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Spring is approaching, and so, too, are a number of changes at the national office. This spring brings us a new national office administrator and we will be welcoming two new members to our board of directors. We have our constantly improving new website and a fresh new set of ideas and directions. Of course, with the welcoming of spring comes the passing of another season and, for us at national office, a time to say goodbye to our previous administrator and two board members. I would like to take this opportunity to talk about four of these individuals. I will talk about our newest board members in our next issue.

First, I would like to say, “Thank you and best wishes” to Tracy Porchak. Tracy was employed at national office as our administrator from the fall of 2004 until the end of January 2007. She brought us organization and enabled us to be more responsive to the needs of our chapters. Reports and membership issues were addressed in a timely and efficient manner. On-line renewals and registrations were developed to help members to access CACCN from a computer anywhere. Tracy’s pleasant manner and ability to keep the board on track is appreciated by members and the board alike. Tracy is leaving us to pursue an exciting opportunity in Tennessee and no, she is not going to be a country music star! We wish her well in her future.

I want to introduce you to Gina Mustard. We are so pleased to welcome Gina who came to us when we posted Tracy’s position in London, Ontario. We received an overwhelming response to the ad and had more than 45 qualified applicants from which to choose! She is a graduate of Wilfrid Laurier University and has a degree in business administration with a minor in fine arts. Gina is organized, energetic, creative, pleasant and extremely professional in her manner. The board of directors believes that Gina will be able to address our ongoing issues of attracting membership, as well as helping us generate original and innovative ideas that will truly make CACCN the voice of critical care in Canada. Her web skills and marketing background will help to make our website and our board even more accessible to members. Gina’s experience in the health care industry will help us to meet the needs of our corporate partners, as well as ensuring that the Dynamics conference continues to be the quality education and network forum that it has always been. Please join us in welcoming Gina to the national office.

Finally, I would like to extend a huge “Thank you and best wishes” to Susan Williams and Grace MacConnell. Sue and Grace joined the national board of directors with me, in April 2003.

Sue Williams represented the central region and hails from London, Ontario. During her time on the board, Sue held the portfolio of secretary and director of retention and recruitment. Most notably, Sue served as chair of the highly successful Dynamics 2005, which was held in Ottawa, Ontario. Sue’s contribution to the board, other than the obvious many, many hours spent on board duties, was her ability to critically analyze every decision. Sue was our board’s “sage”. Her thoughtful deliberation and ability to understand every issue ensured that no decision was made lightly or too quickly. Her constant awareness of her role as a representative of the membership guaranteed that her motivation and commitment was to those she served. On behalf of the CACCN membership, thank you for everything you have done to enhance the well-being of critical care nurses in Canada.

Grace MacConnell served as representative of the eastern region and is from Dartmouth, Nova Scotia. Grace’s expertise in pediatric ICU and palliative care were extremely valuable to the board. Grace was responsible for the corporate and awards portfolio and her leadership was instrumental in securing new funding for research and scholarship for critical care nurses in Canada. Grace was able to make the process of sponsorship for corporations much smoother which, in turn, increased the number and quality of corporate donations that were made to CACCN. In the last year, Grace assumed the role of chairperson responsible for publications. She has done an outstanding job ensuring Dynamics, the Official Journal of the Canadian Association of Critical Care Nurses, continues to be a quality, peer-reviewed journal. Grace’s most notable contribution was the authoring of the Family Presence during Resuscitation Position Statement. This position statement has been used by a number of organizations around the world to help guide how FPDR is being practised. Grace’s easygoing, organized and thoughtful approach, her commitment to social justice and her stories of her many world travels will be missed. Thank you, Grace, for your contributions to Critical Care Nursing in Canada.

Thank you for the opportunity to look to the seasons past, as we move forward into a new spring and a new direction for CACCN.

Sincerely,
Asha Pereira

Critical Thinking
In this issue of Dynamics: The Official Journal of the CACCN, we are pleased to publish two original articles. The first, by Mertin et al., addresses the problem of the surgical stress response and how critical care nurses can intervene in one particularly important way, pain management, to ameliorate the often-deleterious effects of the stress response and possibly impact patient outcomes. This article has an associated CE exam for those readers wanting to collect CE hours to maintain their critical care certification or to use for provincial continuing competency programs. We have not published CE hours in some time for a number of reasons. The editorial review board and I would like to hear from you whether this is an initiative we should offer more often. Is this something useful for you to obtain? You can email me or call me at the addresses inside the cover of this issue.

