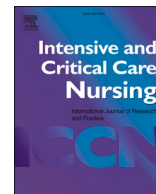




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## Research Article

## The impact of a three-tiered model of nursing redeployment during the COVID-19 pandemic: A cross-sectional study

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## ABSTRACT

**Objective:** The COVID-19 pandemic resulted in extreme system pressures, requiring redeployment of nurses to intensive care units. We aimed to assess the impacts of a 3-tiered pandemic surge model on nurses working in intensive care units during the COVID-19 pandemic.

**Methodology:** In this cross-sectional study, 931 nurses (464 intensive care and 467 redeployed nurses) who worked within four adult units in Western Canada during pandemic surge(s) were invited via email to participate in a survey. The survey explored the impact of redeployment, rapid unit orientations, just-in-time training, and the 3-tiered model of nursing during pandemic surge. Burnout was measured utilizing the Copenhagen Burnout Inventory questionnaire.

**Results:** A total of 191 survey responses were retained (59 intensive care nurses and 132 redeployed). Survey results are reported by tier, with outcomes varying based on team leadership, intensive care unit, and redeployment nursing roles. Burnout in personal and workplace domains was present amongst all nursing tiers, while only team leadership roles experienced burnout in the patient domain. Overall, team leadership roles and permanent intensive care nurses experienced the highest rates of burnout. Redeployed nurses reported numerous aids to success including support from colleagues, prior experience, and educational supports. Skill-based orientation, ongoing education, optimized scheduling, role clarity, and mitigators of psychological impacts were identified by respondents as potential facilitators of redeployment and surge models.

**Conclusion:** Nurses working within this tiered model experienced high degrees of burnout, with highest prevalence amongst team leads and intensive care nurses. Optimization of support for and interventions aimed at improving well-being are important considerations going forward.

**Implications for clinical practice:** Targeted strategies are required to support education, role transition, and optimize competency and role clarity during nursing redeployment for overcapacity surge. Essential strategies to support redeployed nurses include individualized competency assessments pre-redeployment and prior to role transitions, pairing redeployed nurses with the same intensive care nurse consistently, and availability of a nurse educator or resource for additional just-in-time training supports. Contingency disaster strategies should also include interventions targeting staff wellness and prevention of burnout, as well as identify scenarios in which redeployment may increase risks of psychological harm. Debriefing and peer-to-peer support models may increase the efficiency of psychological support for nurses, though additional research is required. Lastly, given enactment of tiered models of nursing care is largely a novel occurrence in the intensive care unit, leadership training is required to support frontline nurses taking on supervisory roles within these team models.

## Introduction

The coronavirus disease 2019 (COVID-19) pandemic has resulted in

significant strain on healthcare systems. Early reports from epicenters in China and Italy reported approximately 1 in every 5 hospitalized patients with COVID-19 infection required intensive care unit (ICU)

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admission (Grasselli et al., 2020; Wang et al., 2020). With the anticipated high numbers of critically ill patients, government and healthcare organizations created plans for the re-allocation of human resources (Al Mutair et al., 2020; Halpern and Tan, 2020).

Intensive care unit nurses have specialized knowledge, advanced skills, and clinical expertise to care for critically ill patients in a technical and rapidly evolving environment. During the pandemic, the limited number of ICU nurses, coupled with the extreme demands for critical care services, required rapid redeployment and implementation of tiered models of care (Perlstein et al., 2021; Wells et al., 2021). These models conceptually consisted of an ICU nurse leading a team of non-ICU nurses (Christian et al., 2006; Halpern & Tan, 2020; Wells et al., 2021). Frameworks outlined in the Ontario Health Plan for an Influenza Pandemic (2006) and by the Society for Critical Care Medicine provided models for surge staffing (Christian et al., 2006; Halpern and Tan, 2020). To accomplish redeployment in a tiered model, rapid identification of staff to relocate to critical care units, development of role appropriate training, and implementation of team nursing was recommended (Aziz et al., 2020).

## Background

In response to the pandemic, various surge strategies were implemented around the world (Vera San Juan et al., 2022); however, evaluation of these strategies remains underexamined. One prospective study used surveys and focus groups to assess nurses' learning needs prior to redeployment and evaluate a dyad surge model (Lauck et al., 2022). Participants in this study reported positive perceptions of competency, safety, and support. However, this was piloted with stable, non-COVID patients to optimize learning and model evaluation (Lauck et al., 2022), and therefore may not reflect the extreme pressures faced during pandemic surges.

Interlaced in the evaluation of redeployment models is the significant stress and psychological impact that the pandemic had on nurses. Several studies have highlighted nurses and health care providers working in critical care units during the COVID-19 pandemic experienced adverse psychological outcomes, including anxiety, depression, post-traumatic stress disorder (PTSD), and burnout (Altmayer et al., 2021; Butera et al., 2021; Celik and Dagli, 2021; Crowe et al., 2021; Heesakkers et al., 2021). Evaluating the impact of the pandemic, redeployment, and shift in care models on nurses is needed to inform future initiatives and model development.

