001	35 (19.4%)
Facilitating patient move to high level of care	59 (53.2%)	52 (46.8%)	0.751	111 (61.7%)	10 (27.0%)	27 (73.0%)	0.001	37 (20.6%)
Relaying patient history	56 (50.9%)	54 (49.1%)	0.587	110 (61.5%)	13 (38.2%)	21 (61.8%)	0.070	34 (18.9%)

UK= United Kingdom
RRS= Rapid Response System
* Chi-square analysis test.

Table 3
Attending in-service education and nurses' knowledge concerning deteriorating patients in Finland and the UK.

	Finland		The UK		Total	
	Attended*	Not Attended*	Attended*	Not Attended*	Attended*	Not Attended*
n	69	25	78	8	147	33
(%)	(73.4%)	(26.6%)	(90.7%)	(9.3%)	(81.7%)	(18.3%)
Knowledge Score						
Mean (SD)	3.55 (1.34)	3.60 (1.25)	3.71 (1.57)	3.38 (0.91)	3.63 (1.46)	3.55 (1.17)
P-value*		0.68	0.36		0.75	

UK= United Kingdom
*Attended or Not attended the in-service Education Program
Knowledge Score was defined between 0 and 6 based on the number of correct answers to case scenarios (with having 0 as the minimum score, and having 6 as the maximum score)
*Mann-Whitney U analysis test

Table 4
Attending in-service education and nurses' practice concerning deteriorating patients.

	If a nurse was attending a RRS-call for a patient who was under their own care			If a nurse was attending a RRS-call for a patient who was not under their own care		
Nurses' Roles	Attended*	Not attended*	P-value*	Attended*	Not attended*	P-value*
during a RRS-call	n (%)	n (%)		n (%)	n (%)	
Observer	50 (84.7%)	9 (15.3%)	0.456	59 (79.7%)	15 (20.3%)	0.575
First responder	115 (83.9%)	22 (16.1%)	0.138	36 (85.7%)	6 (14.3%)	0.439
Initiating the RRS-Call	126 (85.1%)	22 (14.9%)	0.007	65 (89.0%)	8 (11.0%)	0.035
Documenting the RRS data	70 (88.6%)	9 (11.4%)	0.033	37 (88.1%)	5 (11.9%)	0.219
Administering Medication	105 (90.5%)	11 (9.5%)	0.001	80 (87.9%)	11 (12.1%)	0.029
Monitoring vital signs	110 (85.3%)	19 (14.7%)	0.040	103 (83.1%)	21 (16.9%)	0.471
Directing other Team members	42 (97.7%)	1 (2.3%)	0.002	29 (93.5%)	2 (6.5%)	0.060
Keeping family members updated	101 (89.4%)	12 (10.6%)	0.001	33 (94.3%)	2 (5.7%)	0.032
Facilitating patient move to high level of care	97 (87.4%)	14 (12.6%)	0.012	32 (86.5%)	5 (13.5%)	0.395
Relaying patient history	97 (88.2%)	13 (11.8%)	0.004	30 (88.2%)	4 (11.8%)	0.272

RRS= Rapid Response System
*Attended or Not attended the in-service Education Programs
*Chi-square analysis test

nurses' perceptions. We recommend that nurse managers who practice the innovation leadership style improve nurses' attitudes to RRS activation by embedding a no-blame culture. This issue should be valued specifically where nurses' fear of criticism is a more prevalent issue.

4.1.2. Education methods

Nurses reported that the most-preferred educational method for in-service education was simulation scenarios. While medium- to high-fidelity simulation scenarios are suggested elsewhere as being the most preferred education method for in-service education (Connell et al., 2016), the internet-based learning method is also recommended (Liaw et al., 2016, 2017). However, in our study, only 5% of respondents were interested in online learning modules. Although online methods are part of the Open Educational Resources (OER) movement, and are affordable and easy to access (Zhao et al., 2018), simulation methods are suggested to improve nurses' confidence and knowledge (Crowe et al., 2018) and are considered more effective when compared to traditional learning methods (Shin et al., 2015). The learning method is important, as various educational interventions enhance nurses' learning outcomes (Connell et al., 2016). Thus, nurse managers who use the innovation leadership style may empower nurses to facilitate RRS instigation by adopting the multiple-learning-method strategy, achieving steady progress for the hospital.

4.1.3. Education programs

According to our results, most of the nurses do not believe that in-service education programs concerning deteriorating patients enhanced their understanding in two aspects: recognition of obstacles for immediate RRS instigation, and teamwork. Therefore, nurse managers with an innovation leadership style should target the educational curriculum in regard to those two aspects and advance educational programs to 1) enhance the recognition of obstacles regarding RRS instigation, and 2) in improving nurses' teamwork during deteriorating patient management. In particular, the simulation method could be of high importance in increasing teamwork and could further be incorporated into nurses' in-service education programs (Colman et al., 2019; Gilfoyle et al., 2017).

4.2. Nurses' practice

4.2.1. Nurses' experience of deteriorating patient management

Among nurses' reflections on their performance during RRS events, initiating the RRS-call was observed as the most common practice for nurses (with deteriorating patients under their direct care). This finding aligns with the findings of a study carried out in the United States (Pusateri et al., 2011). The second most frequent practice nurses took on for deteriorating patients (under their direct care) was being the "first responder" (the person who detects the RRS criteria).

