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## Research paper

# Responding to the COVID-19 pandemic: Development of a critical care nursing surge model to meet patient needs and maximise competencies



Sandra B. Lauck, PhD, RN <sup>a,\*</sup>, Vininder K. Bains, MSN, RN, CNCC(C) <sup>b</sup>,  
 Dione Nordby, MSN, RN <sup>b</sup>, Emma Iacoe, MSN, RN <sup>a</sup>, Jacqueline Forman, MSN, RN <sup>a</sup>,  
 Jopie Polderman, BSN, RN <sup>b</sup>, Lena Farina, MHA, RRT <sup>b</sup>

<sup>a</sup> Providence Health Care, University of British Columbia, Vancouver, Canada; <sup>b</sup> Providence Health Care, Vancouver, Canada

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## A B S T R A C T

**Background:** The current coronavirus disease 2019 (COVID-19) pandemic is creating unprecedented and uncharted demands on critical care units to meet patient needs and adapt the delivery of health services. Critical care nurses play a pivotal role in developing models of care that are effective, flexible, and safe.

**Objectives:** We report on the accelerated development of a critical care nursing surge model responsive to escalating needs for intensive care capacity.

**Methods:** We conducted an exploratory prospective observational cohort study that included (i) a self-assessment and survey of learning needs of noncritical care nurses identified as candidate groups for redeployment in the intensive care unit and (ii) a pilot implementation of a team nursing model evaluated by individual questionnaires and the conduct of focus groups. We used descriptive statistics and qualitative content analysis to analyse the exploratory findings.

**Results:** We surveyed 147 noncritical care nurses; 99 (67.3%) self-assessed at the lowest level of critical care competency, whereas 33 (24.3%) reported feeling able to help care for a critically ill patient under the direction of a critical care nurse. Identified learning needs included appropriate use of personal protective equipment in the intensive care unit ( $n = 123$ , 83.7%), use of specialised equipment ( $n = 103$ , 85.1%), basic mechanical ventilation, and vasoactive medication. We completed 11 team nursing pilot assignments with dyads of critical care and noncritical care nurses categorised in tiers of competencies. Nurses reported high levels of perceived support and provision of safe care; multiple recommendations were identified to improve the model of care delivery and communication.

**Conclusions:** The complexity, acuity, and unpredictability of the COVID-19 pandemic is placing new demands on critical care nurses to modify existing processes for care delivery while ensuring excellent outcomes and professional satisfaction. The study findings provide a road map to support nursing engagement in meeting patient needs.

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## 1. Background

In early 2020, the projected number of prevalent critically ill patients at the peak of a Wuhan-like outbreak in US cities was estimated to range from 2.2 to 4.4 per 10,000 adults in response to

the rapidly escalating coronavirus disease 2019 (COVID-19) pandemic.<sup>1</sup> Similar estimates emerged from the early experience of hospitals in Italy, the US, and other regions that reported the influx of critically ill patients and the challenges associated with allocating limited resources, infection control, and clinical and ethical decision-making.<sup>2,3</sup> Practice guidelines developed to manage the surge in critical care patients recommended planning and resource allocation, assuming 20% of hospitalised adult patients with COVID-19 would require intensive care unit (ICU) admission, and cautioned hospitals to prepare to more than double their ICU capability.<sup>4,5</sup>

These early warnings confirmed the urgency to anticipate the risk of exceeding healthcare capacity and overwhelming health

\* Corresponding author at: University of British Columbia, 5426-1081 Burrard Street, Vancouver BC V6Z 1Y6, Canada.

E-mail addresses: [slauck@providencehealth.bc.ca](mailto:slauck@providencehealth.bc.ca) (S.B. Lauck), [VBains@providencehealth.bc.ca](mailto:VBains@providencehealth.bc.ca) (V.K. Bains), [DNordby@providencehealth.bc.ca](mailto:DNordby@providencehealth.bc.ca) (D. Nordby), [Elacoe@providencehealth.bc.ca](mailto:Elacoe@providencehealth.bc.ca) (E. Iacoe), [Jforman@providencehealth.bc.ca](mailto:Jforman@providencehealth.bc.ca) (J. Forman), [Jpolderman1@providencehealth.bc.ca](mailto:Jpolderman1@providencehealth.bc.ca) (J. Polderman), [lfarina@providencehealth.bc.ca](mailto:lfarina@providencehealth.bc.ca) (L. Farina).

systems, and to secure appropriate human resources and clinical operations to meet a surge in critical care patients. Consensus recommendations to implement rapid identification of positive COVID-19 cases, and procedural and isolation protocols, secure adequate supplies of personal protective equipment, and maintain quality clinical management and communication emerged. In addition, the development of an effective, flexible, and safe staffing strategy was widely endorsed.<sup>4,6,7</sup>

To this end, we report on the accelerated development of a critical care nursing surge model in anticipation of escalating patient needs for intensive care in a quaternary care Canadian centre. The project's overall objective was to augment the efforts of the British Columbia (BC), Canada, hospital system and public health recommendations to mitigate the burden of the on-going COVID-19 health emergency.

## 2. Method

### 2.1. Study objectives and design

The guiding principles steering the project included (i) patient safety and access to care across the critical care and cardiac programs and (ii) maximised nursing scope of practice informed by nurse-driven identification of competencies and learning needs. We aimed to work collaboratively with registered nurses (RNs) and other members of healthcare teams across multiple critical care and cardiac telemetry units and outpatient clinics staffed by nurses with past critical care experience to develop a coordinated nursing redeployment strategy. The objective was to leverage nursing expertise and resources to accelerate the hospital's capacity to adapt rapidly to escalating patient needs; given the uncertainty of the course of the pandemic in BC,<sup>8</sup> we aimed to match the availability of nurses to the organisation's overall surge plan and prepare for the most demanding clinical scenarios.