### Practice setting and nursing model of redeployment

In Canada, provincial governments oversee public healthcare. In our province, the healthcare system is further organized into geographical zones so that policies and financial decision-making reflect local needs. Within our health zone there are 4 adult multisystem ICUs in which a 3-tiered model of nursing redeployment was used to support multiple surges of critically ill patients. Data obtained from bed-occupancy dashboards reported various levels of ongoing overcapacity in these ICUs during the third (December 2020 to June 2021) and fourth (September to December 2021) pandemic waves with peak average daily occupancy reaching 177% in October 2021 (Alberta Health Services, n.d.). During these waves, approximately 475 nurses were redeployed to support the adult ICU surge. These nurses came from a variety of practice backgrounds, including: a pediatric intensive care unit (PICU), neonatal intensive care units (NICUs), post anesthetic care units (PACUs), emergency departments (EDs), and surgical services. Due to extreme workforce pressures, redeployment numbers (reliant on operational tracking) are approximate. Informally, managers reported a two to threefold increase of patients under ICU RN supervision.

The 3-tiered model of nursing was developed using guiding frameworks (Christian et al., 2006; Halpern and Tan, 2020), and local expert opinion (nurse educators, clinical nurse specialist, nursing operations).

It was implemented across the zone with minor site-based variations. A 'just-in-time training' approach was used to support redeployed nurses after a rapid orientation to ICU (Table 1). Just-in-time training supports timely knowledge or skill acquisition, as well as competency maintenance for high risk, low frequency procedures (Branzetti et al., 2017; Helman et al., 2016; Peebles et al., 2020). This approach to pandemic education expedited training to allow for rapid expansion of capacity.

## Study aim

Our aim was to evaluate the impact of a 3-tiered model of redeployment and supporting initiatives such just-in-time training on nurses working in ICUs during the COVID-19 pandemic.

## Methods

### Study design

We conducted a multicenter survey, consisting of 33–40 questions, dependent on model tier. Our survey was adapted from a questionnaire developed by Lauck et al. (2022), with quantitative components exploring perceptions of tiered roles, team leadership and/or redeployment (where applicable), and adjunctive supports based on statement agreement (strongly disagree, disagree, neutral, agree, strongly agree). Given the reported psychological impacts of the pandemic on nurses, we felt it necessary to contextualize responses on the impact of the surge strategy with the Copenhagen Burnout Inventory (CBI) questionnaire (Borritz and Kristensen, 2004; Borritz et al., 2006). The CBI questionnaire was chosen for its evaluation of personal, workplace, and patient domains, ease of use, and prior validation amongst healthcare workers (Borritz et al., 2005; Borritz et al., 2006; Kristensen et al., 2005; Khasne et al., 2020; Montgomery et al., 2021). It consists of 19 questions (6–7 questions per domain), with each question having five response categories associated with numeric scores (0–100). Burnout is defined as a mean score of 50 or greater per domain (Borritz and Kristensen, 2004).

Two open ended questions were used asking redeployed nurses: *what aided your success* and *what other tools/supports would have facilitated your redeployment*. The anonymized online survey was generated within Qualtrics, Version January 2022 (Qualtrics, Provo, UT). Standard definitions were provided with survey dissemination.

### Participants

Nurses were invited to participate in the survey if they worked in any of the 4 adult multisystem ICUs or were redeployed to these ICUs during the third and/or fourth pandemic wave(s). The list of nurses redeployed to ICU were recorded by managers at the time of redeployment.

### Data collection

Surveys were disseminated via organizational email on January 7th, 2022, by an administration assistant who had no relationship with the study or prospective participants. One email reminder was sent on January 14th, 2022.

### Data analysis

Quantitative survey responses exploring perceptions of redeployment were collated and analyzed using descriptive statistics (frequencies and percents). Mean CBI scores were calculated by nursing tier per CBI domain, in accordance with definition of burnout. Additionally, individual respondent mean scores were calculated per domain along with the standard deviations (SD) and median scores of individual responses per tier.

The results were reported by demographics, nursing experience, and burnout. Open ended questions were analyzed utilizing a qualitative

**Table 1**

The 3-tiered pandemic surge model of nursing and orientation streams used within 4 adult multi-system ICUs.

Tiered Nursing Role	Primary RN (Team Leads and Non-Team Leads)	Secondary Nurse	Helper Nurse
Typical Experience	Adult ICU RN (current or recent)	Critical care experience e.g., PICU, PACU, Prior ICU RN, ED, other	Non-critical care nurse e.g., Surgical, ambulatory care services, other
Sample Roles, Responsibilities*	Advanced critical care competency, knowledge, and skill: – Care of the critically ill patient In addition, team leadership role includes: – Provision of just-in-time education, supervision, delegation, and coordination of care with secondary and helper nurses	Under supervision of ICU team lead: – May include primary assignment, starting with stable ventilated patient(s) – Potential to progress to care of patients with higher acuity, within competency and scope	Under supervision of ICU team lead: – Delegated tasks (e.g.) • Proning • Mobilization • Basic medication administration • Mouth care • Wound/dressing care
Orientation (Redeployed Only)*	Where provided: – Site dependent – Typically individualized	Standardized Classroom – Didactic and low-fidelity simulation: • Care of the COVID-19 patient (ventilator review, assessment, critical care pharmacology, other) • Infection prevention and control • Safety • Proning • Patient care tasks • Complication prevention and best practices • Patient transport • Pandemic tools • Medication and equipment review • Basic hemodynamics (e.g. arterial line maintenance)	Site Based – Variable formats (may have included): • Resource review in conjunction with on unit just-in-time training, and/or • Classroom sessions: o Basic patient care tasks and medication administration o Gastric tubes o Intravenous pump training o Pandemic tools o Basic hemodynamics (e.g. arterial line maintenance, site dependent, certification required)

