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Review paper

Upskill training and preparedness of non-critical-care registered nurses deployed to intensive care units during the COVID-19 pandemic: A scoping review

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ABSTRACT

Background: The increase in intensive care unit (ICU) capacity compelled by the COVID-19 pandemic required the rapid deployment of non-critical-care registered nurses to the ICU setting. The upskill training needed to prepare these registered nurses for deployment was rapidly assembled due to the limited timeframe associated with the escalating pandemic. Scoping the literature to identify the content, structure, and effectiveness of the upskill education provided is necessary to identify lessons learnt during the COVID-19 pandemic response so that they may guide workforce preparation for future surge planning.

Aim: The aim of this scoping review was to map the literature to identify the available information regarding upskill training and preparedness of non-critical-care registered nurses deployed to the ICU during the COVID-19 pandemic.

Methods: This scoping review was conducted in accordance with JBI methodology. A protocol outlined the review questions and used the participants, concept, and context framework to define the inclusion and exclusion criteria. A search of healthcare databases MEDLINE (Ovid), Embase (Ovid), CINAHL (EBSCO), Cochrane, and Scopus was supplemented with a grey literature search via Google.

Results: Screening and review found 32 manuscripts that met the inclusion criterion for examination. Analysis revealed variation in duration of programs, theoretical versus practical content, face-to-face or online mode of delivery, and duration of preparation time at the bedside in the ICU setting. Data on contributors to preparedness for deployment were sparse but included training, support, peer education, buddy time, and clarity around responsibilities and communication.

Discussion: Evaluation of upskill education was mostly limited to post-training surveys. Few studies explored the preparedness of deployed registered nurses as an outcome of their upskill training or described measures of effectiveness of ICU deployment.

Conclusion: There is limited evidence describing preparedness of non-critical-care registered nurses on deployment to the ICU. Further research is needed to identify what elements of upskill education led to preparedness and effective deployment to the ICU setting.

1. Introduction

Data emerging from China in the first quarter of 2020 indicated that 5% of patients with confirmed COVID-19 required admission to the intensive care unit (ICU) for management of severe disease.[1] Manifestations and complications of severe COVID-19 such as respiratory failure, acute respiratory distress syndrome, sepsis, thromboembolism, and/or multiorgan failure, including acute kidney injury and cardiac injury,[2] required management in the ICU setting, where patients could receive continuous monitoring of vital signs and ventilatory or organ support.[3] As cases of COVID-19 escalated, the World Health Organization called for governments to

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ready their hospitals for the pandemic,[4] and around the globe, ICUs prepared to surge to accommodate the proportional increase in patients with severe COVID-19.[5]

ICU surge capacity refers to the ability of an ICU to rapidly expand its capability to accommodate a large influx of critically ill patients in response to the increased demand.[6] This may involve expanding the physical space of the ICU, increasing the number of beds, or providing additional resources such as medical equipment, supplies, and staff to meet the increased demand.[7] The goal of ICU surge capacity is to ensure that critically ill patients receive timely and appropriate care, even during a crisis. If ICU services cannot surge, this can lead to patients being denied admission or experiencing a delay in receiving necessary care, which ultimately results in increased mortality rates.[8]

During ICU surge, an increase in nursing workforce is required to support the associated escalation in ICU-bed demand.[9] Disaster preparedness plans for a respiratory pandemic recommended that to meet the increase demand for nursing workforce to support surge, registered nurses (RNs) with previous critical care experience should be deployed to ICU settings.[9–16] As and when further expansion of the workforce in the ICU was required, the contingency tier was to utilise nurses without critical care experience to work in the ICU under supervision of an experienced ICU nurse.[9–11,13–16] The unprecedented speed with which the COVID-19 pandemic overwhelmed ICU surge contingencies in China and Italy[17] prompted other nations, including Australia, to progress to this tier of preparation.

Patients and nurses in the ICU may be at risk if staff members are inadequately trained.[13] Rapid upskill training programs were enacted to prepare non-critical-care RNs for deployment to the ICU. Upskill training aims to refine existing skill sets or instil new skills.[18] The term is used most commonly in the context of workforce development and training, where the use of more sophisticated technology in workplace requires employees to 'upskill' in order to keep-up with technological advancements.[19] Within the healthcare sector, "upskilling is required to promote workforce flexibility, skill delegation, and adaptation during times of change, restructuring, or crisis".[18] The purpose of upskill training was to improve existing skill sets of non-critical-care RNs to better prepare them for their roles in the ICU.[11]

While the prerequisite of providing upskill training for non-critical-care RNs deployed to the ICU is recommended,[9–13,15,16] specific guidance on the duration, mode of delivery, content, and outcomes is limited. Just-in-time and simulation training are suggested as forms of delivery,[11] and standardised short courses[15] and topics for inclusion[13] are proposed for the content of training. There is no direction on outcomes or the duration of upskill training. During the COVID-19 pandemic, upskill education was developed quickly and was delivered via a range of approaches dependent upon local resources, urgency, and need.[5] Examination of the programs and measures of their effectiveness for preparing nurses for the ICU is now warranted.

The Independent Panel for Pandemic Preparedness and Response[20] has reported that many health facilities around the world were significantly unprepared for the pandemic. The health systems that more effectively managed the COVID-19 response, quickly mobilised, trained, and reallocated their health workforce and took proactive steps to increase system capacity.[20] Defining the realities, successes, and limitations of ICU upskill training is crucial to identify the lessons learnt from the COVID-19 pandemic and is essential to inform planning for future events of this nature.

2. Aim

The aim of this scoping review was to identify and examine the available information regarding upskill training and preparedness of non-critical-care RNs deployed to ICUs during the COVID-19 pandemic.

3. Methods

A scoping review was utilised as it is the preferred method of knowledge synthesis to identify and map the nature and extent of available evidence that is diverse and unsuitable for a more targeted and systematic evidence review.[21] Scoping reviews can be used to clarify key concepts and identify knowledge gaps where there is an emerging field of information.[22] This review was conducted in accordance with the procedural rigour of JBI methodology.[23] Reporting was guided by Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews.[24]

A priori review protocol was developed to define the review questions:

i. What was the structure and content of rapid ICU upskill programs utilised to prepare non-critical-care RNs to deploy to the ICU?
ii. What measures of ICU upskill training or effectiveness have been described?
iii. What training needs were identified by nurses?
iv. What contributors to preparedness for deployment have been described?
v. What barriers and enablers to effective deployment of non-critical-care nurses to the ICU have been described?