We conducted an exploratory prospective observational cohort study to report on the iterative development and evaluation of a surge nursing staffing model across critical care units. The study took place from March to May 2020. The scope of the project was limited to the ICU, postanaesthesia care unit, and inpatient and outpatient cardiac program to capitalise on operations and practice adjacencies, while the nursing surge planning for other clinical units was managed by other stakeholders. The study was reviewed by the University of British Columbia Providence Health Care Research Ethics Board and received exemption from the requirements of research ethics approval in accordance with university policies.

### 2.2. Setting and participants

St. Paul's Hospital at Providence Health Care, Vancouver, Canada, is a 435-bed quaternary care hospital. The hospital serves patients from all parts of BC, the third most populated Canadian province with a territory that spans nearly four times the size of the United Kingdom, with an acute care emphasis on people with heart, lung, and renal disease. The critical care units include a 19-bed ICU, 10-bed cardiac surgery ICU, and 11-bed cardiac ICU.

Nurses participating in this project were classified as either "critical care" or "noncritical care". "Critical care nurses" were currently employed in one of the three inpatient critical care units and held specialised certification in critical care nursing or equivalent. The staffing model for usual care included one RN to one to two patients, depending on acuity. Each critical care unit also includes registered respiratory therapists who are responsible for up to six mechanically ventilated patients, a clinical nurse educator, and a clinical nurse leader responsible for the day-to-day

operations. A patient care manager oversees the operations of the three units, whereas clinical nurse specialists provide practice support across the patient populations. The critical care units are medically managed in a "closed unit" model, in which critical/cardiac care physicians lead medical care in consultation with specialised services. "Noncritical care nurses" had either recent, remote, or no critical care experience and were employed in procedure rooms/units (cardiac short-stay, interventional cardiology, electrophysiology and cardiac device implantation, interventional radiology), cardiac outpatient clinics, or inpatient cardiac telemetry units.

### 2.3. Self-assessment of competencies and learning needs

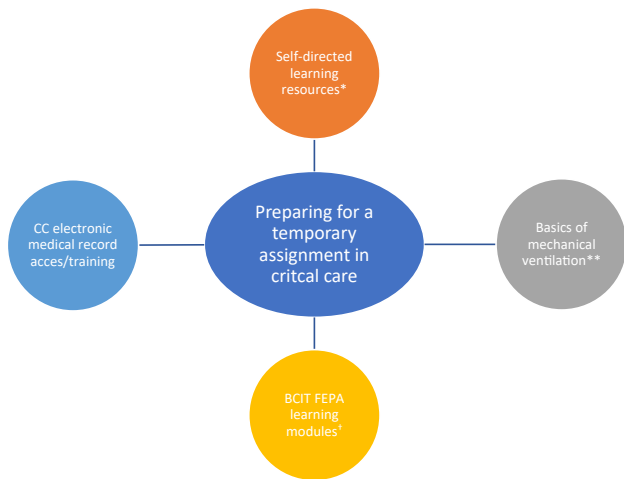
The nursing redeployment planning was aimed at informing the design of a model of care delivery with tiered levels of competency to temporarily augment existing critical care teams; the goal was not to achieve the knowledge and competency level of standard critical care required for conventional times and normal operations. Therefore, the communication distributed to all nurses stressed that the intent was to prepare to support nurses who do not routinely work in critical care units to function temporarily in this more acute environment at varying degrees of autonomy within the scope of their competencies and with the support of critical care nurses and their leadership team.

To evaluate baseline knowledge and the level of expertise, we conducted an investigator-developed survey of noncritical care RNs employed outside of inpatient telemetry units to document their previous critical care training and experience, and their self-assessed competency in one of the three levels of critical care skill sets ranging from level A (very competent in critical care) to level C (not fully competent). RNs working in the inpatient telemetry units reported their additional levels of training or work experience (e.g., full or partial completion of high-acuity or emergency programs, certification in administration of low-dose inotropes).

The clinical nurse specialist and clinical nurse educators provided a comprehensive set of tailored self-directed learning resources to meet the identified learning needs. Registered respiratory therapist practice leaders conducted in-person teaching focused on the basics of mechanical ventilation. In addition, we capitalised on the BC Ministry of Health partnership with the BC Institute of Technology Focused Education Preparation Advancing Frontline RNs (FEPFA) which published four fast-track remote education modules for frontline RNs to accelerate their capacity to provide care for critically ill patients; these included foundations of acute/critical care practice, electrocardiogram interpretation, oxygenation and ventilation, and shock states.<sup>10</sup> Finally, we facilitated the accelerated access to the ICU component of a new electronic medical record system that had been implemented in the 3 months preceding the onset of the pandemic. The provision of formal certification or credentialing based on the completion of the self-directed learning program was not included because of the limited time frame before the anticipated surge in critical care patients and the planning for a team nursing model. We stressed nurses' professional responsibility and opportunity to prepare for an assignment matched to their self-assigned level of competency. The components of the learning program are illustrated in Fig. 1.