\* Unit specific and individual variations existed. Safety, acting within competency, certification, scope, and communication of same to the ICU team was emphasized. Skill certification was to follow established certification protocols, if provided.

content analysis; comments were analyzed and coded into themes independently by two authors. Discrepancies were discussed with consensus achieved.

### Ethics

This study was reviewed and approved by the Conjoint Health Research Ethics Board (REB21-1777). An invitation to participate in the study was disseminated via email with a consent form describing implied consent with completion of the survey. No identifying data or IP address was collected with survey submission.

### Results

Surveys were disseminated to 931 nurses (464 ICU nurses, 467 redeployed nurses). Two hundred and twenty anonymized surveys were recorded (response rate 23.63%). Twenty-nine surveys were removed (27 incomplete, 2 activating the wrong stream (completion of helper and team leadership streams, which was not possible within the model)), resulting in 191 retained responses (see [Supplemental Tables 1, 2, and 3](#)). Of the 132 redeployed nurses, 90% (n = 119) recorded responses to the question (1) what aided your success, and 82% (n = 108) to the question (2) what other tools/supports would have facilitated your redeployment.

### Demographics

Demographic information is presented in [Table 2](#). Seventy percent of redeployed team leads (TLs) had recent ICU experience. Amongst redeployed primary nurses, 39% reported active employment in non-adult ICU critical care areas (ED, PACU, or PICU), while two (6%) reported active ICU employment (casual, redeployed across ICUs). Fifty-six percent of secondary nurses reported active critical care employment outside of adult ICU (ED, NICU, PACU, or PICU).

### Team leadership experience

Key findings pertaining to team leadership are reported in [Fig. 1](#). The majority (85%, n = 39) of ICU and redeployed TLs reported the ability to lead their team effectively. Sixty-nine percent of ICU nurses agreed they gained valuable experiences as a TL compared to only 30% of redeployed TLs. Redeployed TLs reported higher disagreement regarding ability to find resources, receiving education to perform their role, and having clear expectations for their role. However, within the general redeployment survey stream, 60% of redeployed TLs agreed they were able to find resources to perform their role in ICU and 90% reported feeling competent within their role. Only half of redeployed TLs and 44% of ICU TLs felt their teams were able to provide the safest care possible during pandemic surges. In response to the statement: I have been provided with resources for burnout, self-care, and/or moral distress, only 33% of ICU TLs agreed ([Fig. 3](#)).

### ICU nurses' experience

Key ICU non-TL responses are reported in [Fig. 1](#). Seventy-four percent of ICU non-TLs reported they were able to support in-the-moment learning needs for redeployed nurses compared to only 53% of ICU TLs. Additionally, the majority (95%) of ICU nurses felt respected by nursing colleagues. Forty-eight percent of ICU nurses and 36% of ICU TLs felt they were able to provide safe patient care.

### Redeployed nurses' experience

The majority (60%) of redeployed nurses disagreed when asked if voluntarily redeployed. Most (76%) redeployed nurses agreed they supported redeployment to provide care in critical situations, while 50% of redeployed TLs disagreed with this statement. Most (79%) respondents felt welcomed in the ICU and respected by nursing colleagues. Only 45% of nurses agreed they had received adequate education during a time of rapid redeployment ([Fig. 2](#)).

**Table 2**  
Survey respondent demographics.

Characteristic	n (%)
Redeployed	
No (ICU RN)	59 (30.89)
Yes	132 (69.11)
Home unit	
ICU	61 (31.94)
PACU	19 (9.95)
Medical/Surgical Inpatient Units	16 (8.38)
PICU	12 (6.28)
Cardiac: Cardiovascular/Cardiac ICU, Cardiac Catheterization, Cardiac Clinics, Other	10 (5.24)
Operating Room	10 (5.24)
Outpatient Clinics	9 (4.71)
Gastrointestinal/Endoscopy	6 (3.14)
NICU	5 (2.62)
ED/Urgent Care	5 (2.62)
Homecare	4 (2.10)
Other (neurology, transplant, donation, quality/safety, clinical information systems, other, unknown)	34 (17.80)
Nursing Tier	
ICU, Team Lead	36 (18.85)
ICU, Non-Team Lead	23 (12.04)
Redeployed Team Lead	10 (5.24)
Redeployed Primary Nurse	33 (17.28)
Secondary Nurse	39 (20.42)
Helper Nurse	50 (26.18)
Years of critical care experience**	
ICU Team Lead (n = 36)	
<3 years	7 (19.44)
3–5 years	6 (16.67)
6–10 years	12 (33.33)
> 10 years	11 (30.56)
ICU, Non-Team Lead (n = 23)	
< 3 years	1 (4.35)
3–5 years	6 (26.09)
6–10 years	6 (26.09)
> 10 years	10 (43.48)
Redeployed Team Lead (n = 10)	
< 3 years	0
3–5 years	2 (20)
6–10 years	2 (20)
> 10 years	6 (60)
Redeployed Primary Nurse (n = 33)	
None	2 (6.06)
< 3 years	3 (9.09)
3–5 years	6 (18.18)
6–10 years	9 (27.27)
> 10 years	8 (24.24)
Experience noted without recorded years	5 (15.15)
Secondary Nurse (n = 39)	
None	4 (10.26)
< 3 years	5 (12.82)
3–5 years	6 (15.38)
6–10 years	8 (20.51)
> 10 years	8 (20.51)
Experience noted without recorded years	8 (20.51)
Helper Nurse (n = 50)	
None	41 (82.00)
< 3 years	2 (4.00)
3–5 years	2 (4.00)
6–10 years	3 (6.00)
> 10 years	1 (2.00)
Experience without recorded years	1 (2.00)

