CACCN

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Canadian Association of Critical Care Nurses

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CANADIAN ASSOCIATION OF CRITICAL CARE NURSES

Canadian Association of Critical Care Nurses

Vision statement

All critical care nurses provide the highest standard of patient and family-centred care through an engaging, vibrant, educated and research-driven specialized community.

Mission statement

We engage and inform Canadian critical care nurses through education and networking and provide a strong unified national identity.

Values and beliefs statement

Our core values and beliefs:

- Excellence and Leadership
  - Collaboration and partnership
  - Pursuing excellence in education, research, and practice
- Dignity and Humanity
  - Respectful, healing and humane critical care environments
  - Combining compassion and technology to advocate and promote excellence
- Integrity and Honesty
  - Accountability and the courage to speak up for our beliefs
  - Promoting open and honest relationships

Pathways to success

1. **Leadership:**
   - Lead collaborative teams in critical care interprofessional initiatives
   - Develop, revise and evaluate CACCN Standards of Care and Position Statements
   - Develop a political advocacy plan

2. **Education:**
   - Provision of excellence in education
   - Advocate for critical care certification
3. **Communication and Partnership:**
   - Networking with our critical care colleagues
   - Enhancement and expansion of communication with our members
4. **Research:**
   - Encouraging, supporting, facilitating to advance the field of critical care
5. **Membership:**
   - Strive for a steady and continued increase in CACCN membership

Opinion

In 2011, I attended the National Teaching Institute (NTI), the national conference of the American Association of Critical-Care Nurses (AACN) for the first time. There I had the opportunity to attend a talk by Dr. Elizabeth Bridges entitled, "Critical Care Studies You Should Know About". Dr. Bridges provided an overview of numerous research studies pertinent to critical care, such as those on surviving sepsis, preventing central line infection and ventilator-associated pneumonia. She summarized the results, the context and, importantly, whether this evidence was enough to support a practice change in our critical care units. This lecture had a huge impact on me. It highlighted my need for resources, language and knowledge translation tools to help me have conversations, lead quality improvement projects, advocate during team meetings and provide support and education to patients, substitute decision makers and families—ultimately enabling me to effect change at the frontlines of critical care nursing practice.

Scenario 1: The patient you are providing care for is anuric and has been on continuous renal replacement therapy for 24 hours. You remove their Foley catheter and are doing intermittent bladder scans. The family worries the patient will be incontinent and want to know why you took it out.

Scenario 2: You have joined the hospital's acute resuscitation team and now run to every code blue in your facility. The resuscitation carts have an intraosseous (IO) access kit, but they are not routinely used even though you notice the team often struggles with gaining vascular access.

Scenario 3: You recently completed a chart review, as part of an incident debrief, and noticed your team avoided central line catheter insertions when medications could be managed through peripheral venous access. However, once the central line catheter was placed, no one wanted to remove it even when it was no longer needed. The original peripheral also remained in situ.

These three scenarios represent common situations that I have encountered in my critical care nursing practice. Each of the scenarios represents an outdated practice that requires effective change. To effect change, resources like current literature reviews and evidence, change agent(s) and new policies and/or procedures are required.

Effecting change…

In 2017, The Canadian Association of Critical Care Nurses (CACCN) and Canadian Nurses Association (CNA) partnered with Choosing Wisely Canada. Choosing Wisely Canada is an organization that leads a national campaign to reduce unnecessary tests and treatments in healthcare that do not provide benefit or may cause harm to patients. Eleven members of CACCN with representation for all regions of the country reviewed more than 300 practices and looked at all aspects of nursing in critical care to identify current evidence-informed recommendations and associated rationales. Using a rigorous approach, we developed a list of five recommendations of interventions or treatments that are commonly practiced in the intensive care unit (ICU) and are within the scope or influence of nursing. Each recommendation positively impacts the outdated practices highlighted in the previous three scenarios.

The Choosing Wisely – Critical Care Nursing collaboration has provided critical care nurses with evidence to have both a national voice and to communicate with patients, family members and the interdisciplinary team each day on rounds. Evidence-informed recommendations enable critical care nurses to advocate for patients, facilitate stewardship of their units and participate in rigorous processes that influence programs and look to improve outcomes. Critical care nurses are always striving to improve the safety and quality of care for patients in the ICU and this list echoes the scholarship presented by Dr. Bridges in 2011 and supports us in doing less, to do more.

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Choosing Wisely Canada Nursing: Critical Care

The Canadian Nurses Association and the Canadian Association of Critical Care Nurses (CACCN) in collaboration with Choosing Wisely Canada recently published *Nursing: Critical Care – Five Things Nurses and Patients Should Know*.

CACCN representation was comprised of an 11-member nursing working group consisting of CACCN critical care nursing experts from across Canada. There was a broad representation of geographical regions and critical care practice settings.

Following a rigorous process modelled on Delphi (consensus) methodology, a final list of five recommendations was produced. The recommendations were made publicly available on July 27, 2020, and are provided for our readership here.

The CACCN extends its thanks to Aden Hamza, Policy Advisor, Policy & Government Relations at CNA for supporting the nursing work group and to the following CACCN members:
Kathy Bouwmeester, NWG Committee Chair/CACCN Past-President, Calgary, AB
Jane de Boer, Pierrefonds, QC
Colleen Breen, Waterloo, ON
Margie Burns, Vernon Bridge, PE
Basil Evan, Winnipeg, MB
Clare Fielding, Toronto, ON
Carla MacDonald, New Glasgow, NS
Shelly Samwell, Newmarket, ON
Orla Smith, Toronto, ON
Mat Wenger, Calgary, AB

Choisir avec soin Canada Soins infirmiers : Les soins intensifs

L'Association des infirmières et infirmiers du Canada (AIIC) et l'Association canadienne des infirmières et infirmiers en soins intensifs (ACIISI), en collaboration avec Choisir avec soin Canada, ont récemment publié le document « Soins infirmiers : Les soins intensifs – Cinq principes que le personnel infirmier et les patients doivent connaître ».

La représentation de l'ACIISI comprenait un groupe de travail de 11 membres composé d'experts en soins infirmiers intensifs de l'ACIISI de partout à travers le Canada. Il y avait une large représentation des régions géographiques et des milieux de pratique en soins intensifs.

À la suite d'un processus rigoureux modelé sur la méthodologie Delphi (consensus), une liste finale de cinq recommandations a été rédigée. Les recommandations ont été rendues publiques le 27 juillet 2020 et sont mises ici à la disposition de nos lecteurs et lectrices.

L'ACIISI remercie Aden Hamza, conseillère en politique, politique et relations gouvernementales à l'AIIC, pour son soutien au groupe de travail concernant les soins infirmiers, ainsi que les membres suivants de l'ACIISI :
Kathy Bouwmeester, Présidente du comité NWG / Ancienne présidente de l'ACIISI, Calgary (Alberta)
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Carla MacDonald, New Glasgow (Nouvelle-Écosse)
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Orla Smith, Toronto (Ontario)
Mat Wenger, Calgary (Alberta)

Nursing: Critical Care

Five Things Nurses and Patients Should Question

by
Canadian Nurses Association
Canadian Association of Critical Care Nurses
Last updated: July 2020

Choosing Wisely Canada™
In collaboration with the Canadian Medical Association

1 Don't insert or leave in place a urinary catheter without an acceptable indication.

While it's common to insert indwelling urinary catheters for critical care patients, prolonged use can lead to catheter-associated urinary tract infections (CAUTI), urosepsis, increased hospital stays and other complications. Although critical illness can be a legitimate indication for urinary catheter use, daily assessment of urinary catheters is recommended. Some evidence indicates that reminder systems or stop orders in critical care settings can reduce the incidence of CAUTI and catheter duration.

2 Don't administer benzodiazepines to treat symptoms of delirium.

The treatment of delirium is multifactorial, including environmental stimulation, ongoing mobilization and family presence. Guidelines recommend against using benzodiazepines for sedation, unless otherwise indicated (e.g., withdrawal related to alcohol or benzodiazepine use). The inappropriate administration of benzodiazepines may harm a critically ill patient by inadvertently increasing the incidence of delirium or the length of stay in an ICU. Nonpharmacologic strategies should be used, along with monitoring, assessing and treating pain. Preliminary research has shown that implementing nurse-driven daily awakening protocols and best practice bundles such as ABCDE may improve outcomes, including decreases in length of overall hospital stay, ventilator days and risk of ICU-acquired delirium.

3 Don't use physical restraints with critically ill patients as the first choice to prevent self-extubation or removal of lines or tubes.

The intention to use physical restraints to prevent self-extubation or accidental removal of lines or tubes is often misguided. In fact, some research has found restraints have the potential to cause harm to critically ill patients, including complications but not limited to unplanned extubation, increased risk for delirium, and prolonged recovery. The use of physical restraints in ICU patients in Canada is common and significantly higher comparable to some European countries. Guidelines recognize the paucity of evidence to substantiate the use of physical restraints as an effective strategy. The use of physical restraints can be minimized by maintaining direct visual observation of patients, permitting the presence of family care partners, initiating spontaneous awakening and breathing trials (to support removal of endotracheal tube and thus reduce need for restraints), and assessing delirium and the need for mobilization. Decreased use of physical restraints is an important indicator of quality nursing care.

4 Don't repeatedly attempt intravenous access during a life-threatening event when intraosseous access is available.

In emergency situations, intravenous (IV) access can be difficult to obtain. Nurses often lose time trying to insert peripheral IVs, and insertion of central venous catheters may be initiated. However, intraosseous (IO) access is a faster and safer option, with less chance of complications, when inserted by trained personnel.

5 Don't prolong use of central venous or peripherally inserted central catheters without daily reassessment.

Central venous or peripherally inserted central catheters require close monitoring for signs of central line-associated bloodstream infections (CLABSI) and should be reviewed daily during multidisciplinary rounds to ensure the appropriateness of the catheter and its intended use. Peripheral intravenous catheters should be assessed daily and removed if they are not part of the continued plan of care or the lumen remains dormant for greater than 24 hours. Unless medically necessary for parenteral nutrition or vasoactive support, the strategies to mitigate CLABSI in central venous access should include considering an access device that is the least invasive with the greatest likelihood of reaching the end of the planned therapy with the lowest rate of replacements and complications.

How the list was created

The Canadian Nurses Association (CNA) and the Canadian Association of Critical Care Nurses (CACCN) established its Choosing Wisely Canada nursing list by convening an 11-member nursing working group (NWG). The group consisted of critical care nursing experts from across Canada, representing a broad range of geographical regions and practice settings. The NWG began considering its list by reviewing existing recommendations, including items from Choosing Wisely Canada's specialty societies and the American Academy of Nursing (AAN) Choosing Wisely list, both of which had already undergone rigorous evidence reviews. In addition, members brought forward recommendations on new evidence-based items. The NWG appraised 331 items for their relevance to critical care nursing using a structured process developed for this work. Each of these items (302 Choosing Wisely Canada items, 25 AAN Choosing Wisely items and 4 independently submitted items) was appraised by two working group members and then validated by the group. Using a modified Delphi process for the next two rounds of revision, the group refined and adapted 14 items until it reached consensus on a final six-item list. A literature review was conducted to confirm the evidence for these items, with support from the Canadian Agency of Drugs & Technologies (CADTH) and supporting nursing research was added where appropriate. The list subsequently underwent extensive consultation, with input from nursing experts in patient safety, members of the Canadian Network of Nursing Specialties, patient advocates, CNA jurisdictional members, CNA nurses, principal nurse advisors, CADTH and Choosing Wisely Canada's internal clinician reviewers. In March of 2020, the Choosing Wisely Canada critical care nursing list was presented to the CNA Board of Directors, who gave it their full endorsement and support.

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About the Canadian Nurses Association

CNA represents registered nurses from ten provincial and territorial nursing associations and colleges, independent registered nurse members from Ontario and Quebec and retired registered nurses from across the country. CNA advances the practice and profession of nursing to improve health outcomes and strengthen Canada's publicly funded, not-for-profit health system.

About the Canadian Association of Critical Care Nurses

The Canadian Association of Critical Care Nurses (CACCN) is a volunteer organization of Critical Care Nurses. CACCN is the voice for excellence in Canadian critical care nursing. Our shared goal is promote quality patient- and family-centered care for Canadian's experiencing life threatening illness and injury.

About Choosing Wisely Canada

Choosing Wisely Canada is a campaign to help physicians and patients engage in conversations about unnecessary tests, treatments and procedures, and to help physicians and patients make smart and effective choices to ensure high-quality care.

ChoosingWiselyCanada.org | info@ChoosingWiselyCanada.org | @ChooseWiselyCA | /ChoosingWiselyCanada

Soins infirmiers intensifs

Cinq interventions que le personnel infirmier et les patients devraient remettre en question

par
L'Association des infirmières et infirmiers du Canada
L'Association canadienne des infirmières et infirmiers en soins intensifs

Dernière mise à jour : juillet 2020

Choisir avec soin MC

1 N'insérez pas ou ne laissez pas en place une sonde urinaire sans indication acceptable.
Il est courant d'insérer une sonde à demeure pour les patients en soins intensifs; pourtant, une utilisation prolongée peut entraîner une infection urinaire associée à une sonde, un urosepsis, un séjour prolongé à l'hôpital et d'autres complications. Même si une maladie grave peut constituer une indication légitime d'insertion d'une sonde, il est recommandé de réévaluer tous les jours la nécessité de la laisser en place. Des données indiquent que l'utilisation d'un système de rappels ou l'instruction d'arrêt dans les milieux de soins intensifs peut réduire l'incidence des infections urinaires associées à une sonde ainsi que la durée d'utilisation du cathéter.