4. Eligibility criteria

The inclusion and exclusion criteria were defined within the participants, concept, context (PCC) scaffold.[21]

4.1. Participants

Papers describing non-critical-care RNs were included in the review; defined as RNs working outside the ICU setting and with less than 3 months of experience in the ICU before deployment. Exclusion criteria were papers describing prelicenced/prequalified or student nurses, assistants in nursing, or enrolled nurses deployed to the ICU.

4.2. Concept

Papers describing the education, training, or upskill programs for non-critical-care RNs to prepare them for deployment to the intensive care area were included. Furthermore, papers describing program evaluation, preresults/postresults and follow-up to deployment, or papers describing nurses' training needs or preparedness for deployment to the intensive care area were included. Exclusion criteria were papers describing training and experiences of RNs deployed to non-critical-care areas of practice.

4.3. Context

Papers describing training and preparedness of registered nurses deployed from non-critical-care areas of practice to the ICU setting during the COVID-19 pandemic. Exclusion criteria were papers describing training and preparedness of RNs deployed to ICU settings in pandemic events other than COVID-19.

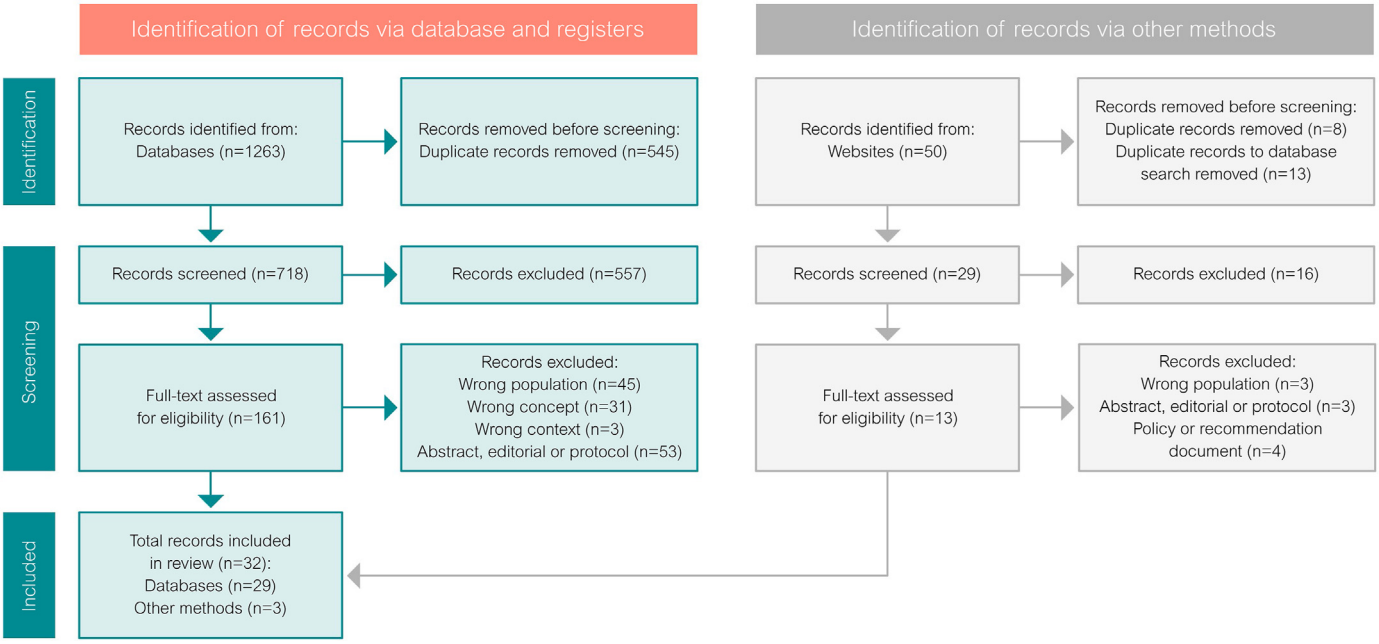

Fig. 1. PRISMA flowchart. Abbreviation: PRISMA, preferred reporting items for systematic reviews and meta-analyses.

5. Information sources and search strategy

The scoping review considered data from academic journals and grey literature in the form of government or educational provider reports.

6. Search

An initial search of CINAHL (EBSCO) was conducted to identify articles on ICU upskill education and deployment for COVID-19. The relevant articles were examined for common indexed terms and keywords within the titles and abstracts. These terms were utilised to develop a search strategy in consultation with a university librarian. The strategy included both controlled vocabulary, such as medical subject headings,[25] and keywords. No search filters were applied to limit retrieval by date as the COVID-19 search term effectively limited the date range of papers. The databases MEDLINE (Ovid), Embase (Ovid), CINAHL (EBSCO), Cochrane, ERIC, and Scopus were searched in June of 2022. A repeat search was conducted in June 2023 to identify more recent articles.[26]

A web search for grey literature and unpublished material was conducted via Google with the same search terms. The Google search was done in the incognito mode with location settings turned off. The Google search results were screened for relevance by one author. The results became less relevant after the first 40; therefore, the first 50 results were included for blind screening.

7. Selection of sources of evidence and data charting

All identified records from the database search were uploaded into EndNote 20.2[27] and from there into Covidence systematic review software.[28] Duplicate results were removed before independent screening by two authors. Two authors (BC and SJ) initially screened 15% of the references for potential inclusion according to the protocol. The reviewers achieved an inter-rater reliability rate of 81%, allowing the screening to continue for the remaining titles and abstracts. Google search results and links were tabled and then screened by two authors independently. Articles with a conflict during title and abstract screening were resolved by a third author (TLJ). Full-text review and reference-list screening were conducted by two authors (BC and SJ) according to the protocol. The reference lists of all identified papers were screened, full text of titles that appeared to meet the criteria were sought and reviewed. Data charting was tabled according to the review questions.

8. Results

From the database search, 1263 records were identified; 545 duplicates were removed leaving 718 records for screening. Of these, 161 were considered eligible for full-text review, and 28 were included in the review. The Google search identified a further three records, leaving 32 total papers for final inclusion in the scoping review, see Preferred Reporting Items for Systematic Reviews and Meta-Analyses flowchart—Fig. 1.

Of the papers, 18 were case reports, seven were course evaluations, six were research papers, and there was one educational resource. The research papers consisted of three qualitative papers, one cohort study, one descriptive study, and one cross-sectional study. Papers from the United States totalled 17; three were from Australia and two each from Canada, the United Kingdom, and Saudi Arabia. There was one each from Italy, New Zealand, Germany, Singapore, and Qatar, along with one transnational paper. Table 1 provides a summary of the findings of each paper specific to the research questions.