### 2.4. Pilot implementation of team-based nursing in the ICU

We used the Society of Critical Care Medicine recommendations for the adoption of a surge model based on the hierarchy of skill sets to increase the limited number of ventilator/ICU-trained clinicians. The Society of Critical Care Medicine model combines the



**Fig. 1.** Components of the self-directed learning program made available to noncritical care nurses in anticipation of a temporary assignment in critical care based on their self-assessed competency level. CC: critical care; BCIT: British Columbia Institute of Technology; FEPA: Focused Education Preparation Advancing Frontline RNs. \*St. Paul's Hospital self-directed learning resources: personal protective equipment in the ICU, critical care assessment, equipment (IV pumps, enteral feeding), basic vasoactive medication titration, basic ventilator refresher, and cardiac arrest management. \*\*Content reviewed: modes of mechanical ventilation, basic care of the patient receiving mechanical ventilation, and patient safety. †BCIT FEPA modules: (i) Module 1 – Foundational Acute Practice: Oxygen supply and Demand; Comprehensive Assessment; Arterial Blood Gas Analysis; Haemodynamic monitoring; (ii) Module 2 – ECG Interpretation: The Basics; (iii) Module 3 – Oxygenation and Ventilation: Part A – CPAP and BiPAP; Part B – Mechanical ventilation: The Basics; and (iv) Module 4 – Shock states: signs and symptoms; Hypovolemic; Cardiogenic; Septic. RN: registered nurse.

leadership of ICU-trained physicians, nurses, and respiratory therapists to integrate a team of non-ICU physicians and nurses able to care for a ventilated patient or support overall ICU operations.<sup>10,11</sup> To adapt the proposed model to our context of nursing care, we recruited volunteer critical care and noncritical care nurses who agreed to serve as key informants and local champions. After consideration of potential options for pilot testing, we selected an initial model of a dyad of critical care and noncritical care nurses providing care for up to three ICU patients with individual assignments and a team structure. We classified RNs in five hierarchical tiers of critical care nursing competency to delineate responsibilities in the organisation of team nursing and guide the selection of appropriate assignments. The model was guided by the principles of (i) ensuring patient safety and (ii) maximising nursing competencies. In addition, we relied on nurses' professional responsibility for identifying their scope of practice and competencies, including their knowledge and experience, to ascertain their potential contributions and role. Although imperfect, we adopted arbitrary duration of work time in inpatient critical care ( $\geq 2$  years, 1–2 years,  $< 1$  year) to classify nurses' level of experience in the extensive skill set of critical care nursing (Table 1). We recognise that the acquisition of specialised skills—ranging from membership in the cardiac arrest team, the management of continuous renal replacement therapy, to the care of patients with a ventricular assist device—varies widely depending on multiple individual and system-level factors; we adopted a pragmatic approach that prioritised nurses' self-assessment and was augmented by the expertise of clinical nurse leaders in determining appropriate assignments. The classification ranged from tier 1 RN—a critical care nurse with a minimum of 2 years of experience, competent to care for all critically ill patients, and able to act as a “team nursing lead” to oversee noncritical care nurses—to tier 5 RN—self-assessed as a noncritical care level C nurse, competent to

provide help related to patient monitoring, documentation of vital signs, basic and family care, and administration of routine medications (Fig. 2).

We conducted an iterative implementation informed by the progressive input of stakeholders. The selection of assignments was determined by the nursing leadership team based on various factors, including patient acuity and COVID-19 status, physical adjacency, and learning opportunities. We prioritised the selection of relatively stable patients who were COVID-19 negative. In addition to the consideration of mechanical ventilation, we aimed to identify assignments that offered a combination of relative clinical stability to ensure patient safety during the development phase and opportunities to practice critical care skills to “test” the model and inform subsequent modifications. We relied solely on volunteer nurses who accepted the invitation to act as “coinvestigators” and champions of the iterative development of the model of team nursing. At the completion of each assignment, we surveyed all nurses to ascertain their self-reported levels of patient safety, competency, organisation, and professional experience and obtain feedback on recommendations for model improvement using an investigator-initiated instrument (Fig. 3). In the absence of an appropriate existing validated instrument, the survey development was informed by expert opinion of various representatives of nursing practice and unit management. The domains measured were validated by the nursing team; clarity of the statements was improved in an iterative manner. Additional psychometric testing was not undertaken owing to the pressing clinical needs and the confirmation of face validity by the nursing team. In addition, we conducted a series of team huddles as short focus groups in the clinical area that included key informant nurses who participated in the team nursing assignment and other clinical and operations leaders. Input was documented by a coinvestigator. We used a content analysis qualitative approach to explore key themes emerging from nurses' perspectives.

### 3. Results

We surveyed 147 nurses employed in cardiac telemetry inpatient units ( $n = 86$ , 58.5%), outpatient clinics ( $n = 18$ , 12.2%), and procedure rooms ( $n = 43$ , 29.3%). Overall, most nurses ( $n = 99$ , 67.3%) self-assessed themselves at the lowest level of critical care competency (level C), defined as being competent to help care for a critically ill patient under the direction of a critical care nurse or for a stable patient awaiting transfer to the ward. Among nurses working in outpatient clinics and procedure rooms, 33 (24.3%) rated their competency as being able to provide care for stable critical care patients (level B—including care of patients on mechanical ventilation and/or receiving low-dose vasoactive medications) (Table 2).

In response to the survey of learning needs, the review of appropriate use of personal protective equipment was selected by 98 (66.7%) cardiac telemetry, 17 (94.5%) outpatient clinic, and 8 (18.6%) procedure room nurses. Among the three groups of nurses, other gaps of knowledge included use of specialised equipment (cardiac telemetry:  $n = 67$ , 45.6%; outpatient clinic:  $n = 18$ , 100%; procedure room:  $n = 18$ , 41.9%), a review of basic mechanical ventilation (outpatient clinic:  $n = 10$ , 55.6%; procedure room:  $n = 18$ , 41.9%), and vasoactive medications (outpatient clinic:  $n = 8$ , 44.4%; procedure room:  $n = 20$ , 46.5%). Provisioning for access to the critical care modules of the electronic medical record and associated training was enabled for all cohort nurses.