2 N'administrez pas de benzodiazépine pour traiter les symptômes du délire.
Le traitement du délire est multifactoriel : il doit notamment prendre en compte la stimulation environnementale, la mobilisation constante et la présence de la famille. Les lignes directrices recommandent d'éviter les benzodiazépines pour la sédation, à moins d'indication contraire (p. ex. les symptômes de sevrage dus à la consommation d'alcool ou de benzodiazépines). L'administration inappropriée de ces médicaments peut nuire aux patients dans un état critique en augmentant l'incidence du délire ou la durée du séjour à l'unité de soins intensifs. Il convient d'utiliser des stratégies non pharmacologiques, ainsi que la surveillance, l'évaluation et le traitement de la douleur. Des études préliminaires ont démontré que l'utilisation par le personnel infirmier d'un protocole d'éveil quotidien et de pratiques exemplaires (p. ex. le protocole ABCDE) peut améliorer les résultats, notamment en diminuant la durée du séjour à l'hôpital, le nombre de jours sur respirateur et les risques de délire dû aux soins intensifs.

3 N'utilisez pas d'emblée des moyens de contention physique chez les patients dans un état critique pour prévenir l'extubation ou le retrait de sondes, de cathéters ou de tubes.
Il est souvent malavisé d'utiliser des moyens de contention physique pour prévenir l'extubation ou le retrait accidentel des sondes, des cathéters ou des tubes. En fait, des études indiquent que cette pratique peut nuire aux patients dans un état critique et entraîner notamment une extubation non prévue, une augmentation du risque de délire ou une augmentation du délai de guérison. Au Canada, l'utilisation de moyens de contention physique chez les patients en soins intensifs est courante et considérablement plus élevée que dans certains pays d'Europe. Les lignes directrices reconnaissent le manque de données sur l'efficacité de cette pratique. Il est possible de réduire son utilisation en gardant un contact visuel direct avec les patients, en permettant la présence de partenaires de soins appartenant à la famille, en effectuant des essais d'éveil et de respiration spontanés (pour aider au retrait du tube endotrachéal et ainsi réduire la nécessité de contention) et en évaluant le risque de délire et le besoin de mobilisation. La diminution des moyens de contention physique est un indicateur important de la qualité des soins infirmiers.

4 N'essayez pas à répétition d'établir un accès intraveineux lorsque la vie du patient est en danger si un accès intraosseux est disponible.
En situation d'urgence, il peut être difficile d'établir un accès intraveineux. Le personnel infirmier perd souvent du temps à essayer d'insérer une injection intraveineuse par voie périphérique; par conséquent, il peut opter pour la pose d'un cathéter veineux central. Toutefois, l'établissement d'un accès intraosseux est plus rapide et sécuritaire et risque moins d'entraîner des complications lorsqu'il est réalisé par du personnel qualifié.

5 Ne prolongez pas l'utilisation de cathéters veineux centraux et de cathéters centraux insérés par voie périphérique sans réévaluation quotidienne.
Les cathéters veineux centraux et les cathéters centraux insérés par voie périphérique requièrent une surveillance étroite des signes d'infection de la circulation sanguine liée à un cathéter central , et leur utilisation devrait faire l'objet d'une réévaluation quotidienne durant les visites multidisciplinaires des patients pour s'assurer qu'ils sont toujours pertinents et remplissent les fonctions prévues. L'utilisation des cathéters centraux insérés par voie périphérique devrait être revue tous les jours, et ils devraient être enlevés s'ils ne font pas partie du plan continu de soins ou si les lumières du cathéter restent éteintes pendant plus de 24 heures. À moins que l'utilisation de ces cathéters ne soit nécessaire pour la nutrition parentérale ou le soutien vasoactif, il convient de réduire les risques d'infection de la circulation sanguine liée à un cathéter central en envisageant d'utiliser le dispositif d'accès le moins effractif possible et le plus susceptible de rester en place jusqu'à la fin du traitement prévu avec un minimum de remplacements et de complications.

Comment la liste a été établie

L'Association des infirmières et infirmiers du Canada (AIIC) et l'Association canadienne des infirmières et infirmiers en soins intensifs (ACIISI) ont établi leur liste Choisir avec soin pour les soins infirmiers en formant un groupe de travail en soins infirmiers de 11 membres. Le groupe était composé d'experts en soins intensifs des quatre coins du Canada, représentant un éventail complet de régions et de milieux de pratique. Le groupe de travail a commencé à élaborer sa liste en passant en revue les recommandations existantes, dont les éléments Choisir avec soin des sociétés de spécialistes et la liste Choosing Wisely de l'American Academy of Nursing (AAN) qui reposaient sur des preuves rigoureusement vérifiées. Les membres ont en outre formulé des recommandations concernant de nouveaux éléments fondés sur des preuves. Le groupe de travail a évalué la pertinence de 331 éléments pour les soins infirmiers intensifs à l'aide d'un processus structuré expressément adapté à cette tâche. Chaque élément (302 éléments tirés de la campagne Choisir avec soin, 25 de l'AAN et 4 soumis de manière indépendante) a été évalué par deux membres du groupe de travail et ensuite validé par l'ensemble. À l'aide d'un processus Delphi modifié pour les deux rondes suivantes de révision, le groupe a raffiné et adapté 14 éléments jusqu'à l'atteinte d'un consensus concernant la liste définitive de six éléments. Une revue de la littérature scientifique a été réalisée pour confirmer les données probantes de ces éléments, avec le soutien de l'Agence canadienne des médicaments et des technologiques de la santé (ACMTS). Des recherches en sciences infirmières ont été ajoutées en complément lorsque nécessaire. La liste a par la suite fait l'objet d'une consultation élargie; on a recueilli les commentaires d'experts en soins infirmiers axés sur la sécurité des patients, de membres du Réseau canadien des spécialités en soins infirmiers, de représentants des patients, de membres des sections de l'AIIC, d'infirmières et infirmiers de l'AIIC, de conseillers principaux en soins infirmiers, et des professionnels de la santé réviseurs de l'Agence canadienne des médicaments et des technologies de la santé (ACMTS) et de Choisir avec soin à l'interne. En mars 2020, la liste Choisir avec soin pour les soins infirmiers intensifs a été présentée au Conseil d'administration de l'AIIC, qui a fourni son plein appui et donné son aval.

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À propos de l'Association des infirmières et infirmiers du Canada

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À propos de l'Association canadienne des infirmières et infirmiers en soins intensifs

L'Association canadienne des infirmières et infirmiers en soins intensifs est une association professionnelle bénévole d'infirmières et d'infirmiers en soins intensifs qui milite pour l'excellence de la profession au Canada. Son objectif est de promouvoir des soins de qualité axés sur les patients, ainsi que sur leur famille, aux prises avec une maladie ou une blessure menaçant leur vie.

Au sujet de Choisir avec soin

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Caring for patients on CRRT—Key safety concerns identified by nurses

By Frances Fothergill Bourbonnais, PhD, RN, Sharon Slivar, MEd, RN, and Sue Malone-Tucker, BScN, RN

Abstract

Background: *Acute kidney injury (AKI) is a common complication in critically ill patients. Renal replacement therapy may be prescribed for patients in AKI and may be provided in the form of intermittent hemodialysis or continuous renal replacement therapy (CRRT). CRRT is suitable for unstable critically ill patients, as it involves a slow continuous process. An intense nursing workload is required for this procedure in addition to caring for a critically ill patient. Therefore, it is important to understand nursing practices.*

Purpose: *A Canadian survey was conducted to gain insight into CRRT nursing practices. This article focuses on selected results pertaining to patient safety.*

Methods: *The design for this study was descriptive using a survey. The target population was ICU nurse educators at Canadian teaching and community hospitals. Topics in the survey included: staff education, CRRT ordering and initiation practices, vascular access, filters and filter life, anticoagulation methods and safety concerns.*

Findings: *One hundred and twenty-nine surveys were mailed out and 73 were returned for a response rate of 57%. In the return surveys, all provinces were represented, but not the territories. Of the 73 completed surveys, 36 (49%) of the hospitals used CRRT. The findings revealed that educators identified several safety concerns related to anticoagulation, vascular access, machine malfunction and medication errors.*

Conclusion: *Specific strategies were identified related to safety concerns. Registered nurses need knowledge and expertise to care for patients on CRRT and are valuable members of the interprofessional team in ensuring patient safety.*

Key words: ICU, CRRT, nursing care, safety

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Implications for nurses

- ICU nurses assess and manage patients on CRRT on a 24/7 basis.
- CRRT is associated with several safety issues recognized and responded to by nurses.
- Strategies used by nurses to prevent or manage safety issues need to be recognized.

Background

Acute kidney injury (AKI) is a common complication for hospitalized patients and especially those admitted to the Intensive Care Unit (ICU) (Bagshaw et al., 2017; Negi et al., 2018). AKI refers to a sudden decline in kidney function that results in fluid, electrolyte and acid-base balance disturbances due to a decreased glomerular filtration rate and decrease in clearance of small solutes (Dennen et al., 2010; Pugh-Clarke et al., 2017). AKI is associated with increased risk of short- and long-term morbidity including possible progression to chronic kidney disease or death (Kane-Gill et al., 2015; Negi et al., 2018; Singbartl & Kellum, 2012). The decision-making related to commencing renal replacement therapy (RRT) in the ICU often occurs within a context of rapid development of AKI and a patient that is hemodynamically unstable (Tolwani & Wille, 2009). From the authors' experience, patients who are hemodynamically unstable are those whose blood pressure state requires vasopressors to maintain a mean arterial pressure of 60–80 mmHg (depending on the setting and patient context). Talley et al. (2013) concur that to have hemodynamic stability requires a mean arterial pressure greater than 65 mmHg. Douvris et al. (2018) conducted a systematic review of interventions to prevent hemodynamic instability during renal replacement therapy (HIRRT) in critically ill patients. Five randomized controlled trials and four observational studies were included in the review. They found that hemodynamic instability is common in all forms of RRT including intermittent hemodialysis (IHD) and continuous renal replacement therapy (CRRT). These authors concluded there was limited evidence related to specific interventions to prevent or limit this instability. There also was variability in defining HIRRT.

CRRT is suitable for ICU patients (Sutherland & Alexander, 2012), as it allows for the slow continuous removal of fluids, solutes and wastes 24 hours per day, rather than rapid removal, as occurs with IHD. CRRT refers to several types of therapy: continuous venovenous hemodiafiltration (CVVHDF), continuous venovenous hemodialysis (CVVHD), continuous venovenous hemofiltration (CVVH), slow continuous ultrafiltration (SCUF) and sustained low-efficiency dialysis (SLED) (Golestaneh et al., 2012). Although the intent of this article is not a detailed explanation of different modes of CRRT, an overview is provided.

In CRRT, all the modalities use a filter with a semipermeable membrane that allows water and solute transport through the membrane and then discards waste substances. Ultrafiltration is present in all CRRT modalities and refers to the passage of water through this membrane under a pressure gradient. There is an increase in the rate of ultrafiltration if higher pressures and faster flow rates are used. Diffusion and convection are the processes by which solutes pass through the semi-permeable membrane. CVVHDF combines diffusion and convection to remove water

and wastes (AlEnezi et al., 2014). It works on small or middle-size molecular weight substances such as urea or potassium. CVVHD uses diffusion to remove toxins from blood to dialysate, but not large molecular weight substances (Golestaneh et al., 2012). CVVH uses mostly convection for removal of large quantities of water and small size substances. SCUF provides slow removal of fluid and is suitable for patients who only need fluid removal (Golestaneh et al., 2012). SLED is a hybrid form, in between CRRT and IHD, that is delivered over eight to 12 hours. It clears small solutes efficiently at a slower rate. It does not have to be delivered continuously because there is efficient solute clearance (Golestaneh et al., 2012). In an attempt to examine different modalities of CRRT, AlEnezi et al. (2014) compared CVVH and CVVHDF in a retrospective cohort study in which records were reviewed for all CRRT procedures between 2007-2010 in a large Canadian tertiary centre. Data from 153 patients were included and revealed that 59 received CVVHDF while 94 received CVVH to treat AKI in the ICU. The researchers found that results were similar for patient length of stay and 30-day mortality in the two approaches.

The CRRT machine is situated at the ICU patient's bedside and incorporates a peristaltic roller pump (Talley et al., 2013) and a series of scales on which the fluids (replacement and dialysate) and effluent bags are situated. The scales continuously and precisely weigh the fluid removed, the replacement fluid returned to the patient and the dialysis solution used, and as well alert the nurse when there is a discrepancy with the weight change it is expecting (American Nephrology Nurses' Association, 2008).

A central venous catheter (CVC), usually with a double lumen (non-tunneled, non-cuffed) is connected to the circuit on the CRRT machine (Dirkes & Wonnacott, 2016). Blood is removed from the patient via the access lumen of the CVC, passes through the extracorporeal circuit (filter) and re-enters through the return lumen of the CVC. During this process, under the influence of osmotic and hydrostatic pressure, water and solutes (the ultrafiltrate) pass through the filter and are collected in a device (the effluent bag). Fluid and electrolyte replacements, such as potassium and sodium chloride to maintain acid base balance, can be added at this time, as the blood returns to the patient (Headley & Wood, 2014).

Many situations can create catheter dysfunction in CRRT such as thrombosis, development of a fibrin sheath, or malposition, which will affect catheter blood flow (Moist, 2016). If the patency of the CVC is not maintained to provide good blood flow, treatment interruption will ensue (Richardson & Whatmore, 2015). Alarms alert the nurse to pressure changes, which may be indicative of catheter dysfunction. Trouble shooting is done by the nurse in response to these alarms in order to maintain the treatment (Palevsky, 2018; Richardson & Whatmore, 2015).

CRRT involves the use of high-alert medications such as anticoagulants (Institute for Safe Medication Practices [ISMP] Canada, 2016) and one of the more difficult management issues related to nursing practice with CRRT is the issue of anticoagulation. The goal of anticoagulation is to decrease circuit (filter) clotting and, therefore, avoid treatment interruption (Palevsky, 2018; Schneider et al., 2017). Changing the circuit is costly, time consuming for nurses and can lead to catheter-associated blood stream infection (Dirkes & Wonnacott, 2016). The net result is fluid removal goals not being achieved (Shingarev et al., 2011).