The second article by Hynes et al. looks at an initiative started in Ontario to standardize critical care nursing education and standards of critical care nursing practice required for safe, competent, and effective nursing care for critically ill patients and their families. We anticipate further updates on this exciting initiative in the future.

Finally, we are pleased to offer you our regular columns: Research Review, ISMP Canada, and the Canadian ICU Collaborative.

On behalf of the entire editorial review board, I wish you a healthy and successful 2007.

Paula Price, RN, PhD
Clinical Editor

Awards Available to CACCN members

Criteria for awards available to members of the Canadian Association of Critical Care Nurses are published on pages 33 – 36 of this issue of Dynamics.

Reminder

Dynamics 2007 is from October 21–23, 2007 in Regina, SK

The election of directors to the Canadian Association of Critical Care Nurses (CACCN) Board of Directors will take place at the CACCN annual general meeting in October 2007, for a two-year term commencing April 2008 and running to March 2010. There are three positions available, two from western region and one from the eastern region. CACCN members interested in letting their names stand for election to the board of directors should contact the national office at (866) 477-9077 or caccn@caccn.ca to obtain nomination forms. Completed forms must be received in the National office no later than 2400 hours on June 30, 2007.
Children's Wish Foundation donation

Marc Pinault and Louise Logue from the Ottawa Police Department who spoke at Dynamics ’06 generously donated their speaker fee to a charity of our choice. The charity we chose to support was the Children’s Wish Foundation and we received the following thank you letter from the organization. Thank you Marc and Louise for your caring and thoughtfulness.

November 15, 2006

Canadian Association of Critical Care Nurses - Dynamics 2006
P.O. Box 25322
London, ON  N6C 6B1

Dear Friends,

Thank you for choosing The Children’s Wish Foundation of Canada as the recipient of your generous donation of $500.00.

It is donations such as yours that enable us to continue to grant the favourite wishes of children coping with high-risk, life threatening illnesses. With the support of people and organizations such as you, we will never have to refuse a child’s wish.

From our special children and all of us involved with the Foundation, we would like to extend our heartfelt thank you.

Warmest regards,

[Signature]

Derek deLouche, CFRE
Chapter Director
Newfoundland and Labrador
What is the role of the CACCN National Administrator?

CACCN response:
The role of the CACCN National Administrator is one that continues to evolve with the growth of the CACCN and the changing technology. As many of you may know, Tracy Porchak tendered her resignation to the board of directors in the fall. During her term, Tracy was able to make some significant changes in the way the office operated by updating many of our documents to electronic format, streamlining the process for chapter reports/quarterlies and working diligently on our new website, www.caccn.ca. Thank you, Tracy, for your contributions to the work of the CACCN. Gina Mustard is our new National Administrator and she has “learned the ropes” from Tracy before she left on January 31, 2007. Welcome, Gina, we are looking forward to working with you.

The National Administrator is an integral member of the CACCN. The core responsibilities of this position include: managing the overall efficiency and functionality of the National Office; maintaining the membership database; providing administrative support to the board of directors and the various initiatives within their portfolios; providing financial tracking support to the treasurer; and acting as a communication link for chapter executives, business associates and, most importantly, the CACCN membership at large. Maintaining information on the association’s website, ensuring distribution of chapter reports and participating in the development of new marketing initiatives to promote the growth of the CACCN are additional key areas of focus for this role.

Gina will be working 40 hours each week, although these hours will increase during the rush of the Dynamics conference when she provides additional support to the planning committee. Overseeing the daily activities of the CACCN encompasses a great deal of organization and effort and we have been fortunate to have had National Administrators who have been flexible in responding to the needs/requests of CACCN members, our partners and the board of directors.

If CACCN members have any questions, the National Administrator is a good place to start. You can contact the National Office by phone at (519) 649-5284, toll-free at (866) 477-9077 or e-mail caccn@caccn.ca.

Grace MacConnell, RN, MN, CNCCP(C)
Director, CACCN
The CACCN Board of Directors wishes to extend thanks and best wishes to Tracy Porchak as she heads in a new direction. Your contributions will not be forgotten.

The CACCN Board of Directors extends a warm welcome to Gina Mustard, who has accepted the position of CACCN Administrator, National Office. We are looking forward to working with you.