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Table 2 (continued)

Characteristic	n (%*)
Number of redeployed shifts worked (n = 132)	
0–5	4 (3.03)
6–10	2 (1.51)
11–15	17 (12.88)
15–20	18 (13.64)
> 20	91 (68.94)

\* Percent rounded to the nearest hundredth decimal.

\*\* Prior critical care experience for redeployed nurses (primary, secondary, and helper) inclusive of adult ICUs and non-adult ICUs (i.e., ED, NICU, PACU, PICU).

Helper nurses scored highest (78%) when asked if they gained valuable critical care knowledge. Redeployed TLs and secondary nurses were more likely to experience unclear role expectations (50% and 49% respectively). Half of redeployed TLs reported discomfort in refusing tasks based on comfort or competency. Only 20% of redeployed TLs reported they felt comfortable asking for additional education or support when needed compared to higher agreement amongst other redeployed tiers (64 to 72%). Thirty-seven percent of redeployed nurses reported receiving resources regarding burnout, self-care and/or moral distress, with the highest rate of disagreement (80%) reported by primary TLs.

#### Copenhagen Burnout Inventory (CBI)

The CBI was used to capture domains of burnout after the 4th wave of the COVID-19 pandemic. Notably, all tiers report high degrees of burnout (mean score  $\geq 50$ ) in both the personal and workplace domains. Personal burnout scores were highest amongst redeployed TLs (mean score 77.08), followed by ICU TLs (74.31), ICU non-TLs (70.11). Workplace burnout scores were highest amongst ICU TLs (74.80), followed by ICU non-TLs (68.94), and redeployed TLs (66.07). Unlike other categories, the only tiers scoring a high degree of burnout in the patient domain were TLs.

#### Qualitative analysis: open text comments

##### Facilitators of ICU redeployment

Of the 119 responses to the question exploring aids to redeployment, support from colleagues was the most cited aid to success across all roles (60%, n = 71). Welcoming, supportive, and appreciative ICU staff were frequently reported (41%, n = 49). Patience and flexibility with redeployed staff learning a new role (6%, n = 7), and ability to support just-in-time training was valued (8%, n = 9). Support from nurse educators, charge nurses, and managers was valued (13%, n = 15). Peer support from other redeployed staff (7%, n = 8), recognizing teammates (3%, n = 4), and manager support from the home unit (2%, n = 2) were also identified. Being assigned to the same team/nurse was recorded to improve confidence, role clarity, or the establishment of relationships (5%, n = 6).

... Staff 'were patient and understanding when it came to my limitations and need for further education to perform tasks successfully' (Respondent 69).

'The nursing staff in the ICU were all welcoming and very grateful... it was nice they recognized how difficult it was for us to be redeployed without a choice' (Respondent 88).

Prior critical care or high-acuity experience was the second highest reported aid to success across multiple tiers (23%, n = 27).

'Having many years of critical care experience gave me the confidence to ask questions and advocate for myself and my patients' (Respondent 54).

The third most reported aids, reported by all tiers except primary nurses, were educational supports including: provision of classroom and/or unit orientations, access to resources (online resources, checklists, role descriptions), and in-the-moment educational supports (11%, n = 13). Individual characteristics were also cited, including organization, grit or perseverance, work ethic, adaptability, and self-advocacy (9%, n = 11).

Other less frequently reported (5%, n = 6) aids to success included: flexible or casual scheduling, optimal patient assignments, prior knowledge of clinical documentation systems, or maintaining current assigned role as secondary nurse (versus transition to primary). Coping strategies were occasionally identified ([3%, n = 4], viewing role as a team support, counseling and trying to make best of the situation, acknowledging the temporary nature of redeployment).