We completed 11 team nursing pilot assignments with dyads of tier 1 or 2 critical care (ICU: 8, 72.7%; cardiac ICU: 3, 27.3%) and tier 4 noncritical care (procedure room: 6, 54.5%; post-anaesthesia care unit: 3, 27.3%; outpatient clinics: 2, 18.2%) nurses. The assignments of the team nursing lead and team nursing member were geographically adjacent in the ICU to

**Table 1**  
Determination of nursing competencies and skill sets.

<b>Guiding principles</b>			
1. Ensure patient safety.			
2. Maximise nursing competencies.			
<b>Competency</b>	All nurses are responsible for identifying their scope of practice and competency. Competency refers to knowledge and experience in practicing skills.		
<b>Capacity</b>	Redeployment is dependent on patient census, volume, and acuity.		
<b>Complexity</b>	Priority is placed on patients/units with the greatest clinical needs.		
<b>Care</b>	Nurses with the highest advanced training/skill set should provide care for the most complex patients if possible.		
<b>Team-based</b>	All nurses can contribute to team-based care if appropriately supported and directed.		
<b>Tier</b>	<b>Current role</b>	<b>Competency statement(s)</b>	<b>Skill set and suitable assignment(s)</b>
1	Critical care nurse working in the inpatient unit (ICU, CICU, CSICU) for at least 2 years	<i>I am competent to provide safe nursing care for <b>all</b> critically ill patients; I am competent to be a charge nurse; I am competent to be a Team Nursing lead for a grouped assignment.</i>	<ul style="list-style-type: none"> <li>- Stable and unstable critically ill patients</li> <li>- Complex mechanical ventilation strategies</li> <li>- Multiple vasoactive infusions and resuscitation</li> <li>- Acute COVID-19</li> <li>- Continuous renal replacement therapy</li> <li>- Intra-aortic counterpulsation therapy</li> <li>- New admissions</li> <li>- Cardiac arrest team</li> <li>- ± Ventricular assist device</li> <li>- ± Extracorporeal membrane oxygenation</li> </ul>
2	Critical care nurse working in the inpatient unit (ICU, CICU, CSICU) for 1–2 years	<i>I am competent to provide safe nursing care for <b>most</b> critically ill patients; I am competent to be a Team Nursing lead for a grouped assignment of stable patients.</i>	<ul style="list-style-type: none"> <li>- Stable and unstable critically ill patients</li> <li>- Mechanical ventilation</li> <li>- Multiple vasoactive infusions</li> <li>- Resuscitation activities ± support</li> <li>- Acute COVID-19</li> <li>- ± Continuous renal replacement therapy</li> <li>- ± Intra-aortic counterpulsation therapy</li> <li>- ± New admissions</li> <li>- ± Cardiac arrest team</li> </ul>
3	Critical care nurse working in the inpatient unit (ICU, CICU, CSICU) for less than 1 year; critical care nurse working in the outpatient critical care unit* with recent (≤2 years) experience in inpatient critical care	<i>I am competent to provide safe nursing care for <b>stable</b> critically ill patients.</i>	<ul style="list-style-type: none"> <li>- Stable critically ill patients</li> <li>- Basic mechanical ventilation</li> <li>- Single low-dose vasoactive infusions</li> <li>- Nonacute COVID-19</li> </ul>
4	Critical care nurse working in the outpatient critical care unit* with remote (>2 years) experience in inpatient critical care	<i>I am competent to <b>contribute to patient care</b> as a member of a Team Nursing assignment</i>	<ul style="list-style-type: none"> <li>- Stable critically ill patient</li> <li>- Basic mechanical ventilation with support from the RRT/RN</li> <li>- Low-dose vasoactive infusions</li> <li>- Nonacute COVID-19</li> <li>- Assistance for the nurse in negative-pressure rooms</li> </ul>
5	Cardiac telemetry nurse; nurse working in outpatient critical care with informal/very remote critical care training	<i>I am competent to <b>perform nursing care tasks</b> under the guidance of a Tier 1–3 critical care nurse; I am competent to care for <b>stable extubated patients receiving minimal oxygen</b> awaiting transfer to the ward.</i>	<ul style="list-style-type: none"> <li>- Basic care</li> <li>- Documentation of vital signs</li> <li>- Basic medication administration</li> <li>- Patient monitoring</li> <li>- Assistance for the nurse in negative-pressure rooms</li> </ul>

ICU: intensive care unit; CICU: cardiac intensive care unit; CSICU: cardiac surgery intensive care unit; RRT: registered respiratory therapist; COVID-19: coronavirus disease 2019.