I. What was the structure and content of rapid ICU upskill programs utilised to prepare non-critical-care RNs to deploy to the ICU?

The structure and content of upskill programs are detailed in Table 2. Duration of training ranged from 3 h[42] to 4 days,[45] with the most common program length being 3 days.[36,41,44,54] The programs under a 5-h duration were described as being too rushed and overwhelming for nurses, with “too much information all at once”[32] and lacking in time to consolidate information provided.[35]

The mode of delivery varied; they were either online, didactic, practical, simulation-based, or combination of these modes. Evaluations related to mode of delivery revealed that opportunities for

Table 1
Description of included papers and their findings specific to the review questions.[29–60]

Authors, year, country	Study design, Aim	Sample	Findings specific to review questions	Strengths and limitations
Research papers				
Hampton et al., 2022, U.S.A.	Qualitative descriptive study. **Aim**: To examine the strategy and preferred mechanisms of training used to rapidly upskill nursing staff and efficacy.	Intermediate care nursing staff (n = 35).	i. **Structure:** Paired staffing models, interdisciplinary education, skills days, and self-directed learning, further detail on **content** in Table 2. ii. **Measures**: Critical care competencies assessed by ICU staff. Confidence in critical care skills rated by participants. iii. **Training needs**: Proning, management of paralytics and train of four testing, management of CRRT, logistics of intubation, and extubation. iv. **Contributor to preparedness**: Peer education from ICU nurses was rated as one of the most helpful forms of education.	Competency checklists were specific to COVID-19.
Hennus et al., 2021, U.S.A, The Netherlands and Ireland.	Cross-sectional survey with qualitative data. **Aim:** To describe the lived experience of staff working in surged ICUs.	Experienced ICU staff and redeployed staff (n = not specified).	v. **Barriers**: Too many inexperienced helpers, lack of training or orientation for deployed staff. **Enablers**: Stable teams, consistent allocation, adequate skill mix, frequent communication regarding plans, collaboration within teams.	Nursing data provided for only two of three sites.
Lauck et al., 2022, Canada.	Exploratory prospective observational cohort study. **Aim:** To examine learning needs of non-critical-care RNs and pilot a team-nursing model in the ICU.	Non-critical-care nurses (n = 147).	i. **Structure:** Individualised learning packages based on gaps identified in self-assessment survey. ii. **Measures**: Pretraining self-assessment survey. Post-deployment evaluation and focus groups. iii. **Training needs**: Basic mechanical ventilation, vasoactive medications, use of PPE, cardiac telemetry, specialised equipment, and electronic medical record. v. **Barriers**: Lack of clarity around scope of deployed staff, increased workload, and stress for ICU staff.	Self-assessment of non-critical-care RNs competence was not reassessed following the educational intervention and prior to deployment.
Marks et al., 2021, U.S.A.	Qualitative interviews. **Aim:** To evaluate the training program and ICU deployment experiences of nurses.	Non-critical-care nurses (n = 8).	i. **Structure:** Didactic, practical, and buddy shifts in the ICU, further detail on **content** in Table 2. ii. **Measures**: Postdeployment interviews. v. **Barriers**: Not enough ICU nurses to 'buddy', psychological stress for deployed staff. **Enablers**: Onsite skills training, having a critical care education specialist available, checklists, daily huddles, clear communication, and buddies.	The number of RNs that participated in the training is not detailed.
Mhawish et al., 2022, Saudi Arabia.	Questionnaire-based survey. **Aim:** To evaluate the challenges and experiences of the non-ICU nursing staff who were redeployed to the ICU.	Non-ICU nursing staff (n = 238).	iv. Orientation was valued and found useful for preparation for the ICU. v. **Enablers**: Positive correlation of satisfaction levels with the choice of	Abbreviated reporting of the survey questions impaired the clarity of what participants were asked.

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Table 1 (*continued*)

Authors, year, country	Study design, Aim	Sample	Findings specific to review questions	Strengths and limitations
			redeployment, ICU staff attitude, administration appreciation, and support from the new coworkers. **Barriers:** Redeployed staff reported concerns of increase in workload, lack of ability to fulfil the tasks, and daily-life disturbance.	
Tang et al., 2021, Singapore.	Qualitative descriptive study. **Aim:** To explore the perceived preparedness and psychosocial well-being of nurses prior to ICU deployment.	General ward nurses (n = 30).	i. **Structure:** Just-in-time ICU training of classroom teaching, ICU orientation, and on-job training. ii. **Measures**: Post-training competencies and focus group. iv. **Contributors to prepare dness**: training, support and clarity around responsibilities.	The number upskilled staff and competencies completed at the end of training were not detailed.
Course evaluations				
Almomani et al., 2020, Qatar.	Course evaluation. **Aim:** To appraise simulation-based critical care upskill programme.	Non-critical-care nurses (n = 445).	i. **Structure:** Online critical care awareness modules, simulation-based scenarios using demonstration and return-demonstration approach, further detail on **content** in Table 2. ii. **Measures**: Post-training surveys evaluated the simulation programme as being an efficient short-track educational method in pandemic crisis. Evaluations further identified the need for longer training times and increased practice opportunity to improve competency.	Evaluation was undertaken at the end of training and prior to deployment yet included questions about critical care competency.
Carter et al., 2022, U.K.	Course evaluation. **Aim:** To appraise the training outcomes of an orientation to critical care workshop for rapidly deployed staff.	Healthcare staff (n = 131).	i. **Structure:** Online learning resources and face-to-face workshop with theoretical and practical skills sessions, further detail on **content** in Table 2. ii. **Measures**: A postworkshop evaluation questionnaire immediately after the training, was compared with a second e-survey questionnaire 2 months post workshop to show which parts of the training participants found most valuable on deployment. iii. **Training needs**: End-of-life care, documentation, tracheostomy care, noninvasive ventilation.	The descriptive statistics were not presented in a way that comparisons between the pre and postdeployment surveys could be made.
Doelger et al., 2022, U.S.A.	Course evaluation. **Aim:** To assess the change in critical care knowledge, confidence, self-assessed competence, and satisfaction in learning of a rapid training program.	Medical-surgical or step-down nurses without critical care experience (n = 32).	i. **Structure**: Didactic sessions, simulation experiences, and hands-on learning in a critical care unit, further detail on **content** in Table 2. ii. **Measures**: Basic Knowledge Assessment Tool (BKAT-9r) administered before and after test to measure critical care knowledge. The Perception to Care in Acute Situations tool measured participant self-assessment of confidence and competence, and results showed significant ($p < .001$)	The use of validated tools was a strength of this paper, although the results before and after administering the critical care knowledge tool was not reported. Limitations were that competence was self-rated rather than observable, measurable competence.