#### Identified redeployment needs and challenges

**Orientation/education.** Of the 108 responses that explored facilitators to redeployment, nurses identified their highest need (46%, n = 50) being additional orientation and educational supports. Redeployed TLs and primary nurses noted unit specific orientations, including overview of unit processes or routines would have been beneficial (16%, n = 6 [of total respondents: redeployed TL, n = 10; redeployed primary, n = 28]). Some helper and secondary nurses requested additional/designated buddy shifts at orientation onset (11%, n = 8 [of total respondents: helper nurses, n = 35; secondary nurses, n = 35]). Thirty-one percent (n = 11) of helper nurses identified up front classroom training, where not received, would have been beneficial. Utilization of just-in-time training was recognized by a few secondary and helper respondents (4%, n = 3) to place a large orientation burden on frontline ICU nursing staff and enhanced classroom training would be optimal. Requests for targeted education for adult populations (from NICU/PICU nurses), care of non-COVID patients, and clinical documentation systems (from nurses requiring access/training) were more commonly recommended by secondary nurses (11%, n = 4).

**Scheduling.** The need for a flexible schedule, and advanced redeployment notice (including notice of extension of redeployment) was reported across all tiers (12%, n = 13), with some indicating they had less than 24 h' notice prior to redeployment. Inability to control one's schedule, disruptions (shortchanges, shift work patterns, longer shift durations), and inability to take time off were disruptive to work and personal schedules (6%, n = 7). Respondents highlighted challenges posed to maintenance of work-life balance, and experienced inadequate periods of rest (4%, n = 4). Unknown duration of redeployment was described as a contributor to stress (5%, n = 5). Respondents with family responsibilities highlighted challenges, such as last-minute coordination of childcare, were exacerbated by last minute notifications and altered work patterns (5%, n = 5).

'It was hard to manage the stress of going back to ICU and the required personal life changes as a result of the unexpected change. It did not



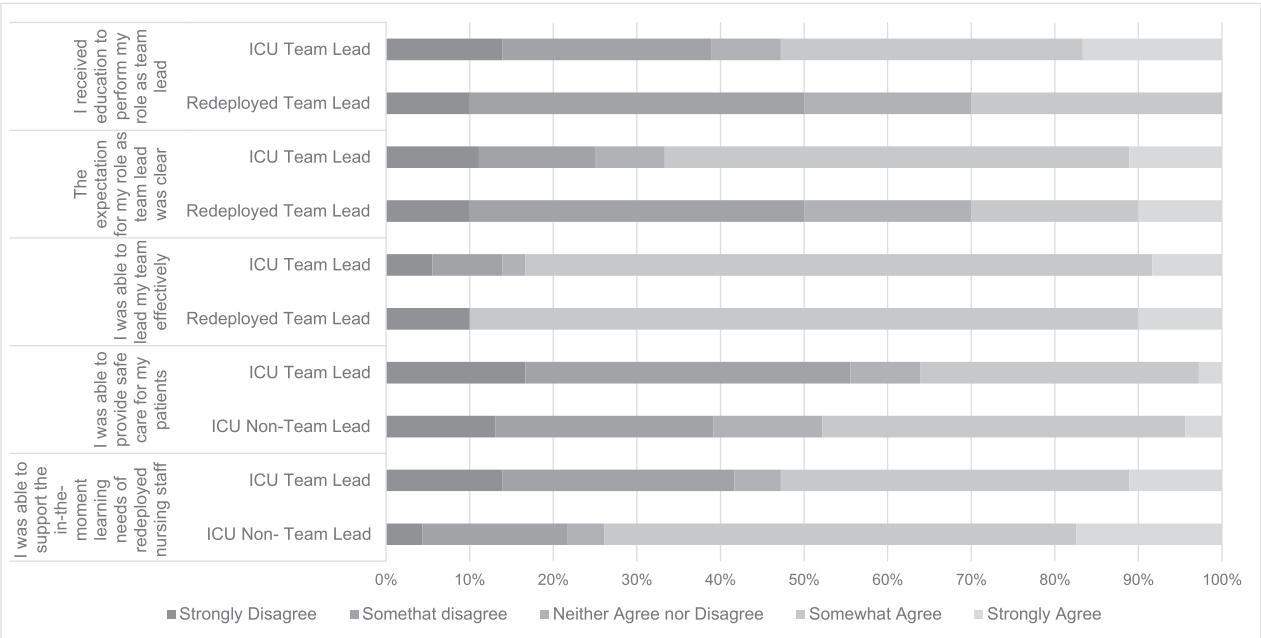


Fig. 1. ICU RNs' and redeployed team lead experiences during the pandemic.