According to Oudemans-Van Straaten et al. (2011) and Tolwani and Wille (2009), heparin was the most commonly prescribed method of anticoagulation during CRRT. However, more recently Schneider et al. (2017), suggest that regional citrate anticoagulation (RCA) may increasingly be adopted. For purposes of this article, the term citrate will refer to RCA. Karakala and Tolwani (2016) cite that evidence is now suggesting that citrate may cause less bleeding and increase circuit life. Recommendations from Kidney Disease Improving Global Outcomes (2012) are that citrate be used if there is no contraindication for the patient and an established protocol for administration exists.

Nursing care and CRRT

ICU registered nurses (RNs) are the only healthcare professional at the bedside 24/7 monitoring and managing patients on CRRT. CRRT is a high-risk, but often low-frequency complex procedure (Windt, 2016) involving an intense nursing workload. Because CVCs are used to deliver CRRT, nurses who care for these patients require experience in managing central lines, as well as comprehensive knowledge and experience caring for unstable, critically ill patients. To care for patients on CRRT, ICU nurses must have knowledge of renal failure and renal replacement therapies, how to initiate, trouble shoot, maintain and terminate CRRT, knowledge and judgement related to high-alert medications used in anticoagulation, fluid replacement (pre- or post-dilution), how to read settings, retrieve data and change flow rates (Windt, 2016).

There are several safety issues with CRRT such as bleeding related to the use of anticoagulation, problems with the extracorporeal circuit leading to treatment interruption, fluid balance errors leading to hypotension and electrolyte disturbances, as well as issues with vascular access (Shingarev et al., 2011). However, there is limited literature related to nursing management of CRRT (Richardson & Whatmore, 2015). A Canadian survey was conducted in 2010-2011 with ICU educators to examine nursing practices with CRRT (Fothergill Bourbonnais et al., 2016). This paper reports on selected results of this national survey.

Purpose of survey

The purpose of this survey was to examine nursing practices with CRRT within Canadian ICUs.

Methods

Design

This study was descriptive in design using a survey for data collection (Grove et al., 2013). Descriptive designs are helpful to acquire knowledge in an area in which limited research has been conducted, in this case nurses' practices managing patients on CRRT. Using a survey in descriptive research can identify information about a current situation such as areas of concern or current knowledge and skills (Grove et al., 2013).

The survey

At the time of this survey, the co-authors were educators for a multi-site regional CRRT program established in 1995, one

of the first in Canada. The co-authors worked within a collaborative model of CRRT management whereby the intensivists consulted nephrology to address the patient's need for CRRT and nephrology decided the treatment approach while the ICU nurse managed the patient on this therapy. However, the authors contemplated how other CRRT programs across Canada functioned as various hospitals had consulted them on CRRT.

The survey was prepared in English and French and had 61 questions that covered the following topics: demographics, general information, CRRT education, ordering and initiating, vascular access, filters and fluids, anticoagulation, filter life, safety concerns, use of SLED. The authors were interested in SLED, as it was a new modality at the time of the survey (2011). There were also opportunities to provide comments. Table 1 provides an outline of the survey. Additional information regarding the development of the survey including pilot testing has been previously reported (Fothergill Bourbonnais et al., 2016).

Sample

The target population for this survey was based on a purposive selection of Canadian ICUs and their nurse educators representing as many as possible CRRT programs across all provinces and territories. Potential institutions were selected by reviewing lists of Canadian teaching hospitals. In addition, community hospitals were included in this mail-out because the authors had received requests for information regarding the implementation of CRRT in local community hospitals. Community hospitals provide essential health services for Canadians residing in small cities and more rural areas. While there are no universal descriptions of community hospitals, it is generally accepted that they are not academic institutions, meaning they are not affiliated with universities in the teaching and training of medical students or fellows (Ministry of Health and Long-Term Care, 2009).

Table 1. *Outline of survey*

Demographics	Type of hospital, critical care unit, size of unit, title of respondent
General information	-If use CRRT: how many years, nurse-patient ratio, type of machines, how many machines, how many patients per month, number of days per patient on CRRT, which population is prescribed CRRT
Education	If dedicated training program: length of session, frequency, number of nurses per session, Percentage of staff trained in CRRT, how certified, amount of experience required for CRRT, staff coverage
Ordering and initiating	Who makes decision, who writes orders, any standard order forms Vascular access: sites for CRRT access, factors influencing site selection, catheters used and who inserts
CRRT specific information	Filters and fluids: type and size of filter, fluids used to prime filter Anticoagulation: any standard order sheet, methods for anticoagulation, monitoring effects of anticoagulation Filter life: how long does filter last, filter changes, -Reasons for interruption of therapy
Adverse events	3 most common with citrate, identify other adverse events encountered, tracking events
Questions related to SLED	If using, who initiates and maintains
Biggest concern **Key patient safety concern**	What is it, how is it addressed If had to change one thing about CRRT practices, what would it be

Each potential participant was sent a survey packet consisting of a cover letter, a letter of information, the survey questionnaire, and a stamped return envelope. The letter of information described the purpose of the study. Follow-up with non-respondents was made following specifications outlined by Dillman (2007). The questionnaire was pilot tested with two ICU nurse colleagues in order to identify any problem areas, as well as determine the approximate length of time required to complete the survey.

Ethics

Ethical approval was obtained from the Office of Research, Ethics and Integrity associated with the university of the first author. Confidentiality was maintained throughout the study by using code numbers. Completing the survey implied consent to participate.

Data analysis

Data were coded by hand under each category. A research assistant went through each survey and recorded answers to each question. For example, there was a question under vascular access that asked the factors influencing site selection. There were four options: patient coagulation status, inserter comfort and experience, patient anatomy and condition, nursing assessment. The research assistant recorded the number of responses for each of these options. Descriptive statistics such as percentages were then employed to analyze the quantitative responses. All written comments were transcribed verbatim and grouped by the topic they pertained to such as anticoagulation.

Results

Sample

One hundred and twenty-nine surveys were mailed to hospitals across Canada ranging in size from large academic teaching hospitals to smaller community hospitals. Seventy-three surveys were returned (including those from nine French-speaking hospitals) for a response rate of 57%. In the return surveys, all provinces were represented, but not the territories. Of the 73 completed surveys, 36 (49%) of the hospitals used CRRT. Therefore, the sample was 36 surveys from 36 ICUs in 36 different hospitals.

Of those 36 hospitals using CRRT, 27 (75%) were teaching and nine (25%) were community. Of the 51% that did not use CRRT, the authors cannot identify the reasons, which might include lack of resources (e.g., human or financial). The majority of the nurses who completed the survey were ICU educators (24/36, or 67%). The remainder were in positions of advanced practice nurse, clinical resource nurse or team leader.

The Prismaflex ™ machine (Gambro) was used by 34/36 (94%) while 2/36 (6%) used the Aquarius™ machine (Nikkiso Medical). Ninety-four percent of the units had a dedicated training program for nursing staff. The nurse-to-patient ratio was predominantly 1:1 (77%) while 20% indicated that when a patient was on CRRT there were two nurses caring for that patient. Respondents were given diagnostic categories from which to indicate patients who were prescribed CRRT. The most frequent populations were those with sepsis, AKI, surgery and chronic renal failure. Table 2 provides details of the units using CRRT.

Focus of the results—Safety concerns

The survey results reported in this article focus on key patient safety concerns identified and the related nursing management. Safety concerns were defined by the authors to indicate adverse events that could occur with the procedure and affect the patient response. The concerns were the perceptions of the nurses who completed this survey. Key patient safety concerns emerged related to anticoagulation, vascular access care, machine malfunction and medication errors. In implementing CRRT, maintaining patient safety is crucial and greatly rests with the RNs in ICU, as they are responsible for the management of CRRT 24/7. As one participant stated: "Once the line is inserted, the RN completely manages therapy other than order writing."

Concerns with anticoagulation.

Participants were asked to identify the usual method of anticoagulation (could answer more than one). Thirty-two out of 36 (89%) used heparin, 15/36 (42%) used citrate, while 2/36 (6%) used argatroban, and 10/36 (28%) stated they used no anticoagulation. The respondents were asked to identify adverse events associated with the use of heparin. Results revealed that 17/36 (47%) cited heparin-induced thrombocytopenia (HIT), while 15/36 (42%) indicated bleeding. They were asked to identify the three most common adverse events when using citrate. These were metabolic alkalosis 14/36(39%), hypernatremia 12/36(33%) and hypocalcemia 6/36(17%).

Other concerns

The respondents identified concerns other than those related to anticoagulation. The most common were vascular access issues, machine malfunction and medication errors, as illustrated in Table 3.

Vascular access. In Table 3, 23/36 (64%) respondents indicated vascular access (catheter) issues as a common concern. Concerns were related to catheter patency, catheter choice (size and location). They were asked to indicate the preferred sites used for vascular access for CRRT. Results revealed that there was no consistency in responses (subclavian, jugular – right or left side, and the femoral) and could be related to physician preference, patient status, difficulty of insertion, and urgency for CRRT, as well as site availability.

Nurses employed the strategy of patient positioning to prevent or handle catheter dysfunction. Other strategies learned in their practice included flushing of the line/circuit with normal saline, and line reversal to improve blood flow. In addition, respondents cited that nurses are involved in ensuring the proper catheter size and site are utilized, monitoring the effectiveness of anticoagulation, and assessing the necessity for thrombolytic therapy (rTPA).

Table 2. *Demographics and general information*

Survey question category	Results	N	%
Type of hospital using CRRT (n = 36)	Teaching	27	75
	Non-teaching	9	25
	TOTAL	36	100
Number of patients on CRRT per month (n = 36)	1–5	27	75
	6-10	7	19
	11–15	2	6
	TOTAL	36	100
Dedicated CRRT training program for ICU nursing staff	Yes	34	94
	No	2	6
	TOTAL	36	100
Preferred mode of CRRT used (n = 36)	CVVHDF	30	83
	CVVH/CVVHDF	6	17
	Other	0	0
	TOTAL	36	100
Type of units using CRRT	Medical-surgical with burns/trauma	17	47
	Coronary/cardiac surgery	11	8
	Medical-surgical	31	22
	TOTAL	36	100
Number of years using CRRT	Greater than 10 years	20	56
	8–10 years	6	17
	5–7	5	14
	3–4	3	8
	1–2	1	2.7
	Missing	1	2.7
	TOTAL	36	100
Number of CRRT days per patient	10 days or greater	3	8
	7–9 days	5	14
	4–6 days	23	64%
	1–3 days	4	11%
	Missing	1	2.7%
	TOTAL	36	100

Table 3. *Adverse events (other than anticoagulation) associated with CRRT*

Other CRRT Adverse events encountered	Number of Canadian Hospital ICUs n = 36
Vascular access issues	23 (64%)
Machine malfunction	20 (56%)
Medication errors	11 (31%)
Filter issues	6 (17%)
First use syndrome	5 (14%)
Other	3 (8%)
No response / Not applicable	5 (14%)

**Participants selected all adverse events relevant to their CRRT experience*

Machine malfunction. Twenty out of 36 (56%) respondents indicated that machine malfunction was a concern because it could affect treatment delivery. Comments included "screen frozen", "general system failure", and "syringe pump issues." Machine malfunction is discussed further under Reasons for Treatment Interruption.

Medication errors. With CRRT, there is the potential for inaccurate fluid removal, which would affect treatment outcomes. In addition, CRRT replacement and dialysate solutions use high-alert medications such as potassium chloride and potassium phosphate, while heparin or citrate is used to maintain the extracorporeal circuit. Thirty-one percent of the respondents cited medication errors as a concern with CRRT. Examples of written comments are as follows: "potential for med errors and a failure to return blood to the patient due to filter clotting"; "medication error potential with Heparin."

Reasons for treatment interruption

To be effective, CRRT should operate with few interruptions. Otherwise, there is decreased efficacy of treatment related to solute clearance, fluid removal, electrolyte and acid base balance. Respondents were asked to identify the three most common reasons for interruption of CRRT and to place them in order of importance. Table 4 reveals that filter clotting and vascular access difficulties were the most common reasons for treatment interruption. Although travelling for tests was cited, it was ranked third.

One of the challenges of CRRT is the prevention of filter clotting. During CRRT, as the patient's blood comes into contact with the filter, the coagulation cascade is stimulated causing the blood to clot in the filter. Therapy is interrupted until another filter circuit can be primed for use. Participants were asked what they did if the filter showed signs of clotting. They could select from specific responses provided: reassess anticoagulation ($n = 21$), assess the access and return lumens of patient catheter ($n = 20$), decrease blood flow rates ($n = 13$). There was a category 'other' of which there were isolated responses. Examples of written comments illustrate some of the strategies employed to limit filter clotting: "Monitor pressure drop and transmembrane pressures"; "reassess anticoagulation as per protocol"; "filter changed in presence of many cloth" (*translated from French*) and "prepare to change circuit."

Tracking adverse events and modifying procedures and protocols

The respondents reported that they were mainly tracking patient adverse events through: (could cite more than one) a memo to the unit nursing educator 21/36 (58%), manager 16/36 (44%) or by incident report 27/36 (75%). Twelve out of 36 (33%) had a CRRT committee while 23 out of 36 (64%) had a database. Nineteen out of 36 (53%) made modifications related to adverse events. Although 34/36 (94%) had a standard order sheet/protocol for anticoagulation, results from the surveys revealed there was no standard approach in the units as far as drug type, dosage and monitoring. The following quotes provide examples of how events were tracked and managed: "recent revision to pre-printed orders (PPO) to include citrate sliding scale to address increased clotting with citrate"; "anticoagulant: improved citrate order forms as had increased metabolic alkalosis"; "it's a working group. We update the protocols and policies, order set text with reoccurring issues"; "meet to discuss issues and develop the program now on an ad hoc basis" and "good for tracking nurse exposure, filter life and patient diagnosis" (referring to data base).