Table 1 (*continued*)

Authors, year, country	Study design, Aim	Sample	Findings specific to review questions	Strengths and limitations
			improvement in participants' rating of their abilities on the pretest and posttest. The National League for Nursing's Student Satisfaction and Self-Confidence in Learning survey was administered, simulation and hands-on experience and combination of teaching modalities were rated as the most valuable part of the program.	
Kramer et al., 2022, U.S.A.	Course evaluation. **Aim:** To appraise an RN cross-training education and implementation plan.	Acute care nurses (n = 85).	i. **Structure:** Pre-learning education modules, case scenarios, simulation experiences and a 4-h shadowing experience in the ICU, further detail on **content** in Table 2. ii. **Measures**: Competencies assessed post training.	Evaluation of the pilot program and competency-assessment process were not detailed.
Jarden et al., 2022, Australia.	Course evaluation. **Aim:** To describe the development, implementation, and evaluation of an upskill education program.	Registered nurse (n = 2875).	i. **Structure:** Online delivery, further detail on **content** in Table 2. ii. **Measures**: Post-training evaluation had a 74.05% completion rate, there was a positive change in knowledge and confidence in pre and post surveys.	Demographics of participants was not described, yet it was acknowledged that the participants were not limited to non-critical-care RNs.
Medcast, 2020, Australia.	Course evaluation. **Aim:** To describe the implementation and evaluation of an upskill education program.	Registered nurses (n = 11,371).	i. **Structure:** Online delivery, further detail on **content** in Table 2. ii. **Measures**: Post-training evaluation had a 74.05% completion rate; there was a positive change in knowledge and confidence in pre-surveys and postsurveys.	Participants were not limited to non-critical-care RNs; some participants had critical care qualifications.
Nelson et al., 2022, U.S.A.	Course evaluation. **Aim:** To determine if skills education would improve nurses' confidence in performing critical care nursing skills on COVID-19 patients.	Procedural nurses (n = 23).	i. **Structure**: Critical care nursing skills stations, further detail in Table 2. ii. **Measures**: Competency assessment at skills station. Presurveys and postsurveys that assessed confidence in performing critical care nursing skills. Nurses' confidence score significantly improved from pretraining to post-training. iii. **Training needs**: Administering and monitoring neuromuscular blockade agents and vasoactive medications, caring for patients in respiratory failure, renal failure, and haemodynamic instability. Preventing central line-associated bloodstream infection, using devices to support proper body mechanics and patient repositioning.	Single setting study, convenience sampling with small sample size and data collection tools were not validated.
Case reports				
Brickman et al., 2020, U.S.A.	Case report. **Aim:** To outline the curriculum used prepare nurses to manage critically ill patients with COVID-19.	Non-critical-care nurses (n = 413).	i. **Structure:** Participants rotated through three critical care skills stations that allowed for hands-on practice with intensive care	Not all staff completed pretraining self-assessments, so it is unclear how curriculums were tailored to these staff.

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Table 1 (*continued*)

Authors, year, country	Study design, Aim	Sample	Findings specific to review questions	Strengths and limitations
			equipment, further detail on **content** in Table 2. ii. **Measures**: Pretraining self-assessment survey for some staff to identify learning needs.	
Duffy et al., 2021, Germany (U.S.A. Facility).	Case report. **Aim:** To describe the training to prepare staff for deployment to the ICU.	Non-critical-care nurses (n = 75).	i. **Structure:** Online learning, hands-on skills session and buddy shift in the ICU.	Evaluation of training by participants was not sought.
Fiore-Lopez et al., 2021, U.S.A.	Case report. **Aim:** To describe the preparation for ICU surge.	Perioperative nurses (n = not specified).	i. **Structure:** Practical training.	The number of redeployed staff was not detailed.
Hemingway et al., 2021, U.S.A.	Case report. **Aim:** To describe the development of a curriculum for surge deployment.	Perioperative nurses (n = not specified).	i. **Structure:** Online, classroom and practical. ii. **Measures**: Pretraining self-assessment survey. Post-training assessment. v. **Enablers**: Emotional support via frequent check-ins with the deployed nurses. **Barriers**: Psychological stress.	Outcomes are anecdotal.
Jones et al., 2022, U.S.A.	Case report. **Aim:** To describe a pilot program of non-critical-care RNs in a team-nursing model in the ICU.	General care nurses (n = 13)	i. **Structure**: Practical training, orientation, and a buddy shift on the ICU. ii. **Measures**: Pretraining self-assessment survey. Post-deployment evaluation. v. **Barriers**: Lack of clarity around scope of deployed staff, increased workload and stress for ICU staff, and frequent changes in COVID-19 protocols. **Enablers**: communication tools.	The pilot program had limited success in making more ICU nurses available to assist with COVID-19 surge.
Leaton et al., 2021, U.S.A.	Case report. **Aim:** To describe the practicalities of an ICU surge.		i. **Structure:** Just-in-time classroom training, further detail in Table 2. v. **Enablers**: Communication tools such as daily huddles and central communication boards, staff wellbeing resources.	Incomplete detail on the number of staff trained and training content and duration.
Lucciola et al., 2021, U.S.A.	Case report. **Aim:** To describe the nurse specialist role in preparation of a COVID-19 surge.	Healthcare staff (n = 127).	i. **Structure:** Classroom, practical, and simulation. ii. Measures: Pretraining self-assessment survey. Post-training evaluation.	The portion of participants trained for deployment to critical care areas was not clear.
Macasieb, 2021, U.S.A.	Case report. **Aim:** To outline the training and redeployment of theatre nurses to the ICU.	Perioperative nurses (n = not specified).	i. **Structure:** Didactic instruction and practical training. ii. **Measures**: Competencies assessed post training. v. **Barriers**: Frequent changes in COVID-19 protocols.	The number of RNs that was trained and the ICU competencies that were completed were not detailed.
Madore et al., 2021, U.S.A.	Case report. **Aim:** To describe the curriculum used to prepare nurses to manage critically ill patients with COVID-19 in a newly formed ICU.	Non-critical-care nurses (n = 34).	i. **Structure:** Didactic, practical and simulation, further detail on **content** in Table 2. ii. **Measures**: Twenty-five competencies were assessed following training.	The level of experience of the participants and the competencies completed at the end of training were not tabled.
Mhawish et al., 2021, Saudi Arabia.	Case report. **Aim:** To describe the preparation of nursing staff for COVID-19 surge.	Nurses (n = not specified).	i. **Structure:** Online and practical sessions. v. **Enablers**: Onsite skills training, clear communication.	Details regarding the number of redeployed staff and how many accessed the training materials are absent.
Monsei et al., 2022, Italy.	Case report. **Aim:** To describe the training to prepare newly hired staff for critical care surge.	Registered nurses (n = 85).	i. **Structure:** Didactic, practical, and insitu simulation training. ii. **Measures**: Post-training assessment.	Evaluation checklists were not tabled.
O'Donnell et al., 2021, New Zealand.	Case report. **Aim:** To describe the delivery of a critical care nurses course.	Registered nurses (n = 353).	i. **Structure**: Online lectures and skills stations with supplemental manual and	Detail of the pre course –and postcourse test results and