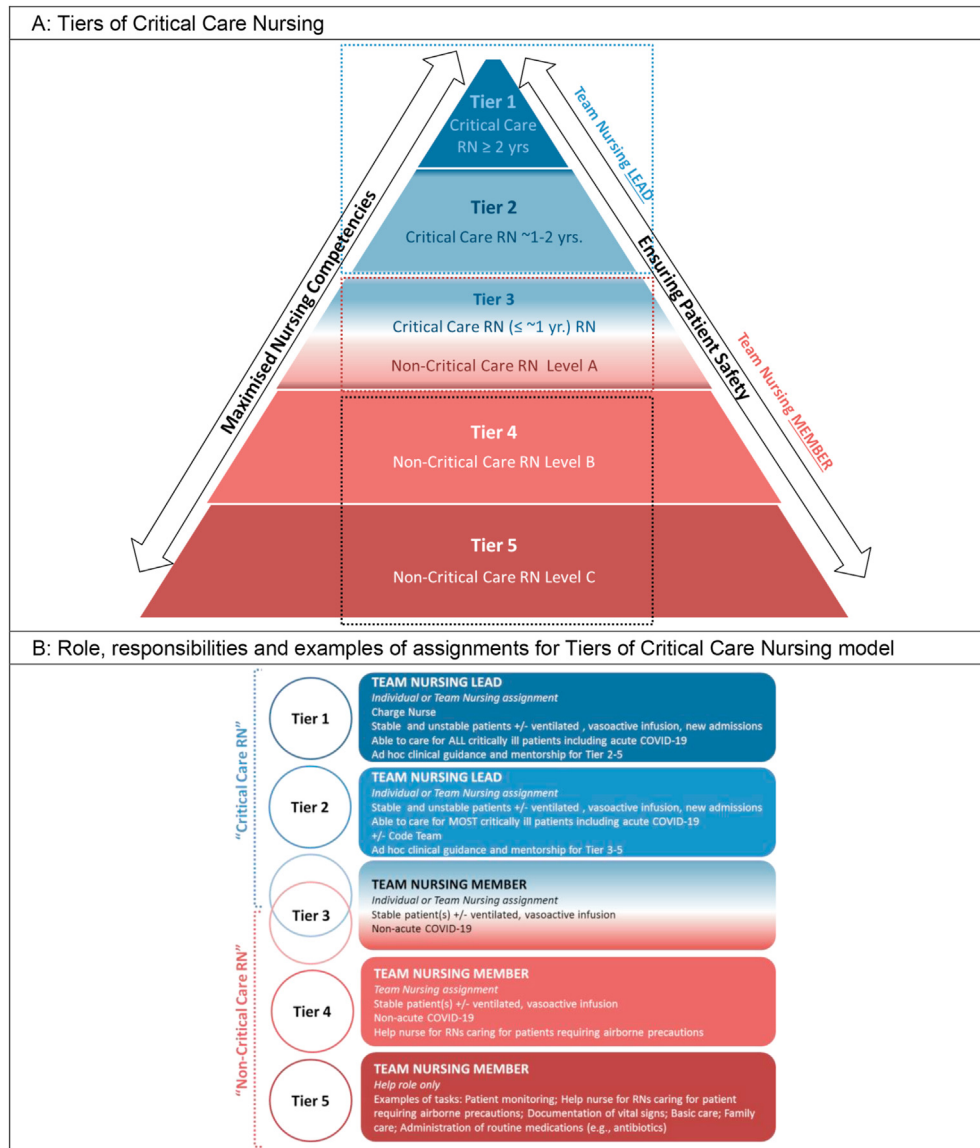
\*cardiac catheterization laboratory, outpatient cardiac clinics, interventional radiology

allow for close communication and collaboration. The team nursing lead and team nursing member described their patients' status as "stable" for 4 (36.4%) and 9 (81.1%) assignments, respectively. Overall, 18 (81.8%) patients were mechanically ventilated. The responses to the survey of nurses' self-reported experience are illustrated in Fig. 4.

Findings from the team huddle focus groups highlighted lessons learned, challenges, and recommendations that contributed unique insights. Members of the dyad differed in their contributions and

perspectives. The mentor critical care nurses reported a lack of clarity about their role as team leaders and their accountability for the overall assignment. Critical care nurses experienced a level of stress related to "feeling responsible" and needing to anticipate how they would manage patients' changes in clinical status and other uncertain scenarios. They recommended a more formal approach to identify noncritical care nurses' skill set and for further guidance on managing expectations and communications. The noncritical care nurses shared concerns about role clarity and





**Fig. 2.** Conceptual illustration of tiers of critical care nursing and role, responsibilities and examples of assignments to integrate varying profiles of nursing competencies and experience to support a team nursing model in critical care. A critical care RN was defined as currently employed in the inpatient critical care unit (intensive care unit, cardiac intensive care unit, cardiac surgery intensive care unit); a noncritical care RN was defined as an RN with no, remote, or recent critical care experience currently employed in outpatient clinics, interventional procedure rooms, or cardiac telemetry units. RN: registered nurse; COVID-19: coronavirus disease 2019.

expectations. They recommended more formal processes for start-of-shift communication and planning, a clear inventory of skill sets and expectations, and an opportunity to improve their familiarity with the physical environment and unit routines to overcome the steep learning curve. Both groups highlighted the “spirit of collegiality” across the nursing teams and the benefits of setting a tone of “welcoming guests” to reach the collective goal of safe patient care and maximised nursing competencies (Table 3).

#### 4. Discussion

In this prospective exploratory study conducted in response to the emergence of the COVID-19 health emergency and the anticipated surge in the requirements for nursing resources in the ICU, we developed a process to determine the competency level and address the learning needs of noncritical care nurses available for temporary redeployment to augment critical care teams. In the pilot implementation of a team nursing model, we found that

nurses felt well supported and respected as engaged stakeholders; most reported that they provided safe care, felt competent within their self-assessed tier of nursing, and were able to contribute in a meaningful way despite challenges related to the organisation of care. In addition, nurses provided a series of recommendations to strengthen the model of care delivery. Our study provides a road map for ICUs and other critical care units to prepare for a pandemic surge.