Discussion

From the data collected in this survey, safety concerns in delivering CRRT were evident. The views of those who responded, mainly ICU educators, are important as they are responsible for policies and procedures, staff competence, and are involved in following up adverse events. The results of this survey revealed many actions taken by nurses in assessing and managing patients on CRRT to maintain patient safety. Indeed, Palevsky (2018) has suggested that nephrology fellows (senior residents in nephrology) spend time with nursing staff to gain more understanding of the practice issues that need addressing when patients are on CRRT or other RRT.

Eighty–three percent of the respondents in the current survey cited that they used CVVHDF. The authors anticipate that this mode was used because of the flexibility that it offers to meet patient goals re-fluid and electrolyte management. For instance, if a patient needs more fluid or electrolyte removal, the nurse could adjust the pump settings on the CRRT machine if the patient is started in the mode CVVHDF. ICU RNs require the skills and knowledge to be able to understand the changing patient context to adapt the mode of delivery to meet patient goals.

Maintaining goals of treatment

The results revealed that 64% of the respondents indicated that vascular access was the greatest safety concern. More than a decade ago, Joannidis and Oudemans-van Straaten (2007) cited that the patient's vascular access catheter was the most important component of CRRT. Managing occlusions and decreasing infection are necessary for vascular access best practice (Verde, 2019). Because catheter issues were identified as a major safety issue in our survey (64%) and in the literature, skills in catheter management and in troubleshooting alarms are essential in preventing

Table 4. *The three most common reasons for interruption of CRRT therapy*

Common reasons for treatment interruptions	Most important	Second most important	Third most important	Not rated	Number of Canadian Hospital ICUs N=36	Number of Canadian Hospital ICUs %
Filter clots	15	13	2	3	30/36	83
Patient travel for diagnostics	3	3	17	4	23/36	64
Patient vascular access issues	12	13	5	4	30/36	83

and minimizing catheter dysfunction and treatment interruption. Nursing care measures such as patient repositioning, cited in this survey, become a challenge when patients are hemodynamically unstable, as they frequently are in an ICU. Nurses play a key role in preventing catheter dysfunction by competently managing CVCs, which in the case of CRRT, is connected to an extracorporeal circuit.

Ensuring expertise of nursing staff through education and hands-on patient care can decrease filter changes and the subsequent treatment interruptions, thus helping to ensure patient goals of treatment are met. The findings of this current survey revealed that the majority (75%) of units had one to five patients per month on CRRT. For nurses to achieve knowledge and expertise in managing patients on CRRT, one can ask what is considered sufficient exposure to CRRT to maintain competence. Graham and Lischer (2011) have stated that it is only when nurses have used a technology at the bedside that the issues needing to be addressed become visible. The article by Fothergill Bourbonnais et al. (2016), which reported selected findings of this Canadian survey on nursing practices with CRRT, revealed that achieving and maintaining competence was the greatest concern among the ICU educators.

The results of this survey illustrated the variation in the management and delivery of CRRT where it pertains, for example, to anticoagulation suggesting that a more standardized approach is required. Bagshaw et al. (2017) reviewed current knowledge and recent advances in RRT including IHD and CRRT for critically ill patients and found that practice patterns and outcomes showed variability in prescriptions and delivery without standardization or an evidence base.

Recommendations

The results of this survey provide several recommendations for practice related, for example, to vascular access and anticoagulation. Although authors have identified causes of catheter dysfunction (Moist, 2016), there is a paucity of articles that relates to the nursing care required to prevent and handle it. The nurses in this current study described strategies such as patient positioning, flushing of the line, and line reversal to prevent or handle catheter dysfunction. Further research is needed to tease out these interventions in order to emphasize the many facets of nursing care required in CRRT.

The results of this survey identified some of the adverse events that can result from using heparin and citrate. For example, citrate requires detailed protocols and specific training of both medical and nursing staff to avoid severe complications such as hypocalcemia and metabolic alkalosis (Schneider et al., 2017). However, few articles have examined the nursing role in decision-making with citrate, which would include monitoring of calcium levels and metabolic status (Dirkes & Wonnacott, 2016; Richardson & Whatmore, 2015). More research is needed on the nursing interventions required to care for patients receiving citrate.

Recently, a Canadian study by Rewa et al. (2017) included a systematic review of quality indicators of CRRT care for critically ill patients. Included in the review were 97 cohort studies, 24 randomized controlled trials, 10 case-control studies and two retrospective medical audits. The findings revealed a focus on filter life, small solute clearance, bleeding, delivered dose and treatment interruption. These indicators are similar to the safety concerns identified in this current study. Rewa et al. (2017) indicated that more research is needed to measure and benchmark CRRT care for patients who are critically ill. Despite CRRT having been used for decades, Bagshaw et al. (2017) reinforce that few quality indicators have been developed and rigorously evaluated.

Limitations

The authors did not ask about the number of patients that nurses cared for per month. Questions regarding issues related to mobilizing patients on CRRT were not asked as this was not standard care at the time of the survey. There are data that may not be included in the perceptions of these nurses. For example, catheter issues may have included the development of infection, but this is not known.

Conclusion

This article has focused on the safety concerns related to nursing management of patients on CRRT. There are many treatment-focused articles written on CRRT, but more research is needed on the nursing management of these patients. Providing complex technological care and ensuring patient safety are foundations of nursing in intensive care environments. Intensive care unit nurses require knowledge and expertise in monitoring and managing patients on CRRT and have a crucial role within the interprofessional team to ensure patient safety.

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Intensive care unit nurse satisfaction with medication management before and after introduction of an electronic medication management system

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Abstract

***Background**: Medication errors are common in the intensive care unit (ICU) and can result in adverse events. The electronic medication management system (EMMS) can ensure standardized medication-related processes and may reduce errors compared to traditional paper-based approaches. A significant proportion of nursing time in the ICU is dedicated to medication-related processes and, therefore, nurses' experiences with changing medication systems are important to elicit.*

***Methods**: We surveyed nurses in four ICUs in a large, academic, urban hospital before and six months after the introduction of EMMS using the 18-item Medication Administration System-Nurses' Assessment of Satisfaction (MAS-NAS) scale.*

***Results**: A total of 328 questionnaires were distributed both before and after with a response rate of 37% (n = 120) and 35% (n = 115) respectively. Overall satisfaction with the medication system was significantly higher after implementation of the electronic system (6.2 versus 7.0, p = 0.003). There were significantly higher scores on all items related to safety after implementation (p < 0.05) and two of six items related to access [access to systems that support medication administration (4.44 versus 4.89, p = 0.008) and availability of information about managing bad reactions (3.14 versus 3.81, p = 0.007)]. Nurses reported that the system was effective in reducing and preventing medication errors (3.24 versus 4.50, p < 0.001). However, there was no difference in nurses' perceptions of system efficiency (4.20 versus 4.42, p = 0.25). There was also no difference in the proportion who agreed that the system was user-friendly (68 versus 71%, p = 0.70) and, at both time points, a large proportion of nurses (45 versus 49%, p = 0.25) agreed they had to store stashes of medication to ensure access to those needed for patient care.*

***Conclusion**: Our study shows that the introduction of EMMS led to increased nurses' perceptions of safety and satisfaction. However, the system was not perceived as more efficient or user-friendly than the previously existing paper-based systems and, thus, resorted to workarounds and compliance to using barcode scanning when administering medication. Further research is needed to evaluate the impact of EMMS workarounds and non-compliance to barcode management system on ICU nursing workflows and patient outcomes.*

Key words: electronic medication management system, closed loop system, intensive care unit nurses' perception

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Background

In the Canadian Adverse Events Study, drug- and fluid-related events were the second-most common type of adverse event accounting for 24% (*n* = 85/360) of all events (Baker et al., 2004). The Institute of Medicine Report identified medication events as the most common type of adverse event in the United States resulting in up to 7,000 deaths per year in hospitals (Kohn et al., 2000). More recent studies have assessed the prevalence of medication incidents where patients are at risk of being prescribed and dispensed medications that are typically intended to treat acute illness, but are no longer indicated (Bell et al., 2011; Scales et al., 2016). The problem of medication errors is particularly concerning in an intensive care unit (ICU) where critically ill patients require high-intensity care and may be at especially high risk of iatrogenic injury and adverse outcomes (Colpaert et al., 2006). Providing one critically ill patient with a single dose of medication requires correctly executing 80–200 steps (Pharmacy-nursing shared vision, 2003). Medication errors can occur in any of the following medication stages: prescription, transcription, preparation, dispensation, administration, and monitoring (Camiré et al., 2005; Hussain & Kao, 2005). Leape et al. (1995) identified prescribing (39%) and administration (38%) as having the highest frequency of occurrence of error in the medication process, with nearly half of the prescribing errors intercepted by nurses and pharmacists. About one third of transcription errors were identified and corrected prior to administration, but only two per cent of errors occurring at the administration stage were intercepted. Studies cited that medication error rates were as high as 61% (*n* = 170/277) in the ICU setting (Paixao Nunes et al., 2013; Rothschild et al., 2005). Furthermore, medication errors were a source of distress for critical care nurses (Malden et al., 2011).

The electronic medication management system (EMMS), defined as a variety of computer-based systems that utilize automated processes instead of a paper-based system (Kaushal et al.,

2003), can ensure standardized medication-related processes through improved access to organized information that helps clinical decision-making processes (Agrawal, 2009). Bates et al. (2001) demonstrated an 81% decrease in medication errors following the implementation of a computerized physician order entry system (CPOE) with clinical decision support systems. An additional benefit to electronic systems is a decrease in documentation time for nurses in the ICU, allowing more time spent on direct patient care activity (Dwibedi et al., 2011; Wong et al., 2003) and, thus, providing more time for nurses to engage in patient assessments and treatment decisions that prevent medication errors. There is a growing trend in healthcare toward closed-loop EMMS, which include automated dispensing, barcode scanning to confirm patient identity and use of electronic medication administration records (eMARs) (Wolf, 2007). Franklin et al. (2007) found that a "closed-loop" system, reduced prescribing errors by 1.8% ($p < 0.001$), decreased medication administration errors by 2.7% ($p = 0.005$), and increased confirmation of patient identity before administration by 63.7% ($p < 0.00$).

Nurses are the largest group of healthcare providers in the critical care areas, and medication management consumes a significant proportion of nursing time (Abbey et al., 2012; Douglas, 2013). The implementation of EMMS has a direct impact on nursing practice and the quality of patient care. The EMMS must be acceptable to nurses so that they will buy-in to the required changes in process and workflow where the nurses have to look at the electronic medication administration record before taking the needed medications to the patient's room, and use a handheld barcode scanner to check patient identification and medication information to make sure they match (Hurley et al., 2007; Marini et al., 2010;). User acceptability may also lead to better integration of EMMS in nurses' daily workflow, thus decreasing the likelihood of *workarounds*, a term referring to behavioural/technological strategies of deviating from formal processes that users of technology employ to deal with perceived problems that hinder them in achieving their goal (Cresswell et al., 2016; Ser et al., 2014). Though workarounds may provide a temporary solution, they can introduce inefficiencies that increase the burden on clinicians and even threaten patient safety (Van Der Sij et al., 2011). Nurses' acceptability of EMMS can be enhanced when they perceive that it improves efficacy and safety, and is easy to use. Despite the widespread adoption of computerized, closed-loop medication systems, little is known about the level of satisfaction of nurses towards EMMS in critical care (Baysari et al., 2016). The critical care area was selected purposely for this study because of its complexity such that delays in critical medication administration can produce life-threatening results (Wideman et al., 2005). Therefore, we aimed to examine ICU nurses' perceptions of medication ordering and administration practices in the context of the introduction of closed-loop EMMS.

Purpose

The purpose of our study was to examine nurses' satisfaction with medication-related processes before and after introduction of a closed-loop EMMS in the ICU.

Methods

Setting

A single-centre study was conducted in the four ICUs—Cardiac ICU (CICU), Cardiovascular ICU (CVICU), Medical Surgical ICU (MSICU) and Trauma Neurosurgical ICU (TNICU) of a large academic, urban hospital in Toronto, Ontario. While the closed-loop EMMS system was implemented on all medical and surgical inpatient wards in 2010, it was only implemented in all the ICUs in early 2014. The four ICUs transitioned one at a time at one-month intervals during implementation.

Paper-based medication system

The ICUs used a paper-based system prior to the implementation of EMMS (Figure 1). Medication and care orders were hand-written by a physician or nurse practitioner on a green sheet with a carbon backing. After checking the order, the registered nurse or delegate sent the copy of the order sheet to pharmacy and transcribed the medication order into the medication administration record (MAR) and the care order into the interprofessional care plan (Kardex) by hand. All medication orders were double-checked by a nurse. The pharmacist then reviewed the order and generated a viewable computer medication profile. Some medications were dispensed in the main pharmacy and delivered to the unit by a pharmacy technician, while other medications were available in the unit as ward stock. The nurse documented orders and medication administration on the paper MAR and on the ICU flowsheet. In this manual process, which relies on human vigilance, the following errors can occur: 1) patient misidentification, 2) incorrect prescription of drug, dose, route, or time, 3) incorrect transcription of drug, dose, route, or time, 4) improper drug administration, and 5) failure to document (Marini et al., 2010). The hospital's corporate event tracker data suggested that medication errors were frequently reported incidents in the Critical Care Department.