Table 1 (*continued*)

Authors, year, country	Study design, Aim	Sample	Findings specific to review questions	Strengths and limitations
			App, further detail on **content** in Table 2. ii. **Measures**: Precourse test and postcourse assessment.	participant feedback are not provided.
O'Donoghue et al., 2021, U.S.A.	Case report. **Aim:** To describe the practicalities of an ICU surge.	Medical/surgical nurses (n = not specified).	i. **Structure**: Didactic presentations, hands-on skill sessions and buddy experience, further detail in Table 2. ii. **Measures**: Post-training assessment. iv. **Contributor** to preparedness: Buddy time. v. **Enablers**: Consistent patient assignments, assigning familiar staff geographically, regular structured rounding, huddles and clear communication, wellbeing supports for staff.	The number of participants completing the training and the results of the post-test are not provided.
Perlstein et al., 2021, U.S.A.	Case report. **Aim:** To describe the practicalities of COVID-19 surge.	Nurses (n = 1400).	i. **Structure**: Skills stations and buddy experience. ii. **Measures**: Post-training competencies. v. **Enablers**: Communication, clarity of scope, support staff who could provide education and guide care of complex patients.	Isolating valuable information on training outcomes is difficult.
Reguindin et al., 2022, Canada.	Case report. **Aim:** To share the planning, implementation, evaluation, and revision of support nurse training for a team-based ICU model.	Nurses (n = 80).	i. **Structure**: Didactic and practical. ii. **Measures**: Pretraining self-assessment survey. Post-training evaluation. Post-deployment evaluation. iii. **Training needs**: Role clarity in the model of care, communication, collaboration, arterial line, central venous access devices, cardiac monitors, documentation and considerations for a person under investigation, code blues, patient assessment, continuous bladder irrigation. v. **Barriers**: uncertainty around role, overwhelm due to the amount of information for deployed staff, inadequate orientation to ICU, and stress and anxiety for deployed staff. **Enablers**: Just-in-time training, access to support staff, written educational materials, communication within the team and from leadership, and debriefing and support for all staff.	The duration of training and number of staff trained was not clear, and the evaluation tools were not provided
Subramaniam et al., 2021, Australia.	Case report. **Aim:** To describe the practicalities of an ICU surge.	Medical/surgical nurses (n = not specified).	i. **Structure**: Online learning modules for theoretical content and video demonstrations of selected skills, followed by orientation and buddy experiences.	The number upskilled staff is not provided and content of the online training is not detailed.
Weiss et al., 2021, U.S.A.	Case report. **Aim:** To describe the nursing professional development specialist role in preparation of a COVID-19 surge.	Nurses (n = 40).	i. **Structure**: Self-learning work and virtual presentation days on critical care essentials. ii. **Measures**: Post-training examination.	Details on post-training assessment and experience of participants are not provided.

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Table 1 (*continued*)

Authors, year, country	Study design, Aim	Sample	Findings specific to review questions	Strengths and limitations
Wells et al., 2021, U.S.A.	Case report. **Aim:** To describe strategies to prepare for pandemic surge.	Perioperative, medical/surgical and step-down nurses (n = 79).	i. **Structure**: Targeted to knowledge gaps revealed by skills assessment checklist. ii. **Measures**: Pretraining self-assessment survey. v. **Enablers**: communication, daily huddles, and frequent rounding.	Details on training and measures were limited.
Educational resources				
London Transformation and Learning Collaborative, 2020, U.K.	Educational resource. **Aim:** To support deployment of staff to the critical care setting.		i. **Structure:** Electronic resources and checklists.	

Review Questions i. What was the structure and content of rapid ICU upskill programs? ii. What measures of ICU upskill training or effectiveness have been described? iii. What training needs were identified by nurses? iv. What contributors to preparedness for deployment have been described? v. What barriers and enablers to effective deployment to ICU have been described?
Abbreviations: CRRT, continuous renal replacement therapy; ICU, intensive care unit; PPE, personal protective equipment; RN, registered nurse.

hands-on and simulation-based learning were positively received by participants as mechanisms to increase competence and confidence in critical care skills.[35] Interdisciplinary simulation training was valued as it provided participants opportunities to develop "both technical and nontechnical skills, such as communication (…) and situational awareness".[52] Participants favoured brief sessions in smaller groups, which allowed for interaction with and questioning of the instructors and less information overload.[32] For the programs that were solely online, the lack of opportunities to perform practical skills was recognised as a limitation by those who facilitated and participated in the programs.[39,40] Some provided supernumerary time 'buddy shifts' in the ICU where they shadowed an experienced ICU nurse to observe their practice, this was highly valued by participants to consolidate learning.[29,32,55]

The content of programs commonly addressed respiratory physiology, airway management, ventilation, haemodynamic, and cardiac monitoring. Some covered sedation management, neuromuscular blockade, proning, pathophysiology of respiratory failure, shock, and sepsis. Cataloguing the content of training programs was challenging due to discrepancies in the amount of detail provided by the case reports and variations in the terminology papers used. Content of programs is reported verbatim in Table 2.