Canada has shared in the devastating impact of COVID-19 on people’s lives. At the time of writing, more than 5800 British Columbians have been infected and 209 have died as a direct result of the pandemic.<sup>12</sup> Compared with other regions, Canada has experienced 24.8 deaths per 100,000 people to date, a better outcome than the United Kingdom (62.6/100,000), Italy (58.7/100,000), or the United States (56.4/100,000), but significantly worse than Australia (2.7/100,000), Singapore (0.48/100,000), or New Zealand (0.45/100,000).<sup>13</sup> In particular, the early infection rates seen in residential care and among the frail elderly were devastating and

<b>What is your primary unit of employment?</b>		
<input type="checkbox"/> ICU	<input type="checkbox"/> CICU	<input type="checkbox"/> CSICU
<input type="checkbox"/> Procedure Room	<input type="checkbox"/> Ambulatory Clinic	<input type="checkbox"/> PACU/SDC
<b>What was your role on the ICU Team Nursing?</b>		
<input type="checkbox"/> ICU Team Lead	<input type="checkbox"/> ICU Team Co-Lead	<input type="checkbox"/> Non-ICU Team Nurse with Assignment
<input type="checkbox"/> Non-ICU "Help" Nurse	<input type="checkbox"/> Buddy Nurse	<input type="checkbox"/> Other:
<b>What was your patient intubated and ventilated?</b>		
		<input type="checkbox"/> Yes <input type="checkbox"/> No
<b>What was your patient's overall status?</b>		
		<input type="checkbox"/> Stable <input type="checkbox"/> Somewhat stable
		<input type="checkbox"/> Somewhat unstable <input type="checkbox"/> Unstable
<b>My experience while working on the team</b> <i>Please rate the following statements</i>		
<b>FOR ICU &amp; NON-ICU NURSES:</b> <i>I provided safe care</i>	<b>FOR ICU &amp; NON-ICU NURSES:</b> <i>I felt competent in my "Tier of Nursing" role</i>	<b>FOR ICU &amp; NON-ICU NURSES:</b> <i>I contributed to patient care in a meaningful way</i>
<input type="checkbox"/> Strongly disagree	<input type="checkbox"/> Strongly disagree	<input type="checkbox"/> Strongly disagree
<input type="checkbox"/> Disagree	<input type="checkbox"/> Disagree	<input type="checkbox"/> Disagree
<input type="checkbox"/> Somewhat agree	<input type="checkbox"/> Somewhat agree	<input type="checkbox"/> Somewhat agree
<input type="checkbox"/> Agree	<input type="checkbox"/> Agree	<input type="checkbox"/> Agree
<input type="checkbox"/> Strongly agree	<input type="checkbox"/> Strongly agree	<input type="checkbox"/> Strongly agree
<b>FOR ICU &amp; NON-ICU NURSES:</b> <i>I felt organized</i>	<b>FOR ICU &amp; NON-ICU NURSES:</b> <i>I felt well supported to provide patient care</i>	<b>FOR ICU &amp; NON-ICU NURSES:</b> <i>I felt respected</i>
<input type="checkbox"/> Strongly disagree	<input type="checkbox"/> Strongly disagree	<input type="checkbox"/> Strongly disagree
<input type="checkbox"/> Disagree	<input type="checkbox"/> Disagree	<input type="checkbox"/> Disagree
<input type="checkbox"/> Somewhat agree	<input type="checkbox"/> Somewhat agree	<input type="checkbox"/> Somewhat agree
<input type="checkbox"/> Agree	<input type="checkbox"/> Agree	<input type="checkbox"/> Agree
<input type="checkbox"/> Strongly agree	<input type="checkbox"/> Strongly agree	<input type="checkbox"/> Strongly agree
<b>FOR ICU NURSES:</b> <i>I was able to provide effective leadership for my team</i>	<b>FOR NON-ICU NURSES:</b> <i>I felt welcome</i>	<b>FOR NON-ICU NURSES:</b> <i>I was able to find the equipment and resource people I needed</i>
<input type="checkbox"/> Strongly disagree	<input type="checkbox"/> Strongly disagree	<input type="checkbox"/> Strongly disagree
<input type="checkbox"/> Disagree	<input type="checkbox"/> Disagree	<input type="checkbox"/> Disagree
<input type="checkbox"/> Somewhat agree	<input type="checkbox"/> Somewhat agree	<input type="checkbox"/> Somewhat agree
<input type="checkbox"/> Agree	<input type="checkbox"/> Agree	<input type="checkbox"/> Agree
<input type="checkbox"/> Strongly agree	<input type="checkbox"/> Strongly agree	<input type="checkbox"/> Strongly agree
<i>Comments</i>		
<b>Recommendations</b>		
<i>These are examples of what worked well for me as a member of the Team Nursing Model in the ICU</i>		
<i>These are examples of the challenges of being a member of the Team Nursing Model in the ICU</i>		
<i>These are my recommendations to improve the Team Nursing Model in the ICU</i>		
<i>Other comments</i>		

Fig. 3. Survey questionnaire completed by critical care and noncritical care nurses at the completion of ICU nursing surge planning team nursing model development. ICU: intensive care unit.

impacted the demand for health resources, especially in the setting of countries that have lower baseline critical care capacity.<sup>14,15</sup> Nevertheless, the proactive public health policies of the British Columbia Provincial Health Officer and Ministry of Health and other factors contributed to maintaining sufficient capacity in BC hospitals without necessitating the full implementation of St. Paul's Hospital ICU team nursing model during the first wave of the pandemic. The project remains instrumental in informing the ongoing surge planning, both locally and with our regional critical care partners.

The study has important implications for the ongoing planning of health service delivery to continue to manage the global health emergency. There are significant concerns across regions that rates of COVID-19 are not abating or may surge in the coming months, including the emergence of new more contagious variants of the virus; the timing and effectiveness of immunisation is

uncertain.<sup>16,17</sup> Vigilance and planning for various scenarios remain essential to mitigate risks and develop a nimble response to an unpredictable and highly morbid virus. The lessons learned in this study provide a template for hospitals to consider as we collectively share strategies to promote excellent nursing practice in modified models of care delivery. Inspired by participatory action research and implementation science,<sup>18</sup> our study design prioritised the meaningful engagement of nurse leaders and frontline nurses across the units and programs involved to achieve a coconstructed model of care delivery, a pilot test integrated in ongoing clinical care, and an evaluation framework informed by nurses' input of potential measurement indicators. The focus on collaborating closely and in a meaningful way with frontline nurses and allied health professionals reflected evidence that team engagement and training contributes to building and sustaining a culture of patient and staff safety, effective care, and optimal outcomes.<sup>19</sup> The

**Table 2**  
Self-reported critical care competency of non-critical care nurses eligible for deployment to critical care.