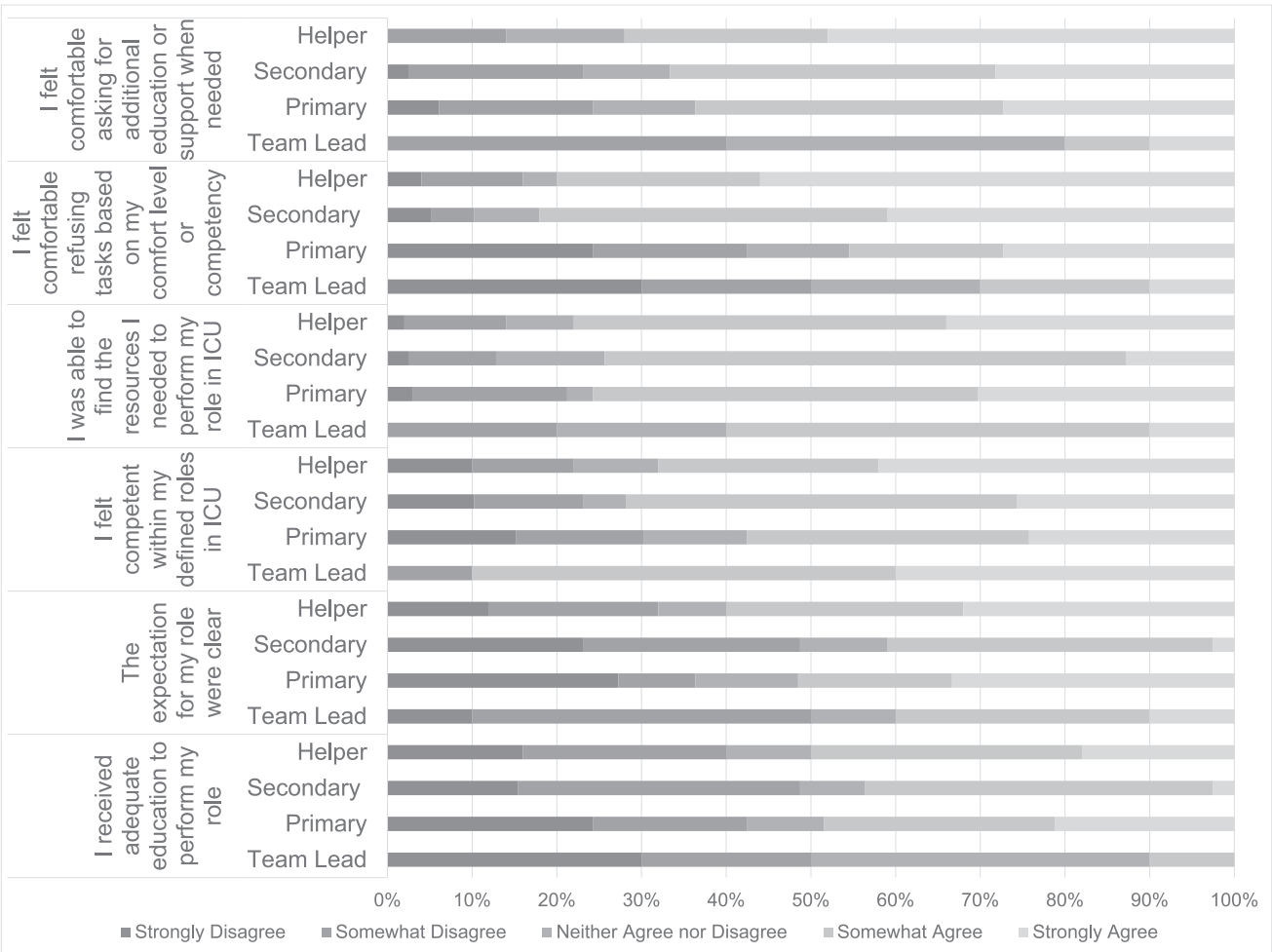


Fig. 2. Redeployed nurses' experiences during the pandemic.

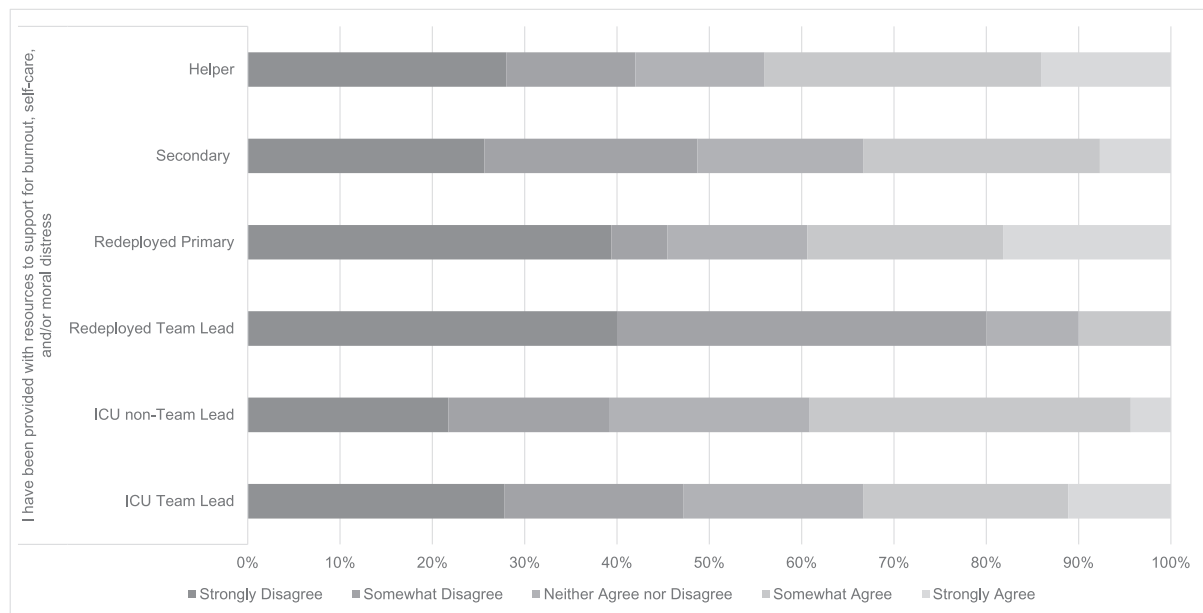


Fig. 3. Resources for burnout, self-care, and/or moral distress.