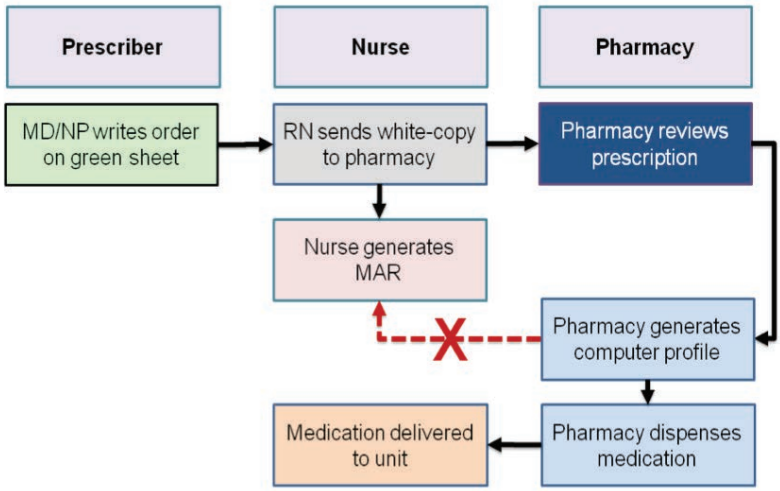

Figure 1: Paper-based Medication System

Closed-loop electronic medication management system

To prevent medication errors, the closed-loop Soarian® Clinicals and Soarian® Medication Administration Check (MAK) was implemented. During the implementation, key staff members (e.g., clinical informatics, doctors, nurses, pharmacists) tailored the system to the hospital environment. This provided reassurance that staff opinions and expertise were taken into account and created a sense of ownership and buy-in to the system. Education included an eight-hour in-class session that covered the fundamentals of the system, with an opportunity to practise with critical care case scenarios that covered common documentation workflows. Following the education, seven content experts were available in the ICUs to provide round the clock unit support and assistance during the transition to EMMS.

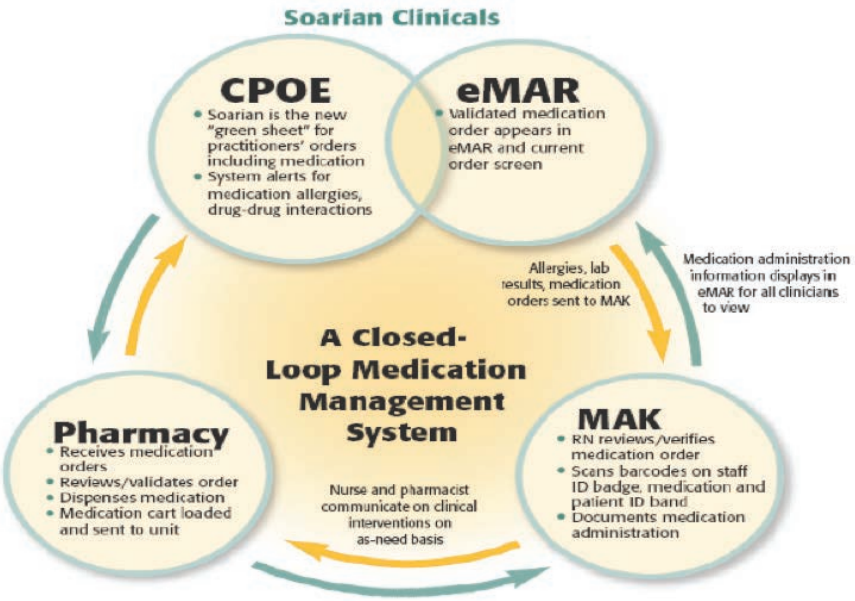

Figure 2: Closed-Loop Electronic Medication Management System
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The closed-loop EMMS has four elements inclusive of: 1) computerized physician order entry system (CPOE), 2) electronic medication record (eMAR), 3) pharmacist verification system, and 4) medication administration check (MAK) using bar code medication administration scanners housed on workstations on wheels (WOWs). With CPOE, all medication and care orders are entered and verified electronically. Medications are verified prior to dispensing and administration. The system contains built-in alerts for medication allergies and drug interactions (Figure 2). Through these mechanisms, the system addresses many of the potential errors that exist in paper-based processes. Once a physician or nurse practitioner enters an order, the system generates an electronic medication record (eMAR) that can be viewed in the patient's profile. All electronic medication orders are automatically flagged in pharmacy where they are reviewed and validated by a pharmacist prior to dispensing and delivery. The pharmacy technicians doublecheck the correct dispensing of patient-specific medication by the ROBOT, an automated dispensing system, and delivery of medications to the point of care. Prior to medication administration, the nurse reviews and verifies the order in MAK and scans the barcode on the medication, as well as the patient's identification band. The nurse completes the closed-loop administration process.

Design

We used a before-and-after research design to elicit nurses' satisfaction with the safety, efficacy, and accessibility of medication ordering and administration in the ICU using the Medication Administration System–Nurses Assessment of Satisfaction (MAS-NAS) scale (Hurley et al., 2006).

Sample

Our sampling frame consisted of active nursing staff in the four critical care areas. Active nurses were nurses who worked at least one or more shifts in the four weeks preceding survey distribution based on the schedules in each unit.

Ethical considerations

The Research Ethics Board of the hospital approved this study. Informed consent was implied by returning the questionnaire. All efforts were undertaken to reduce any potential breaches of confidentiality. Participant data from the surveys were de-identified using non-identifying alphanumeric study code to compare participants' responses pre- and post- intervention. Individuals who received a pay stub for the study's time period received a survey. The receipt of a paystub was used to indicate whether an individual had worked during the study's specific time period. The specific details of one's pay stub (e.g., pay rate, deductions) were not used for the recruitment of participants. Surveys were included in each eligible nurses' mail folder.

It was made clear that completion of the survey was not a condition of one's employment, nor was it necessary to complete the survey in order to receive pay.

Survey instrument

The MAS-NAS scale is an 18-item tool with items loading on to three factors: efficacy (five items), safety (seven items), and access (six items). The scale was developed by Hurley et al (2006) whereby they conducted item reduction by removing items with a low item response rate (≤10%), or high correlation (≥.7) with multiple other items and each other (≥.8), or with a corrected item-total correlation ≤.3, resulting in 18 final items (alpha = .86), and principal components analysis followed by varimax rotation. Response options are presented on a six-point Likert scale (1 = strongly agree, 2 = moderately agree, 3 = slightly agree, 4 = slightly disagree, 5 = moderately disagree, 6 = strongly disagree). The total satisfaction score was assessed on a 0–10 scale (0 = completely dissatisfied; 10 = completely satisfied) and was calculated by summing up the responses. A higher score equates to greater satisfaction. Negatively worded responses were transformed prior to summation. We adapted the MAS-NAS scale (Hurley et al., 2006) by adding the free text section for nurses to

Table 1: Timeline of Data Collection and Number of Respondents					
Unit	Number of Eligible Nurses	Pre-survey		Post-survey	
		Distribution	Number of Respondents	Distribution	Number of Respondents
CVICU	54	Jan. 17–Feb. 27, 2014	3	Sep. 25–Oct. 30, 2014	24
CICU	46	Jan. 17–Feb. 27, 2014	10	Oct. 23–Nov. 27, 2014	5
TNICU	112	Jan. 17–Feb. 27, 2014	52	Nov. 20–Dec. 14, 2014	70
MSICU	116	Jan. 17–Feb. 27, 2014	55	Jan. 15–Feb. 19, 2015	16
Total	328		120		115

Legend:
CVICU = Cardiovascular Intensive Care Unit
CICU = Cardiac Intensive Care Unit
TNICU = Trauma Neurosurgery Intensive Care Unit
MSICU = Medical Surgical Intensive Care Unit

list their top three concerns before and after the implementation of closed-loop EMMS.

Data collection

We administered the survey by attaching the questionnaire to pay stubs for eligible nurses prior to the implementation of the new EMMS in their respective unit and again six months after implementation. The study was advertised by posters and emails (disseminated with unit-based mail list servers, to inform nurses about the survey). Respondents returned their completed questionnaire into a sealed box kept at a central workstation in each of the ICUs. In both pre- and post-surveys, we posted a repeat questionnaire to non-respondents after two weeks' time had elapsed. While the pre survey was distributed at the same time in all units, the post survey was timed at six months after the implementation period for each unit (Table 1).

Data analysis

We summarized the categorical data as frequencies and proportions and the continuous data as means and standard deviation. We used paired *t*-test to compare the pre- and post-survey responses on the MAS-NAS items and considered a *p* value of <0.05 as statistically significant for all comparisons. Using an inductive thematic analysis, the study team went through an iterative process of relating, grouping, and deciding the major themes of the three top concerns about the implementation of EMMS. The top three themes were calculated based on the frequency they were mentioned.

Results

We distributed 328 questionnaires before and 328 after. Response rate was 37% (n = 120/328) before and 35% (n = 115/328) after (Table 1). The majority of respondents were female (82%), held a BSc in nursing (62%), worked rotating day and night (69%) and weekday and weekend (87%) shifts (Table 2). The mean age was 41 (range 25–64) and mean years of nursing experience was 17 (range 1–43). Prior to implementation of the new system, most reported average (58%) or above average (31%) computer skills. Twenty-four percent reported below average skills with computerized medication systems (19%).

Table 2: Demographics	
	N (%) or Mean (Range)
Sex	
Overall	115 (100%)
Male	21 (18%)
Female	94 (82%)
Age	41 (25-64)
Years as RN	17.38 (1–43)
Years working at the hospital	11.98 (0-34)
Highest level of education	
Diploma	39 (34%)
Bachelor's Degree	71 (62%)
MN/MSN	5 (4%)
Shift rotation	
Day shift only	21 (18%)
Night shift only	14 (13%)
Rotating day and night shifts	80 (69%)
Weekly schedule	
Weekend	6 (6%)
Monday to Friday	8 (7%)
Rotating weekday and weekend	100 (87%)
Computer skills	
Above average	36 (31%)
Average	67 (58%)
Below average	12 (11%)
Experience with CPOE system	
Above average	22 (19%)
Average	66 (57%)
Below average	27 (24%)

Table 3: Nurses perceptions of access, efficacy, and safety before and after introduction of a new medication administration system						
Each item references the current medication administration system	**Mean Score**			**% Agreeing**		
	Before	**After**	***p* value**	**Before**	**After**	***p* value***
ACCESS						
Access to information about actions and side effects	3.89	4.22	0.13	62	70	0.06
Access to MD orders and drug information when needed	4.44	4.89	**0.008**	80	90	**0.04**
Easy to access drug information when needed	3.96	4.32	0.07	69	72	0.08
Knowledge of medication storage locations (unit versus pharmacy)	4.95	4.85	0.57	87	84	0.95
Access to information about responding to adverse reactions	3.14	3.81	**0.002**	42	57	**0.007**
Need to keep stashes of medication at bedside	3.99	3.81	0.45	45	49	0.25
SAFETY						
Drug alert feature is helpful	3.61	4.6	**<0.001**	49	77	**<0.001**
Easy to check active medication orders before administration	3.83	4.92	**<0.001**	63	88	**<0.001**
Knowledge of pharmacist check of medication before administration	3.03	5.4	**<0.001**	40	95	**<0.001**
Promotes 2-way communication about orders between clinicians	3.72	4.61	**<0.001**	62	80	**<0.001**
Know that messages about drug-drug interactions were acknowledged by MD and pharmacist	2.89	4.45	**<0.001**	39	21	**<0.001**
Easy to check the "rights" of medication administration	4.3	4.8	**0.005**	75	88	**0.02**
Know that accepting drug-drug interactions is appropriate and medications can be given	2.95	3.77	**0.002**	29	57	**<0.001**
EFFICACY						
Helps me be efficient at medication administration	4.2	4.41	0.25	75	78	**0.03**
Turnaround time for "stat" medications is adequate	3.44	3.51	0.71	54	54	0.43
Effective in reducing and preventing medication errors	3.24	4.5	**<0.001**	47	82	**<0.001**
User friendly for nurses	4.05	4.23	0.36	68	71	0.7
Equipment and supplies needed to administer medications are readily available	4.7	4.75	0.76	47	82	0.25
Legend: MD = Medical Doctor; p value of <0.05 was considered statistically significant for all comparisons						

Overall satisfaction with the medication system was significantly higher after implementation of the electronic system (6.2 versus 7.0, $p = 0.003$).

There were significantly higher scores on all items related to safety after implementation ($p < 0.05$), and on two of six items related to access [access to systems that support medication administration (4.44 versus 4.89, $p = 0.008$), and availability of information about managing bad reactions (3.14 versus 3.81, $p = 0.007$)] (Table 3). Comparatively, the difference in mean scores of nurses' perception that the system was effective in reducing and preventing medication errors is small (3.24 versus 4.50, $p < 0.001$). Moreover, there was no difference in nurses' perceptions of system efficiency (4.20 versus 4.42, $p = 0.25$). There was also no difference in the proportion who agreed that the system was user-friendly (68 versus 71%, $p = 0.70$). At both time points, a large proportion of nurses (45 versus 49%, $p = 0.25$) agreed they had to store stashes of medication to ensure access to those needed for patient care (Table 3).

When asked to list the three concerns about the closed-loop EMMS, nurses listed delays in obtaining medication as their top concern on both pre-implementation ($n = 36$) and post-implementation ($n = 35$) phases (Table 4). The second top concern was lack of access to a computer ($n = 19$) for pre-implementation and new orders not flagged for post-implementation ($n = 24$). While technical glitches was ranked as the third concern in the pre-implementation phase ($n = 19$), lack of a user-friendly interface for ordering and documenting was cited as a concern during the post-implementation phase ($n = 15$) (Table 4). Nurses cited "delay in medication administration due to computer delays", "need to give meds quickly in an emergency", "fear of missed doses if meds don't show up on time" as reasons for keeping medication stashes at the bedside.