II. What measures of ICU upskill training or effectiveness have been described?

The measures of upskill training were categorised as those conducted before training and post training but before deployment, and then during or after deployment. Some training programs conducted a needs assessment before the upskill training[31,42,45,46,48,56,59] and then targeted their training to the knowledge gaps identified by this assessment. Others used pretests and post-tests to assess knowledge gains resulting from training.[53] Measures taken post training but before deployment consisted of training evaluations[35,39,40,56] and examinations or competency assessments.[35,39,45,49,50,52–55,58] Evaluations at the end of programs found that training increased participants' knowledge and confidence in critical care skills,[29,31–41] although these evaluations were rarely revisited following a period of deployment to determine whether this confidence or knowledge translated to the clinical setting.

Measures evaluating training or deployment experiences taken during or after redeployment included surveys,[30,36,46,56] focus groups,[46] and interviews.[32] Feedback indicated that participants found the upskill courses useful and that they improved their feeling of preparedness for working in the ICU.[32,36,56] Advantages of the training programs were identified as opportunities for hands-on practice,[32] written or electronic educational materials,[56] and interdisciplinary training.[52] It was further recognised that educational content, pace, and delivery of programs needs to be tailored to RNs' level of experience and that knowledge, confidence, and consistency of new skills require time to develop.[32,56] Measures of the effectiveness of upskill training following deployment were not identified in the included papers.

III. What training needs were identified by nurses?

Two papers described training needs that were identified by non-critical-care nurses following a period of deployment. Carter et al.[36] described how later iterations of the upskill training included content on end-of-life care, documentation, tracheostomy care, and noninvasive ventilation, based on feedback from non-critical-care RNs and ICU nurses practicing in a surged ICU. Similarly, Requindin et al.[56] surveyed non-critical-care RNs after training and a period of deployment to identify topics they would like further training on, these included role clarity in the model of care, communication, collaboration, management of arterial lines, central-venous-access devices, cardiac monitors, documentation and considerations for a person under investigation, code blue's, patient assessment, and continuous bladder irrigation. The identified training needs to provide valuable insight on the topics relevant to upskill training as they originate from nurses who were redeployed to the ICU environment during a surge event.

IV. What contributors to preparedness for deployment have been described?

Contributors to preparedness for deployment included training, support,[34] peer education,[29] buddy time,[54] clarity around responsibilities, and communication where "clear information about the hospital deployment and training plans was required, for participants to be mentally prepared".[34] Tang et al.[34] derived their contributors for preparedness from focus groups designed to explore the perceived preparedness of ward nurses before their deployment. These insights on preparedness had the limitation that the nurses were interviewed before their deployment to the ICU, and their perceptions may have changed after gaining some experience in the ICU. It is possible that their initial expectations of what they required to prepare them for the ICU may have been different from their actual experiences of deployment.

V. What barriers and enablers to effective deployment of non-critical-care nurses to ICU have been described?

Barriers to effective deployment of non-critical-care nurses to the ICU were psychological stress,[32,45,56] lack of clarity around

Table 2
Structure and content of training programs.[29,31,32,34–45,47–50,52–55,57]

Author/s, year, country	Duration (hrs)	Training delivery					Training content
		Online	Classroom	Practical	Buddy	Simulation	
Almomani et al., 2020, Qatar.		✓		✓	✓	✓	COVID-19 pathophysiology, infection control, critical care environment, scope of service, care of patient on mechanical ventilation, care of patient with invasive lines and chest tube, care of mouth, eyes, nasogastric tubes, and urinary catheters.
Brickman et al., 2020, U.S.A.	3			✓	✓		Cardiac, pulmonary, and renal pathophysiology; care paradigms; and therapies and procedures for managing patients with COVID-19, ventilator management; medications and infusions; CRRT, documentation; haemodynamics and shock; critical care skills training.
Carter et al., 2022, U.K.	8	✓	✓	✓	✓		PPE, COVID-19: the patient pathway, respiratory care, cardiovascular care, neurological care, including pain, sedation and delirium. Essential nursing care, end-of-life care, case study discussion, self-care and orientation to critical care.
Doelger et al., 2022, U.S.A.	12		✓		✓	✓	Working under the direction of an ICU nurse; expected tasks; documentation; common tubes; ICU monitoring; assessing your patient from head to toe; common sedation medication; common analgesia medication; common pressors; common inotropic agents; paralytics; endotracheal intubation; care of the intubated patient; ventilator settings and alarms; intubation simulation scenario.
Duffy et al., 2021, Germany (U.S.A. Facility).		✓		✓	✓		Basics of respiratory assessment, ventilator management of the critically ill patient, and the treatment of acute respiratory distress syndrome, haemodynamic monitoring, assessment related to vasoactive medications, effects of sedation, and manual prone positioning.
Fiore-Lopez et al., 2021, U.S.A.	8			✓			Use of Electronic Medical Record systems.
Hampton et al., 2022, U.S.A.		✓	✓	✓	✓		Care of critically ill patient with COVID-19 web-based resources, proning, managing continuous renal replacement therapy, management and titration of sedation, use of vasopressors and paralytics and troubleshooting ventilator alarms and endotracheal tubes, basics of mechanical ventilation, weaning and sepsis.
Hemingway et al., 2021, U.S.A.	32	✓	✓	✓			Electronic medical records training, performing a patient assessment, maintaining safe patient handling, using physiological monitors, point-of-care testing and IV medication pump use.
Jarden et al., 2022, Australia.	10	✓					Core principles in assessing severe acute respiratory infection, management of hypoxic respiratory failure, arterial blood gas analysis and sampling, airway management, invasive ventilation principles, invasive ventilation management, haemodynamic monitoring, haemodynamic support, care of the sedated and ventilated patient, specific guidelines for the management of sepsis in COVID-19.
Kramer., 2022, U.S.A.	13	✓			✓	✓	Essential of critical care orientation; respiratory modules; assessment of the mechanically ventilated patient, including assessment of pain, level of consciousness, and need for sedation; management of oxygenation and ventilation; ventilator management, including identifying ventilator settings, assessing the position of the endotracheal tube, cuff and security; discussing appropriate settings based on patient condition, troubleshooting for alarms, and suctioning; nutritional assessment including verifying that the type/volume of parenteral/enteral formula is correct; assessment of the patient's ability to communicate; measures that should be taken to prevent ventilator associated pneumonia.