### CACCN calendar of events

#### DATES TO REMEMBER!

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
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<tbody>
<tr>
<td>February 17-21, 2007</td>
<td>36th Critical Care Congress, Orlando, Florida, USA. For more information, go to: <a href="http://www.sccm.org">www.sccm.org</a></td>
</tr>
<tr>
<td>March 1, 2007</td>
<td>Deadline for call for Dynamics 2008 planning committee members</td>
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<td>March 1, 2007</td>
<td>Deadline for BBraun Mentorship Award Submissions</td>
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<tr>
<td>March 1-2, 2007</td>
<td>Pediatric Critical Care Nursing Workshop – Chandigarh, India. For more information, go to: <a href="http://www.wfpccs.org">www.wfpccs.org</a></td>
</tr>
<tr>
<td>March 30-31, 2007</td>
<td>CACCN Board of Directors’ face-to-face meeting in London, ON (tentative)</td>
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<tr>
<td>May 1, 2007</td>
<td>Deadline for CACCN Nursing Week Contest</td>
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<tr>
<td>June 1, 2007</td>
<td>Deadline for Baxter Guardian Scholarship submissions</td>
</tr>
<tr>
<td>June 24-28, 2007</td>
<td>World Congress on Pediatric Critical Care, Geneva, Switzerland. For more information, go to: <a href="http://www.pcc2007.com/">www.pcc2007.com/</a></td>
</tr>
<tr>
<td>October 30–November 1, 2007</td>
<td>Critical Care Canada Forum, Toronto, ON For more information, call 1-866-496-2220</td>
</tr>
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Citation

Research question or purpose
What is the frequency and nature of all errors and near errors reported by critical care nurses?

Research design
Descriptive study derived from a large national project examining the relationship between critical care staff nurse fatigue and error rates.

Participants
A random sample of 502 critical care RNs working full-time (at least 36 hours/week) as staff nurses recruited from the membership list of the American Association of Critical Care Nurses. Participants predominantly female (93%), Caucasian (87%), middle-aged (mean 44 ± 8 years, range 23-66 years), with an average of 17 ± 8 years of experience as a staff nurse (range 0-43 years), mostly working 12-hour shifts (88%), during the day (55%), or a rotating shift pattern (12%), evening shift (2.7%), and night shifts (31%).

Setting
United States

Methods
Participants completed two logbooks containing 14 pages/logbook, one page for each day of a two-week period (for a 28-day data collection period). Each page included 41 questions that collected data on such items as sleep, mood, caffeine intake, work hours, drowsiness, overtime, as well as questions regarding errors and near errors. Participants were asked to give a detailed narrative description of any errors during the shift or if they had caught themselves before making an error. Content analysis of the narrative descriptions ascertained the nature of the errors and near errors. Descriptive statistics were used to summarize the prevalence of each.

Main findings
Five actual or near error categories identified were: (1) charting errors, (2) procedural errors, (3) medication-related errors, (4) transcription errors and (5) not specified. Medication-related errors were further subcategorized as: (i) wrong patient, (ii) wrong drug, (iii) wrong dose, (iv) wrong route, (v) wrong time, and (vi) omission. Just over 25% of the critical care nurses reported making at least one error and 37.8% reported catching themselves making at least one near error in the 28-day reporting period. Two hundred and twenty-four errors and 350 near errors were reported during the study period. The majority of nurses who reported making errors described only one error, but a small percentage reported making two or more errors (4.2% x 2 errors; 2.8% x 3 errors; 2.4% x ≥ 4 errors), a finding similar for near errors. Medication administration was the most frequent type of error (56.7%), the majority of which were associated with the administration of drugs at the wrong time (37.8%) or the omission of a prescribed medication (22%). Most incidents involved antimicrobials, antihypertensives, vasopressors, or antiarrhythmic agents, but also included insulin, potassium and anticoagulants. The most common reasons cited for actual or potential medication errors included simply forgetting, heavy workload, distraction, and high patient acuity. Less commonly reported factors included missing or misreading the orders, incorrectly transcribed orders, medications unavailable from pharmacy, receiving the wrong dose or medication from pharmacy, pulling wrong drug from medication cart or refrigerator, incorrect storage of medication, pump-programming errors, and attaching medications to the incorrect IV lines.