Table 4: Concerns of Staff Nurses Pre-implementation and Post-implementation

PRE-IMPLEMENTATION CONCERNS	N
Delays in obtaining medications	36
Lack of access to computers	19
Technical glitches	19
Time consumption	15
Flagging of new orders	13
Learning curve	10
Lack of physical space for equipment	8
POST-IMPLEMENTATION CONCERNS	**N**
Delays in obtaining medications	35
New orders not flagged	24
Interfaces for ordering and documenting not user friendly	15
Issues with barcode scanning	12
Lack of flexibility related to standardized times and doses	11
Errors of commission or omission by physicians	9
Lack of clarity related to PRN administration history and cancelled orders	9

Discussion

We examined nurses' satisfaction with medication-related processes before and after introduction of a closed-loop EMMS in the ICU. Medication administration includes the following nursing steps: 1) reviewing medication order in MAK, 2) barcode scanning of medication and patient's armband identification, 3) administering medication, and 4) ticking chart in MAK to confirm the steps were completed and documented. There were significant increases in scores on all items within the safety domain after implementation of the new system. There were also significant increases in scores on two items on the access sub-scale, namely access to MD orders and drug information, and access to information about managing adverse reactions. There were also significant increases in scores on two items on the efficacy scale: inclusive of efficiency in medication administration and efficacy in reducing medication errors. However, there were no differences in nurses' perceptions of user-friendliness and turnaround times for medications. While we recorded a significant increase in satisfaction, the clinical relevance of these results is unclear. In comparison, Hurley et al. (2007) reported that pre/postpartum and medical surgical intermediate and intensive care unit nurses were more satisfied with the barcode/eMAR system, reporting statistically significant differences ($p = 0.000$) in all the items of the MAS-NAS Scale (Hurley et al., 2006).

In our study, the most frequent concern listed in the free text section was related to delayed access to stat and emergency medications in both pre- and post-implementation phases, corroborating the observed high proportion of nurses agreeing that they keep stashes of medications to be sure they have medications to give when needed in both pre- and post-implementation phases. This may be a workaround in both paper and electronic systems. Van Der Sij et al. (2011) described the bottlenecks and workarounds in a hospital by comparing a paper-based and an electronic system, and concluded that several workarounds remain present if bottlenecks remain unsolved. Our study showed no significant difference in nurses' perceptions of the efficiency and turnaround times of medication delivery to the unit when needed, suggesting that nurses perceive issues that delay medication administration processes as persistent bottlenecks that can lead them to keeping medication stashes at the bedside.

Pre-implementation, access to computers was listed as the second most prevalent concern, but this did not appear to be an issue in post-implementation phase since each bedside was allocated a WOW for the conversion to EMMS. Post-implementation, concerns about order flagging were frequently articulated in reference to the computerized system, as there is

no mechanism to quickly identify new versus existing orders in the system compared to the paper system where new orders were visibly flagged.

The third listed concern in the pre-implementation phase was technical glitches, but this did not appear post-implementation, as the glitches were addressed by the clinical informatics and information technology specialists during the rollout. Instead, lack of user-friendliness of the interface for ordering and documenting was cited as a concern during the post-implementation phase. This was substantiated by the MAS-NAS survey results, where there was no difference in nurses' perceptions of user-friendliness; this perception has implications for nursing practice because it impacts nurses' decision-making on medication administration processes. Similarly, Marini et al. (2010) found in their descriptive, cross-sectional study of nurses' attitudes toward the use of the bar-coding medication administration system that the system's user-friendliness was a major factor influencing nurses' perceived functionality of the system. The authors professed that nurses consider the electronic system to have a positive impact on nursing practice if it supports medication administration decision-making, speeds up the flow of work, and enhances productivity.

Our study has strengths. When introducing new technology, it is important to solicit end-user feedback to understand both enablers and challenges. An awareness of both of these is important in ensuring successful transition to the electronic system (Klein, 2013). One of the identified barriers to the implementation of closed-loop EMMS is stakeholder resistance (Ash et al., 2007). Our study provided insight of the perceptions of medication ordering and administration practices of nurses, the largest group of end-users. We adapted a survey instrument that has been validated, and we incorporated small modifications that have not altered its original structure and, consequently, its validity. In addition, we engaged the clinical leader managers from the four ICUs, proposing that the results can inform them in supporting the implementation of the EMMS and in examining the areas that nurses considered challenging.

Our study also has limitations. While we measured the nurses' satisfaction by surveying nurses before and six months after EMMS implementation, we did not explore the contextual information into why nurses' satisfaction with EMMS improved. Eliciting qualitative information, like in the study of Hurley et al. (2007) where structured interviews were conducted, could have elucidated why our respondents' level of satisfaction with safety and access to the system improved and why some items in the efficiency domain did not change after conversion to the electronic format.

The response rate to our pre-implementation survey distributed to nurses of 37% (n = 120/328) and post-implementation survey of 35% (n = 115/328), is higher than the 13% (n = 1087) in the survey of Hurley et al. (2007). While our study only included nurses from four ICUs in our hospital, Hurley et al. (2007) included nurses on medical and surgical intermediate units in addition to ICU nurses. Like Hurley et al. (2007), we acknowledge that the small sample size and single site limit our study's generalizability.

This study evaluated the pre- and six months' post-implementation perceptions of nurses, and we do not know the changes in nurses' level of satisfaction towards EMMS over time. In a cross-sectional study, Hoonaker et al. (2013) examined the differences in the perceptions of ICU nurses and providers toward CPOE between three months and nine months after implementation and found that respondents' overall satisfaction did not change significantly over time, but recognized that some nurses who responded to the second post survey may have been influenced by the way they responded to the first survey nine months earlier. EMMS has been instituted in our ICUs for five years, and it is unknown if nurses still hold the same perceptions. Nurses perceived that some aspects of the EMMS was not user friendly and, thus, resorted to workarounds. As workarounds may jeopardize patient safety and effectiveness of care (Blijleven et al., 2017), further exploration is needed to evaluate the impact of EMMS workarounds on ICU nursing workflows and patient outcomes.

Nursing satisfaction of EMMS user-friendliness is also directly linked to barcode override, as nurses are likely to use a system if it is simple and easy to use. Despite the intended purpose of EMMS to ensure medication safety, there are opportunities for errors when clinicians are allowed to override its safety functions. For example, hard-stop alerts generated by the barcode medication administration system can be overridden, resulting in errors with potential patient harm (Miller et al., 2011). The barcode verification process is part of nursing medication administration. Our current incident reporting system can now track barcode override data that allows managers to assess nursing compliance to EMMS.

Continuing refinements to the system are necessary to address issues raised by users related to system functionality. As technology advances, our organization is reviewing current EMMS with innovative interfaces. Because nurses are the ultimate users of medication administration systems, their satisfaction and perception of the system remain critical as existing systems are evaluated and new systems are contemplated and introduced.

Finally, although there was an observed trend of frequent reporting of medication-related incidents in the four ICUs pre-implementation, we did not systematically compare the impact of EMMS to the frequency of medication-related incidents post-implementation in the ICUs, as well as compare the frequency ICU medication-related incidents to other specialties. Future research should also evaluate the impact of closed-loop EMMS on the number and types of medication-related incidents in the ICU.

Conclusion

Understanding nurses' perceptions is essential to creating a positive climate of change. This descriptive study provided us insight of the perceptions of medication ordering and administration practices of nurses, the biggest end-users. The introduction of EMMS was associated with nurses' perceptions of greater safety and increased overall satisfaction

with medication processes in the ICU. The implementation of EMMS has a direct impact on nursing practice and patient safety. Continuing refinements to the system are necessary to address issues raised by nurses related to system functionality. The system was not perceived as more efficient or user-friendly than the previously existing paper-based systems and, thus, resorted to workarounds and compliance to using barcode scanning when administering medication. Further exploration is needed to evaluate the impact of EMMS workarounds and non-compliance to barcode management systems on ICU nursing workflows and patient outcomes.

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Impact of an inter-hospital transfer online module on critical care nurses' preparedness for transfers

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Abstract

Background: *Nurses must provide care to critically ill patients during inter-hospital transfers in challenging and stressful situations. It is not surprising that nurses are often reluctant to participate in transfers. Given this situation, an online educational module specific to inter-hospital transfers was developed and implemented to better prepare nurses for transfers.*

Aim: *The purpose of this study is to evaluate the impact of an online educational module on nurses' preparedness for inter-hospital transfers.*

Method: *A single group, pre-test post-test design. Nurses in critical care settings were asked to complete an online survey consisting of measures on structural empowerment, psychological empowerment and self-efficacy both pre- and post-module completion.*

Results: *A total of 19 nurses responded to the surveys. Informal power and several self-efficacy items related to interprofessional collaboration increased significantly post-module. There were no significant differences in scores for other structural empowerment subscales, psychological empowerment and overall self-efficacy.*

Conclusion: *This study highlights the impact of an online educational module in improving nurses' understanding of the roles of other team members during inter-hospital transfers. The combination of an online module with other workplace initiatives, such as inter-hospital transfer guidelines, may best improve nurses' confidence and preparedness for inter-hospital transfers.*

Keywords: inter-hospital transfers, critical care, education, on-line module, quantitative, surveys

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Implications for Nurses

- An online educational module can improve nurses' understanding of the roles and responsibilities of team members involved in inter-hospital transfers.
- Considering continuing education challenges in rural settings, an online educational module may be a feasible way of better equipping nurses for inter-hospital transfers.
- Combining an online educational module with other practice improvement initiatives may be the most beneficial to improve nurses' inter-hospital transfer preparedness.

Sometimes, critically ill patients are transferred to other healthcare facilities to gain access to resources or services not available at the referring facility (Gupta & Mueller, 2015). The decision to proceed with inter-hospital transport exposes the patient and accompanying staff members to risks (Fanara et al., 2010; Warren et al., 2004). Moreover, transferring a patient to another facility to access required care generates financial expenditures for the healthcare system, as well as for patients and families, such as travel costs (Kulshrestha & Singh, 2016). Critically ill patients transferred from one hospital to another are extremely vulnerable to iatrogenic injuries and a range of complex medical problems (Rothschild et al., 2005). Incidents occur in 17 to 70% of inter-hospital transfers (Droogh et al., 2015; Lyphout et al., 2018). Three factors are significantly associated with transfer incidents: operational problems (i.e., equipment failure), communication incidents, and patient acuity (Lyphout et al., 2018). Medical problems are generally related to cardiovascular, neurological, respiratory or hypothermia issues (Droogh et al., 2015; Fanara et al., 2010). This said, as much as 70% to 91% of adverse events related to inter-hospital transfers are preventable (Fanara et al., 2010; Ligtenberg et al., 2005)

Critical care nurses often accompany these patients alone on ambulance transfers, as they possess advanced problem-solving skills and specialized knowledge to ensure comprehensive care for life-threatening complications. Given the associated risks and care complexity, it is not surprising that critical care nurses are often concerned about their participation in inter-hospital transfers (Gustafsson et al., 2010). Findings from a qualitative study of 30 nurses indicate that they do not feel adequately prepared to deal with inter-hospital transfer responsibilities (Gustafsson et al., 2010). Nurses felt they had no control over their work environment during the transfer and worried about being alone in the ambulance. Moreover, communication between team members was not always helpful and guidelines were unclear. Similarly, nurses in a rural New Brunswick, Canada, hospital expressed concerns over their participation in inter-hospital transfers. From 2014 to 2016, approximately 13% of critically ill patients admitted to the Chaleur Regional Hospital's (HRC) intensive care unit (ICU) were transferred to another larger healthcare facility several hours away from the referring facility (Doucet et al., 2017). The HRC is a small, 215-bed, rural hospital in northern New Brunswick. A needs assessment was conducted to explore

the reasons for the reluctance of ICU nurses to participate in inter-hospital transfers (Doucet et al., 2017). Nurses' concerns over transfers centred around three areas: uncertainty surrounding scope of practice, lack of clear guidelines for transfers and unclear collaboration among team members. Many of the concerns expressed by nurses were related to the need for further training and lack of clear guidelines for transfers. A key recommendation arising from the needs assessment was to develop a comprehensive educational program for nurses participating in inter-hospital transfers.

Creating an environment whereby nurses can access the resources they need to safely transfer patients from one hospital to another may increase nurses' preparedness for transfers. Specific strategies, such as providing information, organizational resources and support, have the potential to empower nurses, as well as increase their knowledge and skills for transfers. Many studies have examined the impact of workplace empowerment on nurses. Structural empowerment has a positive relationship with work commitment (Boamah & Laschinger, 2015), job satisfaction (Laschinger et al., 2014), self-efficacy (Trus et al., 2012) and quality of care (Goedhart et al., 2017). Conversely, evidence suggests that structural empowerment has a negative relationship with stress (Lautizi et al., 2009), burnout (Laschinger et al., 2013) and mental health symptoms (Wing et al., 2013). More recently, a scoping review of 12 cross-sectional studies reported a positive association between structural empowerment of frontline nurses and in-hospital quality indicators (Goedhart et al., 2017). The authors concluded that structural empowerment is positively associated with work efficiency, quality of care, and patient safety climate.

Creating an empowering work environment is an important organizational strategy that leads to positive work behaviours and improved patient outcomes (Boamah et al., 2017; Wagner et al., 2010). Therefore, providing nurses with organizational resources and support, could better prepare them for inter-hospital transfers. Given that online learning is an effective way of acquiring knowledge and skills (Koch, 2014), an online educational module may be a way of meeting nurses' learning needs in relation to inter-hospital transfers, which, in turn, would increase their willingness to take part in transfers.