Although the popularity of these practices is satisfactory, it is understandable why RRS-application is still suboptimal. According to nurses' reflection on their practice, one out of five nurses were not the initiators of RRS for the deteriorating patient, and one out of four nurses did not detect the RRS criteria in the deteriorating patient. Our statistics highlight the frequency of missed nursing care incidents in management of deteriorating patients and underpins the need for future research focusing on missed nursing care frequency assessment (Hubsch et al., 2020). A lesson for nurse managers is to enhance nurses' practice by focusing on improving their identification of deteriorating patient and RRS instigation through in-service education.

4.2.2. Nurses underestimate documenting

Based on nurses' reflection on their performance during RRS events, "directing others," "observing," and "documenting" were the least common practices. Importantly, "not-directing" and "not-observing" do not necessarily indicate poor practices. Directing is predominantly within the responsibilities of the RRS team, and being an observer is a passive practice, whereas nurses are expected to be active in critical conditions. However, documenting is an important practice (Collins et al., 2013) that seems to be underestimated by nurses. However, the present study's findings indicate that where NEWS was in use, documentation was significantly a higher practice in the management of deteriorating patients compared to MET. This result could be attributed to having the color-coded observation chart in NEWS. This should interest the hospital managers, nurse manager, and educators: there is a need to focus more on improving nurses' documentation in critical conditions while planning in-service education.

4.3. Nurses' knowledge

Although our findings did not indicate any relationship between attending the in-service education and nurses' knowledge concerning deteriorating patients, evidence suggests that in-service education for general ward-staff positively impact upon the effectiveness of RRS (Bunch and White, 2009). In our study, a small sample of non-attendance to the in-service education could have affected the result. Nonetheless, considering that training and education are core activities of the health services in order to ensure patient safety at hospitals, nurse managers employing the innovation leadership style should pay special attention to it.

5. Limitations

The initial limitation of this study is having only two acute hospitals. Including more settings in different countries would have increased the generalizability of the findings. However, in order to cope with this limitation, we chose two major hospitals in two European countries with different RRS models and RRS guidelines, namely Finland (MET) and the UK (NEWS). Another limitation is that this research takes a quantitative approach. A mixed-method design can provide more in-depth and expanded data. Moreover, one limitation is using self-reflect measures, which potentially are due to the subject of "recall bias" (Smith and Noble, 2014). Nonetheless, it was not considered influential in this study as participants commonly experienced RRS events.

6. Conclusions

The findings of this study are important for raising awareness concerning nurses' attitudes, practice, and knowledge, and to provide nurse managers with information required for choosing the appropriate leadership style. Nurse managers should promote a no-blame culture, mitigate unnecessary hospital culture and routines, and facilitate in-service education focusing on identification and management of deteriorating patients, simultaneously improving nurses' confidence.

7. Implications for clinical practice

Facilitating nurses' in-service education is nurse managers' core activity in assuring the quality and safety of healthcare delivery (Institute of Medicine, 2011). Nurse managers are clinical leaders who can translate the evidence-based changes at hospital settings by adopting a robust leadership style (Welch et al., 2020). Nurse managers may use the transformation leadership style to advance the management of deteriorating patients (Liukka et al., 2018) through inspiring participation, in-service education, or illustrating a picture of what the future will hold for patient safety if nurses become committed to in-service education (Zuraik, 2017). Moreover, nurse managers using the innovation leadership style may motivate, support, and empower nurses in managing deteriorating patients and may enhance nurses' capability of managing the condition before the golden window of time shuts in emergency cases (European Resuscitation Council Guideline, 2015; Horth and Buchner, 2014).

Following our results, nurse managers should focus on confidence, organizational culture, documentation, and identifying and managing deteriorating patients via educational programs, and to train nurses who are appropriately competent in recognizing and responding to deteriorating patients. Our study revealed limited effects of in-service education on nurses' team spirit and teamwork. Since those are the core competencies in management of patients (Institute of Medicine US Committee on the Health Professions Education Summit, 2003), nurse managers should advance the in-service education programs to improve teamwork among nurses. Specifically, simulation may be of help in improving teamwork (Colman et al., 2019; Gilfoyle et al., 2017). We recommend nurse managers to consider the multiple-learning-method strategy for educational objectives in empowering nurses. Moreover, even after receiving in-service education, nurses regarded "fear of criticism" as preventing them from reacting efficiently. We argue that nurse managers need to prioritize embedding no-blame cultures among nurses and within healthcare settings.

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Ethical approval details

Conducting this study complies with the Helsinki Declaration and the General Data Protection Regulation principles. Ethical statements were obtained from the Ethical Committees of Universities (UK: 160708-160702-21140819; Finland: Statement 11/2016), and the UK "Health Research Authority" (Application ID: 210978). We recieved permission from both hospitals – the UK (01753634340) and Finland (Statement 11/2016). Permission to use tools were obtained from Authors (Brown et al., 2012; Paul & Lane, 2014).

Declaration of interest

None.

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Appendix A. Supporting information

Supplementary data associated with this article can be found in the

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