Procedural errors (19.6%) or near errors (4.6%) were almost as high as medication errors and were associated with laboratory procedures and types of equipment, such as Swan-Ganz catheters, patient-controlled analgesia, dialysis machines, pacemakers and rapid transducers. Forgetting to draw blood specimens or drug levels, failing to report or act on abnormal values, and mislabeling specimens were illustrations of the former. Errors associated with equipment included such acts as inserting intravenous catheters in patients who did not need them, flushing IVs with the wrong solution, inadvertently disconnecting lines, and forgetting to unclamp drainage systems (e.g., chest tube or external ventricular drain). The most commonly associated reasons attributed to the errors or near errors included forgetfulness, distracting environments, problems concentrating, and high patient acuity levels. Less frequent causes were the use of unfamiliar devices and difficulties with, or a lack of knowledge regarding procedures for programming IV pumps.

Conclusions
The results of this study suggest that errors and near errors are common in critical care settings. While many of these episodes involved medication administration, an almost equal number involved other nursing functions. Although it is obvious that the nurses in this study were vigilant and careful, thus preventing a large number of errors from reaching the patients, error rates were still high. Identifying, acknowledging and understanding the frequency and types of errors that may occur in critical care nursing practice is integral to maximizing patient safety.

Commentary
The research by Balas, Scott and Rogers describes the nature and type of actual and near errors made by critical care bedside nurses. A strength of this study is that the results are consistent with other international studies that have found medication errors the most frequent type of error (Tissot, Cornette, Demoly, Jacquet, Barale, & Capellier, 1999; van den Bent, Fijn, van der Voort, Gossen, Egberts, & Brouwers, 2002). However, the study adds to the literature by illustrating the frequency of errors with medications recognized as high-risk, despite the number of strategies suggested by the Institute of Medicine (Kohn, Corrigan, & Donaldson, 2000), such as implementing computerized physician order entry and unit dose, having high-risk medications supplied by the central pharmacy, and not storing concentrated solutions of hazardous medication on patient-care units. This study also
The findings of this study have significant implications for critical care nursing practice. During the course of their shift, critical care nurses make multiple decisions that have the potential to either elevate or diminish the likelihood that their patient will experience a medical error. The prevalence of errors suggests the continued need for systematic changes to reduce preventable health care mishaps. For example, as noted by the authors, critical care nurses should not be expected to mix or prepare medications in distracting environments, yet critical care structural designs and the nature of nursing work in this environment typically prevent this from happening. Further studies are required to evaluate the impact of system-wide efforts on error reduction and the impact on patient safety. Critical care nurses also need to champion the development of readily accessible, confidential and “blameless” institutional-based reporting systems (perhaps similar to that of ISMP Canada), as well as to be leaders in the identification of and strategies to prevent errors and near errors.

Judy Rashotte, RN, PhD(c), CNCCP(C), Director, Nursing Research & Knowledge Transfer Consultant
Children’s Hospital of Eastern Ontario, Ottawa, ON

References

Celebrating National Nursing Week
May 7-13, 2007

CNA Theme for National Nursing Week:
Think You Know Nursing? Take a Closer Look

CACCN Nursing Week Contest
Win Tuition to DYNAMICS 2007, October 21–23, in Regina, SK
Send in a picture, story, or poem to help promote understanding of Critical Care Nursing

Contest Rules:
• Send your entry to caccn@caccn.ca by May 1, 2007. Please remember to enclose your contact information
• Participants must hold current CACCN membership
• Individual or team entries accepted
• Entries may be published in CACCN Dynamics Journal, Communication Boards or Website
• Winning entry will receive ONE FREE early bird tuition at Member’s rate

Winners will be notified by May 13, 2007
By Cathy Mawdsley, RN, MScN, CNCC(C), and Tracie Northway, RN, MScN, CNCCP(C)

“Quality improvement is not a one-person or one-discipline task; it requires the shared commitment of the entire interdisciplinary ICU team. All voices need to be heard and respected since everyone has something to contribute” (Curtis et al., 2006, p. 211)

Critical care nurses have a unique perspective as every day they see “gaps in practice” and work within systems that need to change. Large-scale practice changes often start off with tremendous attention and publicity, and frequently result in short-term change with unsustainable results. Sometimes common-sense solutions from frontline staff are ignored. Subsequently, the practices often return to “what we did before” because the system does not support the changes.