Theoretical framework

This study was based on Kanter's (1993) theory on structural empowerment. Kanter defines power as the ability for employees to mobilize information, resources and support for carrying out their work or achieving an objective within an organization. Three empowerment structures are described: opportunity, power and proportion. The opportunity structure pertains to the opportunity to advancement within the organizations, as well as knowledge and skill development. The power structure relates to access to information, support and resources needed to do the job. The proportion structure refers to percentage of people sharing similar characteristics within an organization, such as gender or race. Both formal and informal systems influence an individual's perception of power. Formal power is derived from work activities that allow for work discretion and decision latitude, while informal power is derived from alliances, collaborations or relationships with people at different levels in the organization. Kanter's theory provides insight into how workplace behaviours and attitudes are determined by social structures, not by personal predispositions. Improving aspects of the work environment through training might lead to improved psychological empowerment and confidence of nurses leading to positive outcomes related to inter-hospital transfers. We believe that enabling critical care nurses to access information and resources needed will improve their confidence and skills when participating in transfers.

Aim

The purpose of this study is to evaluate the impact of an online educational module on critical care nurses' preparedness for inter-hospital transfers.

Methods

Design and Sample

A single group pre-test post-test design was used to evaluate the impact of an online module on critical care nurses. A minimal sample size of 34 participants was required to attain a 0.8 power level for a two-tailed *t*-test (Faul et al., 2013). The sample was obtained through convenience sampling from a health authority's ten emergency departments and five ICUs in New Brunswick. Inclusion criteria were: 1) being a critical care nurse (employed in either emergency or intensive care), and 2) having a minimum of one-year general nursing experience.

Inter-Hospital Transfer Module

Content from the online education module was based on a needs assessment (Doucet et al., 2017), a literature review on inter-hospital transfers and inter-hospital transfer guidelines (Warren et al., 2004). The online education module's competency indicators are summarized in Table 1. Module content addressed essential factors to consider when preparing patients for transfers and care considerations during transfers. An asynchronous online module was chosen to overcome obstacles inherent to in-service education in rural settings, namely lack of financial resources, technical assistance, perceived administrative support, replacement staff, workload or competent educators (Hendrickx & Winters, 2017).

The online module was created by the main researcher in collaboration with stakeholders and validated by three critical care clinicians. Afterwards, trauma-related content was approved by New Brunswick's Traumatology program. The module was offered in English and French. The content was translated into English by the researcher and afterwards validated by a certified translator. Online content focused on preparing the patient for transfer, roles of the team members, communication requirements and communication with receiving centre. Pictures of the internal ambulance environment and equipment, decision algorithms and policies were included. Approximate completion time ranged from 30 to 60 minutes.

Measures

Structural empowerment is defined as employees' perception of the presence or absence of work environment conditions allowing them to do their jobs (Laschinger et al., 2004). It was measured using four dimensions of the Condition for Work Efficiency

Table 1. *Inter-hospital transfer module competency indicators*
Preparation • carries out the essential tasks when preparing for an inter-hospital transfer • anticipates the potential needs arising from the transferred patient's health condition and adapts the preparation for the transfer accordingly • collaborates with the interdisciplinary team members when preparing for the inter-hospital transfer (e.g., physician, respiratory therapist)
Professional boundaries • practises in accordance to the nursing professional standards with regards to inter-hospital transfers • collaborates with the physician, as needed, when the health condition requires further interventions, such as delegated medical procedures
Collaboration and communication • clarifies roles and responsibilities with the team members prior to departure when there is an overlap of professional skills • collaborates with the interdisciplinary team members during inter-hospital transfers (e.g., paramedical technician, respiratory therapist) • communicates relevant information in a comprehensive manner to the receiving centre • properly coordinates the inter-hospital transfer with the key stakeholders involved

Questionnaire-II (CWEQ-II) (Laschinger et al., 2001) and translated into French by Laschinger (2005). The CWEQ-II includes 19 items that measure nurses' perceptions of access to empowerment structures described by Kanter (1993), (H. Laschinger, communication personnelle, 16 novembre 2017). However, because of their relevance to the aim of this study, only the opportunity, resource, support and informal power subscales were used. Opportunity, resource and support subscales each include three items while informal power includes four items. Scores are obtained using a five-point Likert scale whose response choices varied from one (not at all) to five (many). Subscale scores were calculated by averaging the items from each of the subscales. Internal consistency was demonstrated in previous studies with Cronbach's alpha ranging from 0.82 to 0.94 (Hauck et al., 2011; Laschinger & Finegan, 2005). Similarly, psychometric data supports the validity and reliability of the French version (Beaulieu, 2005).

Psychological empowerment is described as an employee's reaction to work environment characteristics (Spreitzer, 1995). This variable was measured with the Psychological Empowerment Scale (PES). The PES is a 12-item instrument that evaluates each of the four dimensions of psychological empowerment using a five-point Likert scale (Spreitzer, 1995). The four subscales of this instrument are meaning, competence, self-determination and impact. Response choices vary from one (disagree) to five (strongly agree). Psychological empowerment scores are obtained by adding the mean scores of subscales. Factor analysis reproduced the four original dimensions, demonstrating construct validity of the PES (Boudrias et al., 2010; Spreitzer, 1995). Average Cronbach's alpha for the English version is 0.80 (Boudrias et al., 2010). The PES has been translated to French by Boudrias et al. (2010), and psychometric data of the French version also support its validity and reliability.

Self-efficacy is defined as a person's judgment of his or her ability to organize and execute the action required to achieve a designated level of performance (Bandura, 1977). Scales evaluating self-efficacy are developed specifically in relation to the area of interest studied. In this study, nurses' self-efficacy in relation to inter-hospital transfers was measured using a scale developed by the researcher and guided by Bandura's self-efficacy scale construction guide (Bandura, 2006). Course competency indicators were used as the basis for the development of the scale's nine items. Scores were obtained using a Likert scale ranging from 0 (cannot accomplish) to 10 (most certainly can accomplish). Scores represented the degree of certainty to which participants believed they could accomplish each mentioned activity and were obtained by adding all the item scores. Competency indicators were validated by three intensive care clinical experts. Cronbach's alpha score for this scale was .96 pre-module and .97 post-module.

Procedure

Completion of the online module was mandatory for all nurses working in critical care and emergency units. Nurses were recruited to participate in the study by an email sent by hospital management. Also, posters were placed in participating ICUs and emergency departments. Nurses could begin the survey by accessing a link in the email. If nurses chose not to participate in the study, they could immediately begin the online module. The link itself contained a letter explaining the study and connected participants to the online questionnaire. A reminder was sent to potential participants one week after the initial invitation. Participants were required to create an identification code at the beginning of the survey to ensure anonymity and pairing post-module results. An email was sent three weeks after completion of the education module inviting them to participate in the post-module survey. A reminder email was sent at the two-week and four-week marks. Pre- and post-module survey pairing was ensured using an identifier created by each participant. Data were collected between November 8, 2018 and January 22, 2019.

Data Analysis

Data were analyzed using SPSS software version 25. Descriptive statistics were used to determine the sample characteristics and variable mean scores. Reliability was assessed by Cronbach's alpha. Data was assessed for skewness and kurtosis. Paired *t*-tests were used to compare the means of the main variables (structural empowerment subscales and psychological empowerment and self-efficacy) pre-and post-intervention. Effect size was measured using Cohen's *d*. Statistical significance was defined as a *p*-value equal to or less than 0.05.

Ethical Considerations

Ethical approval was obtained from the ethical review committee of the Vitalité Health Network and the Université de Moncton. Since the participants had to complete the online questionnaire, informed consent was expressed implicitly by their doing so.

Results

There were 319 nurses working in critical care and emergency units at the time of our study. In total, 72 nurses responded to the pre-education online survey and 30 nurses responded to the post-intervention survey. However, only 19 nurses responded to both surveys representing a retention rate of 26.4%. Sociodemographic data are summarized in Table 2. Participants were between the ages of 24 and 56 years old, with the mean of 36.4 years. They had on average 13 years of nursing experience and 11 years of critical care nursing. Ninety percent (89.5%) of participants were French while approximately 10 percent (10.5%) were English. The majority of participants were female (89.5%) and 78.9% reported having full-time employment. Most participants were baccalaureate educated (84.2%). Nearly half (47.4%) of the participants worked in a hospital that has between 200 and 300 beds. Sixty-three percent (63.2%) of the participants reported working in an ICU while about a third worked in an emergency department (36.8%). Independent sample *t*-tests and Chi-square tests were conducted to determine if there were any significant differences between nurses who responded to both surveys and those who responded only to the first survey. No significant differences were found in relation to the age of participants, years of critical care experience, gender, employment status and type of unit.

With regards to structural empowerment, informal power scores increased significantly from 4.11 (SD = .55) pre-module to 4.34 (SD = .55) post-module ($p = 0.025$), as shown in Table 2. Although nonsignificant, the empowerment dimensions of opportunity, support and resource scores increased after the online module. There were no significant differences in pre-test post-test scores for neither overall psychological empowerment nor for its four subscales.

Table 2. *Characteristics of Study Participants (N = 19)*

	Frequency	**Percentage (%)**
Age	$\bar{x}$ = 36.37	SD = 10.64
Nursing experience (years)	$\bar{x}$ = 12.97	SD = 10.68
Critical care experience (years)	$\bar{x}$ = 11.11	SD = 10.97
Gender		
Male	2	10.5
Female	17	89.5
Employment status		
Occasional	1	5.3
Part time	3	15.8
Full time	15	78.9
Education		
Diploma	3	15.8
Baccalaureate-	16	84.2
Hospital		
Less than 100 beds	2	10.5
Between 100 and 200 beds	8	42.1
Between 200 and 300 beds	9	47.4
More than 300 beds	0	0.0
Type of unit		
Emergency	7	36.8
Intensive care	12	63.2

Note. $\bar{x}$ *= Mean, SD = Standard deviation*

Table 3. *Pre- and post-module means, standard deviation, scale reliability and p-values for main variables*

	Pre-module		**Post-module**				
	Mean (SD)	**α**	**Mean (SD)**	**α**	***t***	***r***	***p***
CWEQ-II	-	-	-	-		-	-
Opportunity	4.49 (0.60)	0.74	4.58 (0.67)	0.94	-.630	0.02	.537
Support	3.79 (0.85)	0.91	3.81 (0.91)	0.90	-.121	0.00	.905
Resource	3.67 (0.71)	0.68	3.68 (0.54)	0.50	-.203	0.00	.841
Informal power	4.11 (0.55)	0.57	4.34 (0.55)	0.61	-2.455	0.25	.025*
Psychological Empowerment	4.40 (0.63)	0.94	4.42 (0.56)	0.94	-.339	0.01	.739
Meaning	4.53 (0.53)	0.82	4.65 (0.49)	0.93	-2.073	0.21	.055
Competence	4.43 (0.74)	0.84	4.41 (0.64)	0.80	.236	0.00	.817
Impact	4.14 (0.74)	0.87	4.12 (0.67)	0.77	.152	0.00	.881
Self-determination	4.49 (0.64)	0.81	4.47 (0.61)	0.75	.212	0.00	.835
Self-efficacy	76.58 (13.25)	0.96	80.74 (9.11)	0.97	-1.810	0.15	.087

*Note. SD = Standard deviation, α = Cronbach's alpha, t = t-test scores, r = Cohen's d, *p value is significant at < .05*

The online intervention (module) did not have a significant impact on overall self-efficacy scores. Nonetheless, as shown in Table 4, several self-efficacy item scores had significant increases, for instance, item 3 (*clarify roles and responsibilities with team members prior to departure when there is an overlap of professional skills*) increased from 8.05 (SD = 2.12) pre-education to 9.05 (SD = 1.08) post-education (p = 0.009). Scores for item 4 (*collaborate with interdisciplinary team members when preparing for inter-hospital transfer*) increased from 8.18 (SD = 2.24) pre-education to 9.18 (SD = 1.13) post-education (p = 0.039). The mean score for item 5 (*collaborate with the interdisciplinary team members of during inter-hospital transfers*) increased significantly from 8.53 (SD = 1.71) pre-module to 9.16 (SD = 1.12) post-module (p = 0.024).

Several trends were noted regarding critical care nursing experience. Experienced nurses had slightly lower informal power scores at baseline ($\bar{x}$ = 4.09, SD = 0.45) than less-experienced nurses ($\bar{x}$ = 4.13, SD = 0.69). Furthermore, the scores for experienced nurses increased substantially more after the module ($\bar{x}$ = 4.43, SD = 0.53), as compared to less-experienced nurses ($\bar{x}$ = 4.22, SD = 0.60). Self-efficacy scores increased similarly for less-experienced nurses and more-experienced nurses. We also found differences between nurses from emergency units and critical care units. Nurses from emergency units had higher baseline scores than nurses from intensive care units in relation to structural empowerment subscales, psychological empowerment and self-efficacy. The most pronounced differences were with regards to the self-efficacy scores, whereby scores increased from 73.91 (SD = 14.96) to 79.25 (SD = 10.10) for intensive care nurses, compared to 81.14 (SD = 8.80) to 83.29 (SD = 7.06) for emergency department nurses.