*provide a good emotional mindset for the change. More warning of the change would have been helpful...* (Respondent 13).

Other recommendations to improve redeployment included redeployment on a voluntary basis (4%,  $n = 4$ ), ensuring redeployed staff are sent back to their home unit if not needed (2%,  $n = 2$ ), paid shift differential (for non-unionized employees; 1%,  $n = 1$ ), and ability to choose redeployment unit (2%,  $n = 2$ ).

**Support.** Increased support from nurse educators was a need identified by 7% ( $n = 5$ ) of secondary and helper nurses. Further, 10% ( $n = 7$ ) of secondary and helper nurses highlighted having dedicated check ins (with educator, manager), or a dedicated mentor, would have streamlined competency development, and may have improved unit transitions.

*'Having a designated mentor to work with. Additional teaching or follow up from the educators. I felt bullied and constantly belittled. It was very difficult to anticipate the needs and preferences of each nurse'* (Respondent 123).

Despite need for these supports, 5% ( $n = 3$ ) of nurses in primary and secondary tiers highlighted the limited availability of nurse educators and bedside staff to address in-the-moment learning needs. One nurse reported the exhaustion experienced by ICU nurses negatively impacted the ability to engage in teaching opportunities. Another nurse highlighted the need for resources for staff experiencing burnout. A general need for enhanced communication was identified (9%,  $n = 10$ ). Less commonly identified support needs included (5%,  $n = 5$ ): support from home units or managers, advocating for activation of pandemic protocols by physicians when faced with high workload/patient load, debriefing, or integration of feedback between pandemic waves to improve processes.

**Role clarity/transition.** Across primary, secondary, and helper roles, the need for enhanced role clarity was identified (11%,  $n = 11$ ). A few respondents (2%,  $n = 2$ ) reported not working to full scope and advocated for appropriate role assignments reflective of training and experience. A small number of respondents in primary or secondary tiers (5%,  $n = 3$ ) reported role transitions (to the primary tier) should only be undertaken if mutually agreed upon: such transitions were identified as sources of discomfort and requiring additional educational support. One NICU

nurse explicitly reported experiencing stress as a direct result of role assignment, due to gaps between neonatal and adult practices.

**Psychological impacts.** A few nurses (3%,  $n = 3$ ) reported psychological trauma and harm from their previous work in ICU:

*'I find it extremely disappointing that redeployment was done without consideration of previous experience and current well-being of staff. I left... due to PTSD and to continue nursing. To be put back in that situation... almost ended my nursing career. I am still considering leaving nursing...'* (Respondent 60).

One nurse without prior ICU experience stated they would have benefited from education and support for potential traumatic scenarios witnessed in the ICU. Another nurse further indicated that programs beyond offered organizational supports were required. Three nurses (3%) reported needing medical or stress leave as a result of redeployment to ICU. Reasons for leave included disruptions to personal life, burnout, and stress associated with redeployment.

A number of respondents acknowledged the challenges faced during extreme surge, with no further identification of supports (e.g., none; 7%,  $n = 7$ ), or recognition that additional supports were not always feasible (4%,  $n = 4$ ):

*'They did the best they could for this situation'* (Respondent 108).

## Discussion

Rapid expansion of ICUs to support increased patient volume during the pandemic presented many challenges. Redeployment of nurses to ICU was a common strategy used during the pandemic to meet the increased need for ICU resources (Vera San Juan, 2022). To better understand the impact of redeployment on nurses, we conducted a cross-sectional study utilizing a survey to assess the 3-tiered model of redeployment used within 4 adult ICUs. Respondents across all tiers reported positive outcomes of redeployment, including high degrees of mutual respect. All redeployed tiers perceived making meaningful contributions to patient care. Similar outcomes were reported in an evaluation of a dyad team nursing model for a pandemic surge by Lauck et al. (2022).

Several key redeployment and surge strategy issues uncovered in this study echo those identified in the piloted dyad team nursing model, including: Dedicated support from the ICU team (optimization of



assignments, support from ICU buddy and nurse educator), provision of buddy shifts, and up-front education to address learning gaps (Lauck et al., 2022). In contrast, fewer nurses in our study felt competent within their role. Open-text responses further underscored this finding, citing the need for increased role clarity and educational supports. Assignment of redeployed staff with the same nurse has been identified as a strategy to enhance role clarity and team cohesion (Cadge et al., 2021). Given the differences in study designs we are unable to extrapolate if this outcome is related to the differences in models or the collection of data after several significant surges in our study. Additionally, nurses in our study were involuntarily redeployed, which may have contributed to negative experiences.

Participants in our study identified appropriate education as a key strategy to improve redeployment. The need for ongoing education has been identified in the literature (Endacott et al., 2022). Although efforts were made to provide necessary education prior to redeployment, efforts to individualize education and creation of infrastructure to support ongoing education may better address the learning needs of redeployed staff. Further barriers to ongoing education in our study was the redeployment of educators to direct patient care, the large number of redeployed staff, and the absence of educators overnight. TLs were heavily relied on for training and support which may have contributed to their negative experience and high workload (Sezgin et al., 2022). In another study, responsibility for other staff members was significantly associated with higher Depression, Anxiety, and Stress Scale scores (Hammond et al., 2021).