As critical care nurses, we can no longer ignore the fact that some of our traditional and current practices have been associated with patient harm and adverse outcomes. There is increasing evidence that making change at the grassroots can positively impact patient safety, length of stay, mortality and other outcomes (Brattebo, Hofoss, Flaatten, Muri, Gjerde & Plesk, 2002; Couves, 2005; Leape et al., 2006; Pronovost et al., 2006). Pronovost et al. (2006) reported reductions in catheter-related bloodstream infections through the use of low-cost changes to nursing and physician practices. Brattebo et al. (2002) reported reductions in average ICU length of stay and ventilator hours through standardizing sedation and sedation assessment.

Furthermore, there are numerous Canadian examples of multidisciplinary ICU teams successfully making these grassroots improvements that impact patient outcomes, using the influence and perspective of bedside staff (Couves, 2006; Esmail, Kirby, Ingstrom & Boiteau, 2005). Many of these teams will specifically identify that the knowledge, passion and problem-solving of frontline critical care nurses have been key to the success of the change (Couves, 2005; Esmail et al., 2005).

In previous columns, we have reviewed the purpose of the Canadian ICU Collaborative, and some of our broad goals (see Table One). As well, we have briefly identified some of our achievements (Mawdsley & Northway, 2006; Northway, Mawdsley & Couves, 2006). In this column, we will describe in more detail the success of two ICUs in implementing grassroots change that was embraced and championed by frontline critical care staff. The two teams are:

- Winnipeg Children’s Catheter-Related Blood Stream Infection (CRBSI) team,
- St. Paul’s Saskatoon Ventilator Associated Pneumonia (VAP) team.

Each of these teams championed frontline critical care nurses to test ideas for improvement, to identify and overcome barriers, and to develop strategies to ensure sustainable success.

Winnipeg Children’s Hospital - CRBSI

Winnipeg Children’s Hospital is an eight-bed combined medical/surgical pediatric ICU. This unit is the only pediatric referral centre for Manitoba, Northwestern Ontario, and Nunavut supporting a population of 1.1 million. This unit averages 500 admissions a year, with patients from birth to age 16.

This team joined the Canadian ICU Collaborative in December 2004 to work on reducing the rate of CRBSI. The baseline rate for this unit was 4.4 infections per 1,000 catheter days, and compliance to insertion and catheter maintenance practices was 100%. This team was committed to reducing CRBSI by 50% within the following 12 months, and to improve compliance with insertion and catheter maintenance practice bundles to 100%.

Although central line insertion practices were largely a physician-driven practice (e.g., sterile drapes, cap and mask, etc.), the monitoring of insertion practices by the bedside nurse was crucial to ensuring compliance and success. Checklists were developed to clearly outline expectations for central line insertion. The nurse at the bedside was responsible for ensuring compliance with all steps of the checklist during the insertion of the line.

Table One: Canadian ICU Collaborative Goals

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<tr>
<th>Goal</th>
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<tr>
<td>Improve appropriateness of RBC transfusion by 80% in the next 12 months</td>
<td>April 2003</td>
</tr>
<tr>
<td>Reduce incidence of VAP by 50% in the next 12 months</td>
<td>April 2003</td>
</tr>
<tr>
<td>Reduce harm from administration of high-risk medications</td>
<td>April 2003</td>
</tr>
<tr>
<td>Reduce mortality rates from sepsis by 10% using strategies to prevent or provide early management of sepsis</td>
<td>February 2004</td>
</tr>
<tr>
<td>Reduce in-hospital cardiac arrests by 50% using Medical Emergency Teams</td>
<td>February 2004</td>
</tr>
<tr>
<td>Reduce overall incidence of central venous catheter-related blood stream infections by 50% in the next 12 months</td>
<td>October 2004</td>
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Frontline critical care nurses have become involved in the patient’s exposure to harmful events. Once again, using a maintenance checklist and implementing other ideas from bedside staff, systems were changed to ensure best practice and improved compliance.

CRBSI rates decreased from a baseline of 4.4 in November 2004, to 1.03 in 2005, and to zero infections per 1,000 catheter days in 2006. Compliance with the insertion checklist improved to 88%, and to 85% for the maintenance checklist. Through the use of insertion checklists, reminders of catheter maintenance practices (e.g., choice of dressing, use of single lumen for TPN, etc.), use of a patient-specific daily goals sheet, and multiple educational strategies, this unit was able to change practice and reduce harm. Furthermore, using strategies that involved the bedside staff, this unit was able to sustain their changes in practice over a two-year period.