(*continued on next page*)

Table 2 (*continued*)

Author/s, year, country	Duration (hrs)	Training delivery					Training content
		Online	Classroom	Practical	Buddy	Simulation	
Lauck et al., 2022, Canada.		✓		✓			Basics of mechanical ventilation, foundations of acute/critical care practice, electrocardiogram interpretation, oxygenation and ventilation, and shock states, electronic medical record training.
Leaton et al., 2021, U.S.A.			✓				Acute respiratory distress syndrome, commonly used critical care medications, prone positioning, and basic ventilator management, concepts of haemodynamics, arterial catheters, noninvasive monitoring, and case simulation.
Lucciola et al., 2021, U.S.A.	24		✓	✓		✓	IV pumps and access, telemetry, code blue, nutrition care, postmortem care, oxygen delivery, safe patient handling, isolation precautions, ventilator familiarisation and manual proning exercise.
Macasieb, 2021, U.S.A.			✓	✓			Medication administration; ICU charting systems; safe patient handling; medical equipment and PPE, oxygen delivery devices, IV therapy, blood draws, viral swabs collection, IDCs, central line care, electrocardiography, ICU beds, and the continuous patient monitoring systems.
Madore et al., 2021, U.S.A.	24		✓	✓		✓	Pulmonary, cardiac, and renal pathophysiology, pharmacotherapy treatment methodologies, ventilation, advanced life support and COVID-19-specific management.
Marks et al., 2021, U.S.A.	4		✓	✓	✓		Respiratory/ventilators, proning, relevant pharmacology, and critical care monitoring including train-of-four monitoring for neuromuscular blockade assessment.
Medcast, 2020, Australia.	20	✓					Fundamental cardiac physiology, cardiovascular pathophysiology assessment and management of the patient with chest pain, and in shock states, respiratory physiology, monitoring techniques for the critically ill patient, respiratory assessment, mechanical ventilation, airway management, renal, neurological disorders, endocrine & metabolic.
Monsei et al., 2022, Italy.	30		✓	✓		✓	Description on the ICU environment, infection control, fundamentals of nursing care in the ICU, arterial/venous blood gas sampling, ventilation, intubation, CVADs, IV pumps, invasive pressure monitoring, ventilator settings, noninvasive ventilation, high-flow nasal, canula, simulation scenarios.
Nelson et al., 2022, U.S.A.	8			✓			Airway management; chest tube management; central venous line management; patient repositioning system; enteral feeding pumps; nasopharyngeal swab specimen collection; arterial line management; ICU room setup; train of four monitoring.
O'Donnell et al., 2021, New Zealand.		✓	✓	✓			Physiology; respiratory; cardiovascular, airway management; mechanical ventilation principles, modes, settings and troubleshooting; haemodynamic monitoring and shock; routine nursing care; communication and clinical handover; basic nursing assessment; airway management, haemodynamic monitoring and shock; care of the intubated patient.
O'Donoghue et al., 2021, U.S.A.	8		✓	✓	✓	✓	Care of ventilated patient, arterial lines and vasoactive infusions; closed loop communication with ICU RNs.
Perlstein et al., 2021, U.S.A.				✓	✓		Mechanical ventilation, medication management, documentation, and physical care.
Reguindin et al., 2022, Canada.			✓	✓	✓		ICU routines; nursing model; documentation; tracheostomy care and suctioning; advanced oxygen therapies; arterial lines maintenance; central vascular access device; intravenous administration; protected code blues; cardiac monitors; and ECGs.

Table 2 (*continued*)

Author/s, year, country	Duration (hrs)	Training delivery					Training content
		Online	Classroom	Practical	Buddy	Simulation	
Subramaniam et al., 2021, Australia.		✓			✓		Orientation to environment, equipment, policies and procedures.
Tang et al., 2021, Singapore.	24		✓				Invasive haemodynamic monitoring, mechanical ventilation, ECG interpretation, vasoactive and complex medication.

Abbreviations: CRRT, continuous renal replacement therapy; CVAD, central venous access devices; ECG, echocardiogram; ICU, intensive care unit; IDC, indwelling catheter; IV, intravenous; PPE, personal protective equipment; RN, registered nurse.

scope,[31,46] inadequate training or orientation,[30,56] and changing COVID-19 protocols.[46,49] ICU nurses reported uncertainty regarding their oversight and delegation of responsibilities to non-critical-care RNs and that this increased their workload and stress levels.[31,46] They also indicated that too many inexperienced helpers hindered their ability to provide patient care.[30]

Factors that facilitated effective deployment of non-critical-care nurses to the ICU included onsite skills training[32,51,56] or having access to an educator or buddy.[32,55,56] Stable teams,[30] consistent patient assignments,[30,54] allocation of familiar staff to the same geographical location,[30] and clarity of scope[55] were described as enablers. Deployed nurses found that they could be more effective in a familiar setting, where they knew the environment and staff well. Likewise, ICU nurses found that consistently working with the same deployed nurses allowed them more time for patient care as they did not lose time estimating the expertise of new coworkers. Clear and frequent forms of communication were found to be an enabler of effective deployment; this could be in the form of huddles, rounding communication boards, checklists, or written resources.[30,32,46,47,54–56,59] Wellbeing supports such as counselling services, debriefs or check-ins with education staff were well received by deployed non-critical-care RNs.[45,47,54,56]

9. Discussion

This scoping review mapped 32 papers to examine upskill training and preparedness of non-critical-care RNs deployed to the ICU during the COVID-19 pandemic. Training and redeployment of healthcare workers to the ICU during the COVID-19 pandemic[61] has been previously explored; however, this is the first review, to our knowledge, that is specific to the nursing workforce.

Upskill training varied widely in duration, mode of delivery, and content. Some explanation for these deviations can be found in the rapid and unprecedented nature of the COVID-19 pandemic. For example, some of the shorter upskill training programs were situated in New York, where the surge happened with little warning, and healthcare services were required to increase their ICU bed numbers quickly.[62] It is not surprising that upskill training of only a few hours was found to be inadequate for participants. What is not clear is how long the upskill training needs to be in order to adequately prepare non-critical-care RNs for deployment to the ICU. There is an absence of guidance on appropriate duration of upskill training, and clear recommendations are needed to allow for educational planning for surge contingencies.