Within our study, team leads faced further unique challenges. Redeployed TLs reported unclear role expectations, difficulty finding resources, and inadequate education to perform their role. TLs reported the highest discomfort refusing tasks based on comfort/competency, possibly related to their increased workloads, including the need to support team members. Inability to perform patient care tasks while maintaining adequate supervision during peak capacity is a challenge noted by ICU nurses (Hennus et al., 2021). Though many redeployed nurses taking on TL roles had recent or current ICU experience, tailored education that includes leadership, coordination of teams, and tools to assess competency and provide education could be considered as part of advanced nursing skill or part of future pandemic planning (Stalpers et al., 2022). Likely several factors contributed to the TLs perception that they were unable to provide safe care during patient surges, including increased responsibility for team members, high patient acuity and overall pandemic-related stress.

The majority of respondents in this study reported burnout within personal and workplace domains, indicating high levels of exhaustion both within and outside of work (Borritz et al., 2005). Our findings echo the existing literature, where burnout has been further observed amongst nurses and health care providers working in critical care units during the pandemic (Azoulay et al., 2021; Butera et al., 2021; Douglas et al., 2022; Gomez et al., 2020). Identified risk factors for burnout include high workload (Butera et al., 2021), perceived inadequate resources, poor communication, lack of scheduling control, and shift work patterns (Gomez et al., 2020).

Despite stress and burnout experienced by nurses within our study, utilization of counselling and other formal support resources were rarely reported, consistent with other published studies (Altmayer et al., 2021; Cadge et al., 2021). Further, despite circulation of broader organization supports during various pandemic waves, few nurses in our study reported receiving resources for burnout/self-care/moral distress. Factors that likely impacted the use of formal supports include accessibility and timeliness, as schedules and workloads would have required attendance during time off. Nurses may also prefer models of peer support, given mutual understanding of lived experiences (Cadge et al., 2021). Exploration of in-the-moment resources and training staff as peer supports may be an opportunity to improve negative psychological impacts from the critical environment nurses work in, even outside of the pandemic.

Beyond burnout, this study was not designed to evaluate the

psychological impact of the pandemic on nurses, however open text responses suggest psychological harm. Notably, rapid redeployment and altered schedules also had significant impacts on those with family responsibilities. Redeployed nurses reported stress related to skill acquisition, comfort with role, role transitions and available supports. A study by Hammond et al. (2021) found healthcare providers working in ICU during the pandemic who reported inadequate support were more likely to score higher for depression, anxiety, and stress. Importantly, Azoulay et al. (2021) found the ability to rest and care for family has been associated with lower depression, anxiety, burnout, and PTSD scores amongst healthcare providers during the pandemic.

Ideally, pandemic preparedness includes interventions to address potential burnout, well-being and retention of staff post pandemic surge. Based on our findings, to improve the 3-tiered redeployment model for future surges we recommend interventions to address 3 key areas: appropriate selection of TLs and redeployed staff, provision of ongoing education and support, and prioritization of staff well-being. Leadership training as part of continuing competencies in ICU may better prepare nurses to adapt to leadership roles within team models (Stalpers et al., 2022). Assessment of nursing skills to individualize education and maximize competency is warranted (Lauck et al., 2022). These assessments could also be employed prior to tier advancement. Pairing redeployed nurses with the same ICU nurse supports ongoing role clarity (Cadge et al., 2021). Lastly, additional means to enhance just-in-time training support, including on unit nurse educator availability is recommended (Lauck et al., 2022); the need for this availability as a resource should be considered prior to direct patient assignment.

Although redeployment of staff is a strategic approach, leadership should be mindful of the risk to redeployed staff. Some nurses have previously left ICU because of significant trauma and are at high risk of further trauma with involuntary redeployment. Nurse redeployment should not be required if there is significant risk to their well-being. Additionally, meaningful interventions to prevent and identify those at risk of burnout are needed. Peer to peer support and mentorship may help to address this in the future.

## Limitations

This study has numerous limitations. By nature of the cross-sectional study design, we can only identify the prevalence of burnout, without identification of causative factors. Participant bias may be present within our sample (e.g. those experience burnout may be under/over represented). Further, the ongoing workload of ICU staff approaching the onset of wave 5 pandemic surge may have impacted response.

## Conclusion

The pandemic surges posed extreme challenges and necessitated rapid expansion of ICU capacity and space, rapid redeployments of nursing staff, and implementation of tiered models of nursing to meet critical demands. However, to appropriately prepare for future disaster situations, it is crucial to examine the relevant issues. This study identified nurses working in ICU experienced a high degree of burnout, with highest prevalence amongst team leads and ICU nurses. Our findings contribute to the evolving literature exploring the experiences of nursing during multiple pandemic waves and will aid in the identification of strategies to improve future pandemic planning. We recommend additional research evaluating psychological impacts, including burnout, within the context of tiered nursing models.

## Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.iccn.2023.103431>.

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