Discussion

The purpose of this study was to evaluate whether an online educational module increased nurses' preparedness for inter-hospital transfers. Our findings indicated that the online module significantly increased nurses' informal power. This suggests that nurses felt they were better able to collaborate with other healthcare professionals involved in transfers post-module. Nonetheless, the small difference in subscale means may not reflect any visible changes in informal power. It, however, denotes a tendency. Derived from alliances and relations at different levels within an organization, informal power facilitates

Table 4. *Self-efficacy item statements, pre- and post-module mean scores, standard deviations, effect size and p-values*

	Item statement	**Pre-module mean (SD)**	**Post-module mean (SD)**	***t***	***r***	***p***
Item 1	Anticipate the potential needs arising from transferred client health situation and adapt the transfer preparation accordingly	8.47 (1.31)	9.00 (1.05)	-2.014	0.19	.056
Item 2	Carry out essential tasks when preparing for an inter-hospital transfer	8.74 (1.45)	9.11 (0.94)	-1.439	0.10	.167
Item 3	Clarify roles and responsibilities with team members prior to departure when there is an overlap of professional skills	8.05 (2.12)	9.05 (1.08)	-2.924	0.32	.009*
Item 4	Collaborate with interdisciplinary team members when preparing for inter-hospital transfer (e.g., physician, respiratory therapist)	8.18 (2.24)	9.18 (1.13)	-2.244	0.24	.039*
Item 5	Collaborate with the interdisciplinary team members during inter-hospital transfers (e.g., paramedical technician, respiratory therapist)	8.53 (1.71)	9.16 (1.12)	-2.467	0.25	.024*
Item 6	Collaborate with the physician, as needed, when the health situation requires further interventions such as delegated medical procedures	8.32 (1.77)	8.95 (0.97)	-2.051	0.19	.055
Item 7	Communicate relevant information in a comprehensive manner to the receiving centre	9.00 (1.20)	9.32 (1.11)	-1.555	0.12	.137
Item 8	Practise within nursing professional boundaries during inter-hospital transfers	8.74 (1.41)	9.05 (1.13)	-1.242	0.08	.230
Item 9	Properly coordinate the inter-hospital transfer with the key actors involved	8.42 (1.90)	8.89 (1.15)	-1.580	0.12	.132

*Note. SD = Standard deviation, α = Cronbach's alpha, t = t-test scores, r = Cohen's d, *p value is significant at < .05*

cooperation (Kanter, 1993; Laschinger et al., 2010), as well as access to organizational structures of information, support and resources (Connolly et al., 2017; Laschinger et al., 2010; Lethbridge et al., 2011). Information conveyed in the online module may have clarified ambiguities pertaining to roles and responsibilities of team members, such as overlaps in scope of practice. It is imperative to understand each other's roles, particularly during inter-hospital transfers, in order to provide quality care to the critically ill patient (Schmitt et al., 2011).

Informal power is one of the dimensions of structural empowerment. Nonetheless, the online module did not significantly increase other dimensions of structural empowerment. One of the reasons may be that the module did not address other important work environment characteristics. Managerial support, inter-hospital transfer guidelines and specific tools, such as an equipment checklist, are important facets of the broader environment, which can greatly assist inter-hospital transfers (Clinical Excellence Commission, 2013; Warren et al., 2004). The online module also did not significantly increase psychological empowerment. Psychological empowerment occurs in response to a working environment that promotes structural empowerment (Laschinger et al., 2001). Moreover, psychological empowerment is the mechanism by which structural empowerment affects behaviours and attitudes of nurses, such as self-efficacy (Laschinger et al., 2004). Psychological empowerment is also a mediating variable between structural empowerment and work behaviours (Laschinger et al., 2001; Laschinger et al., 2004). Increasing nurses' comfort in providing safe transfers may need a more multi-pronged approach rather than a singular strategy of an online educational module.

Although the overall self-efficacy score did not increase after the online module, several items related to inter-professional collaboration significantly increased. Participants were more confident communicating and collaborating with interdisciplinary team members after completing the online module. Effective communication and collaboration with physicians, respiratory therapists and paramedical technicians is essential in ensuring safe competent care during transfers (Warren et al., 2004). Several studies suggest that education programs increase self-efficacy (Karvinen et al., 2017; Moein et al., 2017). High self-efficacy scores indicate that nurses have confidence in their ability to provide care. Thus, empowering facets of the work environment can increase self-efficacy (Trus et al., 2012).

Our findings suggest that intensive care unit nurses benefited more from the online module than emergency unit nurses, as both informal power and self-efficacy scores increased post-module for intensive care unit nurses. These differences may have occurred because emergency nurses have the opportunity to collaborate more frequently with physicians, which could result in better baseline collaboration skills (Connolly et al., 2017). In relation to work experience, informal power scores increased more for experienced nurses than less-experienced nurses. Factors such as experience may facilitate collaboration abilities (Morley & Cashell, 2017). Moreover, age and experience are typically positively associated with perception of global empowerment (Laschinger et al., 2009). On the other hand, self-efficacy increased similarly for less experienced nurses and more experienced nurses, suggesting that the module was equally relevant for less experienced nurses. Unsurprisingly, overall self-efficacy was higher for more experienced nurses, which may be attributed to experience (Bandura, 2003).

Online education programs may not meet every nurse's learning needs. It would be unreasonable to think that a single strategy may represent a solution to every leaning need, particularly in complex healthcare environments. Nonetheless, the online module is a feasible option that can overcome obstacles inherent to continuing education in rural settings, such as limited financial resources and a shortage of personnel (Hendrickx & Winters, 2017; Riley & Schmidt, 2016). According to a study conducted by Riley and Schmidt (2016), online education programs work well when the participants have protected time. Nurses who participated in the above study indicated that they valued the accessibility of online modules allowing them to review information at any time. Education programs combining different types of teaching strategies may be the most beneficial to promote learning (Rolstadås, 2013).

The combination of online module with other work environment-based initiatives, aiming to better equip nurses for inter-hospital transfers, may be a more comprehensive solution (Rolstadås, 2013). For example, Bérubé et al. (2013) evaluated the impact of incident reduction initiatives within the context of inter-hospital transfers. The preventive intervention outlined in this study consisted of a pre-transfer checklist, which significantly reduced incidents occurring during transfers. The results suggest that the risks associated with transporting critically ill patients can be reduced by implementing a simple prevention program. We believe that combining education programs and clinical tools may have a great potential to improve quality of care during transfers.

Limitations

This study has several limitations. First, the generalizability of study results is limited because of the small sample size. Moreover, the sample size may have limited our detection of significant differences in pre-test post-test scores. Recruitment occurred during a nursing shortage within participating units, creating heavy workloads for nurses. This situation made participant recruitment challenging. If this study were to be reproduced, retention could be improved with incentives such as gift cards offered to participants. Additionally, a target recruitment strategy, such as the identification of nurse champions on the units, could be used to encourage participation. Second, extraneous factors such as nursing leadership or differences in current practice might have had an influence on study results. For instance, nursing units in larger hospitals may have had more resources to offer their nurses participating in inter-hospital transfers. Third, a quasi-experimental design with a control group would have increased the rigour of this study. However, given the geographic context and the nursing shortage, this was not deemed feasible. Fourth, the use of survey questionnaires may have introduced response bias because of social desirability. Lastly, there is a risk of selection

bias because of the high probability that respondents who participated in both measurement times were more motivated to learn about inter-hospital transfers.

Recommendations

The results from this study indicate that an online educational module is an intervention that may improve the ability of nurses to collaborate with interdisciplinary team members during inter-hospital transfers. Consequently, implementation of an online module in combination with other clinical tools may increase nurses' confidence and willingness to take part in transfers. For nurses working in largely rural areas, an online module is a strategy that facilitates access to information and resources enabling safe participation in inter-hospital transfers. Since sample size may have prevented detection of some significant increases, replication of this study with a larger sample is recommended. Furthermore, future research should provide descriptive data to evaluate online module characteristics. It would also be interesting to collect descriptive data on transfer frequency per unit and other characteristics, such as average transfer per nurse, which could help explain discrepancies between units.

Conclusion

Given the associated risks and complexity of critically-ill patients, it is understandable that nurses are reluctant to participate in the inter-hospital transfer of critically ill patients. Significant increases in informal power and several self-efficacy items suggest that an online module improved nurses' understanding of the roles and responsibilities of team members. This type of work-environment based intervention is likely to contribute to the improvement of the overall empowerment of nurses, thus translating into better results. Online education modules can be offered at low cost while also providing adequate accessibility for rural sites or centres experiencing staff shortages. Since provision of continuing education is a greater challenge in rural settings, an online module may be a sound strategy of equipping critical care nurses for inter-hospital transfers resulting in better preparedness. Combining an online module with other work-environment practice improvement initiatives, such as checklists or guidelines, may also be beneficial to improve nurses' inter-hospital transfer preparedness.

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Research review

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Citation

Chaplin, T., & McLuskey, J. (2019). What influences the nurses' decision to mobilise the critically ill patient? *Nursing in Critical Care*, *8*(1), 1–7. https://doi.org/10.1111/nicc.12464

Background

Critically ill patients benefit from early mobilization (EM), experiencing fewer immobility-related health risks and shorter hospital admissions. Still, EM remains an infrequently practiced intervention in intensive care units (ICUs).

Purpose of the study

To explore the ways in which nurses make decisions to mobilize critically ill patients. A secondary objective was to identify factors that influence nurses' decision-making processes.

Research approach and methods

A qualitative study using an Interpretative Phenomenological Approach articulated by Smith et al. (2009).

Sample

Nurses who were primary care providers for critically ill patients were recruited. In total, 12 nurses participated (n = 11 females; n = 1 male). The sample demographics included a range in age from 26 to 61 years. Total nursing experience ranged from 5 to 40 years. Their years of critical care specific experience ranged from 1 year to 39 years. Six nurses were diploma prepared and six held bachelor's degrees.

Setting

The study setting was a 12-bed integrated critical care unit in a large urban district in the United Kingdom. The nurse-to-patient ratio in this setting ranged from 1:1 to 1:2.

Data collection

Data were collected through face-to-face, semi-structured interviews. The interview guide was composed of open-ended questions designed to explore the meaning of nurses' experiences. Demographic data were collected prior to the interviews.

Ethical approval was appropriately received from identified sources and informed consent was obtained from the participants prior to the start of each interview.

Data analysis

Data analysis was completed using the six steps of Interpretative Phenomenological Analysis, as articulated by Smith et al. (2009). The analysis methods described by the authors are consistent with this approach. Methodological rigour specific to qualitative research was described and was congruent with the four criteria identified by Lincoln and Guba (1985) – credibility, dependability, confirmability, and transferability.

Findings

The authors describe three *super-ordinate* themes that emerged from the data analysis phase: prioritizing and mobilization; team roles and responsibilities in the mobilization process; and influences on decision-making. Each super-ordinate theme was comprised of sub-themes. All were supported using anonymized participant quotes. In summary, the researchers found that nurses did not prioritize EM, lacked knowledge on its benefits, and interpreted the task as complex and difficult to perform. Participants also experienced uncertainty, role ambiguity, and challenges related to the interprofessional collaboration required for EM. Finally, participants' decisions to mobilize their patients were influenced by time and resource constraints, unit demands, cultural influences, and prior experiences with mobilization.

Commentary

Smith et al. (2009) identify that IPA is suitable for researchers seeking a detailed understanding of the meaning and perceptions that people ascribe to experiences of phenomena, therefore, its application was appropriate for addressing the study objectives. To enhance the dependability of their research, Chaplin and McLuskey (2019) provided a detailed description of their design and analysis, which proved congruent with IPA methodology (Smith et al., 2009). For example, the authors appropriately promoted an in-depth analysis of individual experiences by purposefully selecting a small sample of experiential experts to interact with (Chaplin & McLuskey, 2019; Smith et al., 2009). Furthermore, verbatim transcription facilitated the interpretation of the explicit and concealed meanings of participants' words (Chaplin & McCluskey, 2019; Smith et al., 2009). The researchers also appropriately described identified themes through a detailed, narrative account that included direct quotes from multiple participants (Chaplin & McLuskey, 2019; Smith et al., 2009). Finally, in accordance with phenomenological analysis, the authors discussed overarching themes without discrediting unique participant experiences by identifying sub-themes that emphasized "differing ideas and values" (Chaplin & McLuskey, 2019, p. 5).

Chaplin and McLuskey (2019) also fittingly acknowledged that the results from their qualitative research were theoretically transferable, but not generalizable (Lockwood et al., 2015). As is appropriate to enhance the transferability of a qualitive study, the authors described their participants and setting in sufficient detail (Korstjens & Moser, 2018). They also considered the context of participants' experiences, referencing research finding that EM is a complex process that opposes the historically prominent "bed rest culture" (Chaplin & McLuskey, 2019, p. 6) of the ICU. Situating their findings in the context of current research and culture provides assurance that their interpretations were accurate, and their results are likely transferable to similar settings (Polit & Tatano Beck, 2017).

Limitations of this report included a lack of identification of the authors' paradigmatic worldview, backgrounds, relationships to participants, and roles in data collection and analysis. The philosophical underpinnings of IPA closely reflect the assumptions of constructivism's relativist ontology (Guba & Lincoln, 1994; Smith et al., 2009). Specifically, interpretive phenomenologists study human experiences assuming that it is not possible to interpret the meaning of an experience without considering its context (Lopez & Willis, 2004; Smith et al., 2009). Unfortunately, it is unclear if Chaplin and McLuskey (2019) considered these parallels, as they did not comment on their study's paradigmatic underpinnings.

Furthermore, while Chaplin and McLuskey (2019) mentioned generally that they engaged in reflection and had "discussions with supervisors" (p. 3), they did not describe their cultural and theoretical backgrounds and how their values and beliefs may have influenced the research process. For this reason, it is unclear whether they demonstrated sufficient reflexivity (Korstjiens & Moser, 2018). They also did not elaborate on the nature of their relationship with the participants and how this may have impacted recruitment and data collection. Furthermore, while the authors identified having one person conduct all interviews to "maintain continuity" (Chaplin & McLuskey, 2019, p. 3), they did not specify who conducted the interviews, who analyzed the data, or how incongruencies in interpretations, if any, were resolved.

Overall appraisal

Overall, Chaplin and McLuskey's (2019) choice of methodology permitted a detailed examination of nurses' perspectives on EM of critically ill clients. Information about the researchers' paradigmatic influences, backgrounds, relationships to participants, and specific roles in the research process would have enhanced the trustworthiness of their otherwise strong study.

Considering the findings of this research, nurse educators should consider re-educating critical care nurses on the benefits of EM, with special focus on challenging the predominant bed rest culture in the ICU. Chaplin and McLuskey (2019) also recommend multidisciplinary training sessions on EM to enhance role clarity, communication, and collaboration related to the practice so it is more readily adopted.

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