The high transmissibility of COVID-19 most likely played a role in the mode of delivery of training, with some programs being delivered solely online[39,40,60] and others incorporating online elements to reduce the risk of cross infection of staff members and allow a higher number of participant access to the content. The lack of opportunities to perform practical skills was a recognised drawback of the online training programs. Reliance on this mode of delivery should be approached with caution as e-learning for healthcare staff has not been shown to have significant impact on health professionals' performance or patient outcomes.[63] The rationale for deployment of non-critical-care RNs is to support the ICU workforce with nurses who can perform practical nursing care,[9–13,15,16] so some form of practical skills training would seem to be crucial to their preparation. The inclusion of simulation education in training programs is one of the few pieces of guidance in ICU surge recommendations;[11] however, only seven of the training programs in this review utilised this approach.[35,37,38,48,50,52,54] Simulation is resource intensive, which may account for why it was not used more widely. During the pandemic, resources, in particular, personal protective equipment, had to be rationalised against the resources that were needed in the clinical area.[64]

Cataloguing the content of training programs was challenging due to the limited amount of detail provided by some papers. At the conception of this review, it was anticipated that it would be possible to map the content of upskill training to identify common core topics; however, this was not able to be achieved and is acknowledged as a limitation of this paper. What has been revealed is that while some common topics could be found, there was also a fundamental variation in approach to content by various programs. Some of the training programs were based on introductory critical care programs designed for new staff members that taught theoretical concepts designed to prepare deployed nurses to be a novice critical care nurse. Other programs took a more pragmatic approach to prepare non-critical-care RNs with skills or competencies to 'help' in the ICU. It can be derived from this that the absence of clear guidance in content or outcomes in this part of surge recommendations may have contributed this inconsistency.

Review questions (ii) through (v) were devised to capture any information that could be pertinent to the preparation of non-critical-care RNs for successful deployment to the ICU. Evaluations and assessments of ICU upskill training were described; however, no measures of effectiveness of upskill training were found. A point of interest that was revealed by this question was in Carter et al.,[36] where deployed RNs evaluated their training program at the conclusion of the training and then again following deployment. The results demonstrated that there was a change in the sessions that nurses found valuable once they had experienced some time being deployed to the ICU. This may indicate that those training evaluations that were done following training but before deployment may not have been as insightful as those done after the RNs had practiced in a surge ICU. Carter's study was one of few that contributed to the review question 'what training needs were identified by nurses?' This suggests that this requires further investigation as nurses practising in the surge environment as supervisors or deployed nurses may be the most appropriate to describe non-critical-care RNs training needs.

During the pandemic, the ICU became a focus of the healthcare system's resilience. It became clear that nurses were critically important to maintaining the continuity of ICU operations, even more so than the supply of doctors or beds. The use of staff deployment, which required nurses to step up to meet the demand or move into new roles, was the principal solution.[65,66] In future

strategic planning for healthcare workforce preparation, it has been suggested that one component of onboarding acute medical/surgical nurses is simulation training to prepare them for strategic redeployment.[67] Mobility flexibility is a workforce strategy that does not change the collective number of nurses but instead redeploys those nurses with multiple skills and knowledge to work in other under-staffed departments. Increasing the capacity of staff to work more flexibly across departments is not only relevant to pandemic preparation but has been suggested as a healthcare cost-saving mechanism.[68]

Mobility flexibility can be associated with positive outcomes such as meeting the needs of understaffed units, higher cost efficiency, acquisition of new skills and insight, and increased collaboration between the units. However, studies have shown that flexibly deploying nurses across different work units needs to be used with caution. Clinicians who work in a dedicated environment with a specific team achieve greater specialisation and better performance in their primary workplace. When clinicians are trained in a higher number of skills and work more frequently outside their units, they can become a generalist rather than a specialist. Studies have shown that nurses working across departments can reduce costs only when done at an optimal level, outside of which training costs become higher and productivity becomes lower.[68] Furthermore, greater use of flexible nurses outside of their core areas of expertise constitutes a form of work disruption that may have a detrimental effect on patient safety. Nurses who operate outside their comfort and safety zones can experience anxiety, fear, and frustration, resulting in dissatisfaction and higher turnover rates.[68,69]

The impact of the COVID-19 pandemic has placed a heavy burden on critical care nurses contributing to burnout, moral distress, and disengagement.[70–72] Deployment of non-critical-care RNs to the ICU and the resulting altered models of care placed a further burden on experienced critical care nurses.[73–76] ICU nurses reported increased workload and stress in a surged ICU that was compounded when there was a lack of clarity around their supervisory responsibilities and scope of practice of redeployed RNs.[31,46] This review also highlighted that non-critical-care RNs experienced psychological stress[32,45,56] upon deployment to the ICU setting and that they felt increased stress when there was lack of clarity around scope[31,46] or when there was not enough training or support provided.[30,32,56] Suggestion from ICU nurses and deployed RNs were for a more formal approach to defining non-critical-care nurses' skill set and expectations.[31] Surge recommendations indicate that scopes of practice should be well defined in altered models of care;[10–13,15,16] the reason this was not consistently reflected in practice is not clear. This needs to be explored further so that deployment does not place additional burden on an already incumbered nursing workforce.

9.1. Strengths and limitations

Key strengths of this review include its rigour through its adherence to Preferred Reporting Items for Systematic Reviews and Meta-Analyses Scoping Review guidelines and JBI methodology. Search terms were judiciously selected, and multiple iterations of the database searches were executed to identify the most effective terms. It is possible that relevant papers may have been excluded due to international variations in terminology; however, an exhaustive review of the reference lists of included papers did not reveal any unidentified records. Some sources did not delineate nursing data from that of upskill training for other healthcare staff and were therefore excluded; this eliminated some records,[77,78] an unavoidable consequence of the nursing focus of this review. Upskill training is a contemporary topic, and records are still emerging. This review captured those published before June 2023; it is important to recognise that these are initial data as the pandemic is still impacting parts of the world.

10. Conclusion

There is a need for a better understanding of the training requirements to equip nurses with the necessary skills to deploy to the ICU in times of surge as indicated in the findings of this scoping review. When unprepared nurses are deployed, they not only experience psychological stress but also add to the burden on ICU nurses. Although there is a consensus on the need for a surge plan for the ICU nursing workforce, current guidelines lack specific guidance on the required training. The preparation of deployed non-critical-care RNs during COVID-19 surges should inform future pandemic planning so that organisations may be in a state of operational readiness. Further exploration on how non-critical-care RNs can be adequately prepared for ICU deployment is warranted.

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CRediT authorship contribution statement

Belinda Causby: Conceptualisation, Methodology, Formal analysis, Investigation, Data Curation, Writing—Original draft preparation, Project administration. Samantha Jakimowicz: Conceptualisation, Methodology, Validation, Investigation, Writing—Reviewing and Editing, Supervision. Tracy Levett-Jones: Conceptualisation, Methodology, Validation, Investigation, Writing—Reviewing and Editing, Supervision.

Conflict of interest

None.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.aucc.2024.02.003.

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