Home clinical unit	Nurses	Level A <sup>a</sup>	Level B <sup>a</sup>	Level C <sup>a</sup>
Description of the self-reported level of critical care competency among noncritical care RNs	147	<i>Competent to provide nursing care for all/most critical care patients</i>	<i>Competent to provide nursing care for stable critical care patients</i>	<i>Competent to help care for a critically ill patient under the direction of a regular critical care nurse and/or for stable patients awaiting transfer to the ward</i>
All units	147 (100%)	13 (8.8%)	35 (23.8%)	99 (67.3%)
Cardiac telemetry inpatient units	86 (58.5%)	2 (2.5%)	2 (2.5%)	82 (95.3%)
Outpatient clinics <sup>b</sup>	18 (12.2%)	3 (16.7%)	10 (55.6%)	5 (27.8%)
Cardiac procedure rooms <sup>c</sup>	43 (29.3%)	8 (18.6%)	23 (53.5%)	12 (27.9%)

RN: registered nurse.

<sup>a</sup> Description of levels of self-assessed critical care competency for registered nurses with previous critical care experience employed outside of inpatient critical care units.

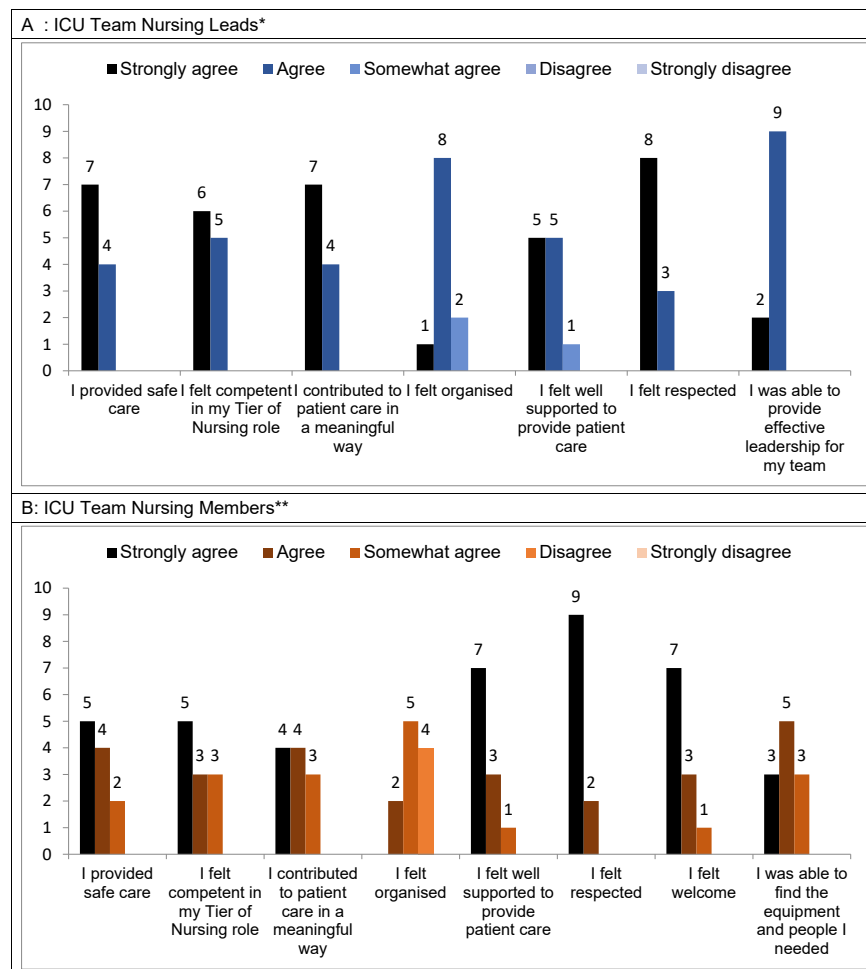
<sup>b</sup> Includes heart function, cardiac implantable electronic devices, atrial fibrillation, cardiac transplantation, adult congenital heart, transcatheter heart valve, cardiac surgery triage, cardiac catheterisation triage, and cardiac rehabilitation clinics.

<sup>c</sup> Includes cardiac short-stay unit, cardiac catheterisation laboratory, electrophysiology laboratory, cardiac procedure room, and interventional radiology.

development of a program that includes training, tools, and organisational (re)design has been shown to be an effective intervention to improve healthcare delivery.<sup>20</sup> Short-term interventions focused on technical skills augmented by a series of 30–60-min training sessions over a short period of time, with structured facilitation, evaluation, and debriefing, are associated with improved team functioning.<sup>21</sup> This evidence is particularly salient in the context of uncertainty, confusion, and anxiety experienced by nurses who care for critically ill patients with COVID-19<sup>22,23</sup> and

the imperative need to ensure nurses feel respected, valued, and engaged in the process of change management.

Although nursing practice ranges across various specialities and involves unique competencies, RNs have a single scope of practice that is conventionally overseen by a regulatory body that dictates professional standards and certifies registrants. This common scope of practice is foundational to guide all RNs' professional responsibility and accountability, knowledge-based practice, provision of service, and ethical practice.<sup>24</sup> The temporary redeployment



**Fig. 4.** Self-reported assessment of nurses' experiences during the pilot implementation of the tier-based ICU team nursing model. \*Tier 1 and 2 nurses. \*\*Tier 4 nurses. ICU: intensive care unit.



**Table 3**  
Summary of findings of focus groups and key recommendations.

Challenges	Recommendations
Critical care nurses Leadership role	<ul style="list-style-type: none"> <li>- Clarify expectations of “leadership”, the team nursing model, and implications for providing supervision/feedback.</li> <li>- Consider a role similar to preceptorship of students in the critical care training program.</li> <li>- Treat the team nursing care member as a “welcome guest” who can significantly help address the needs of ICU patients.</li> </ul>
Management of expectations	<ul style="list-style-type: none"> <li>- Use clear communication to identify the team nursing member's skill set, experience, and learning needs to address individual variation and develop/review shift plan.</li> <li>- Encourage frequent communication and “thinking-aloud” strategies (e.g., mutual role/responsibilities, clinical questions, interruptions, check-ins).</li> </ul>
Selection of the assignment	<ul style="list-style-type: none"> <li>- Be prepared to fill gaps of care that the team nursing member may not be able to complete.</li> <li>- Anticipate the need to modify the assignment/leadership role if patient acuity warrants additional care requirements.</li> <li>- Appropriate to create team nursing care dyads as a first approach to implement the model; if responsible for more than one team nursing member, need to be unassigned to provide appropriate support.</li> </ul>
Noncritical care nurses Lack of familiarity with physical environment and unit routines; steep learning curve	<ul style="list-style-type: none"> <li>- Provide “buddy shifts” with clear objectives before the assignment.</li> <li>- Develop a short orientation package with daily schedules, pertinent protocols, and photo depiction of the ICU resource team.</li> <li>- Select an appropriate assignment if possible to promote optimal learning opportunity and patient safety.</li> </ul>
Inconsistent role clarity and expectations	<ul style="list-style-type: none"> <li>- Communicate the role/model to the ICU nursing team to manage expectations.</li> <li>- Implement short “check-in” meetings between the team nursing lead and member at the start of the shift to outline the competency level, role, and support required and plan for the shift.</li> </ul>
Availability of “just-in-time” clinical support/mentorship	<ul style="list-style-type: none"> <li>- Conduct a joint first-patient assessment as a team to discuss patient issues, clinical priorities, and responsibilities.</li> <li>- Encourage clear and early communication of clinical concerns and emerging issues to ensure help is available.</li> <li>- Enhance the role of a clinical nurse educator to be available as an additional resource.</li> </ul>
Selection of the assignment	<ul style="list-style-type: none"> <li>- Optimise geographical proximity between the team nursing leader and member.</li> <li>- Select an assignment that considers the team nursing member's learning trajectory in the ICU if possible.</li> <li>- Modify the assignment in case of the patient's rapid onset of clinical deterioration.</li> </ul>
Difficulty navigating and completing electronic medical record documentation in the newly implemented system	<ul style="list-style-type: none"> <li>- Address learning needs before the temporary assignment in the ICU.</li> <li>- Provide the readily available EMR resource to address challenges and provide “just-in-time” teaching/troubleshooting.</li> </ul>

ICU: intensive care unit; EMR: Electronic medical record.

of noncritical care RNs to provide care to critically ill patients can be enabled by implementation of nursing care standards and other practice supports, with appropriate education and mentorship in place for RNs to use existing or new competencies and practice within their regulated scope.<sup>25</sup> Importantly, our model development was limited to RNs only, at the exclusion of healthcare providers with less education and training (e.g., practical nurses, nursing care aids), given the improved outcomes associated with the RN skill mix in acute settings and the established model of care at the institution.<sup>26</sup>

## 5. Limitations

Study findings should be interpreted in light of several limitations. We report on the experience of a single centre with an established environment that shaped the conduct of the study. Change in management is deeply impacted by workplace culture and other determinants; applicability and generalisability are limited by the local context of care. In the absence of evidence, we used investigator-designed classifications and questionnaires that were not previously validated. The pilot implementation was limited by the use of a single model involving a dyad of critical care and noncritical care nurses. Other models have been recommended and warrant further investigation. There is a pressing need for future research to examine the impact of modifications of critical care nursing models on patient outcomes in the context of the current pandemic to inform ongoing planning and evidence-based practice.

## 6. Conclusion

The complexity, acuity, and unpredictability of the COVID-19 pandemic is placing new demands on critical care nurses to modify existing processes for care delivery while ensuring excellent outcomes and professional satisfaction. Research is urgently needed to scrutinise modifications of established historical processes and evaluate how we can best meet the needs of patients with critical conditions without compromising safety. The dissemination of nurses' shared experience will be instrumental to promote evidence-based practice in the era of COVID-19 critical care nursing.

## Conflict of Interest

The authors do not have any conflicts of interest pertinent to this study and publication.

## CRediT authorship contribution statement

**Sandra Lauck:** Conceptualisation, Methodology, Investigation, Visualisation, Writing (Writing – original draft); **Vininder Bains:** Conceptualisation, Validation, Investigation, Visualisation, Project Administration, Writing – review & editing; **Dione Nordby:** Conceptualisation, Validation, Investigation, Supervision, Writing – review & editing; **Emma Iacoe:** Conceptualisation, Software, Validation, Formal analysis, Visualisation, Data curation, Writing – review & editing; **Jacqueline Forman:** Conceptualisation,

Methodology, Investigation, Writing – review & editing; **Jopie Polderman**: Conceptualisation, Software, Formal analysis, Data curation, Writing – review & editing; **Lena Farina**: Investigation.

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