This team reports several factors as crucial to their success: having staff RNs believe in and champion the change, regular feedback back to the team on compliance and infection rates, and the use of the Plan-Do-See-Act (PDSA) rapid change methodology. This team accomplished its goals within the year, and has spread its success and methods to the medical surgical units and the NICU. Winnipeg Children’s ICU has also started to work on VAP prevention.

St. Paul’s, Saskatoon – VAP
St. Paul’s is a 10-bed combined ICU/CCU supporting a 200-bed tertiary teaching hospital. This hospital specializes in nephrology, and vascular, thoracic and ENT surgery. St. Paul’s Hospital joined the Collaborative in October 2005. Its goals were to introduce best ventilator practices into its unit (e.g., circuit changes, etc.), increase the time between VAP cases by 20%, and to achieve 90% compliance with HOB > 30 degrees. At the time of starting the Collaborative, the time between VAP cases ranged from two to 200 days, compliance with HOB > 30 degrees was < 70%, and compliance with oral gastric or Kaofeed tubes was < 50%.

Through the use of daily goals checklists, educational strategies, modification of sedation practices, monitoring of spontaneous breathing trials, and compliance with oral feeding tubes, this unit was able to achieve 309 days with no VAP. Compliance with HOB > 30 degrees has increased to more than 80% for the first nine months of 2006, almost 100% of patients have appropriate site or types of feeding tubes. Their current VAP rate is 1.8 per 1,000 ventilator days.

Both Winnipeg Children’s and St. Paul’s have worked hard to achieve their goals and be successful. They have challenged the “way we always do it” with the belief all patients deserve best practice; the frontline nurses are committed to reducing a patient’s exposure to harmful events.

In each of these stories, there are common threads to success:
1. Frontline critical care nurses have become involved in the change process and are champions for change in their respective ICUs and hospitals.
2. Frontline critical care nurses take patient advocacy to a higher level, and insist on system change for the safety of patients, and
3. Administration has facilitated the involvement of bedside staff and ensured obstacles are identified and removed. This has allowed the solutions and perspectives of the frontline staff to become a stronger voice in the process.

As critical care nurses, we have a unique responsibility towards changing practice. We have the responsibility to patients and families to coordinate their care, provide honest information, advocate for them through the complex health care system, and keep them safe from harm. As well, we have first-hand knowledge of inefficient and ineffective systems through our interactions with the multiple layers of the health care system: porters, laboratory and diagnostic technicians, volunteers, fellow RNs, and the many specialties of physicians. We are often the gatekeeper and collectors of information, and see first-hand how systems interact and can be changed. We have a professional obligation to ask ourselves, “Did I make my voice heard? Was my patient put at risk today?” Frontline critical care nurses need to be visible partners in the leadership of these changes, or the relevant common sense approach may be lost.

Next steps
Now you are asking – how can I do this in my ICU?
Foremost, you need a multidisciplinary team. Gladwell (2000) has written a critically acclaimed book about the tipping points of change – identifying the pivotal “small step” that has caused system-wide changes in industry, health care, and retail. In this book, he provides examples of three specific types of people, and their role in the change process. Successful change requires representation from each of these three groups to ensure initial acceptance of the change, and sustainable systems change. Yet, at times, we deliberately do not seek out some of these personalities as they are so different from our own.

In addition to the people on your team, support and infrastructure to make change is important. The absence of either will result in frustration, and ineffective change. One vehicle for this support and infrastructure can be found within the Canadian ICU Collaborative. Collaboratives and the use of rapid change methodology have been proven to work in various settings, including practice changes in the ICU (Brattebo et al., 2002; Couves, 2005; IHI, 2006; Leape et al., 2006; Pronovost et al., 2006). The Canadian ICU Collaborative is the Canadian critical care version of other successful collaboratives. Like other collaboratives, the Canadian ICU Collaborative focuses on multi-disciplinary teamwork, networking and sharing among teams, systems analysis, and the integration of frontline critical care nurses as integral members of a successful practice change.

How can I get started?
The Canadian ICU Collaborative will be accepting new teams on four topics for 2007-2008. The four topics are prevention of VAP, reducing CRBSI, medical emergency teams, and end-of-life care. The first three topics are also part of the Safer Health Care Now (SHN) campaign, and the fourth topic, end-of-life care, is a new topic specific to the Canadian ICU Collaborative. If you are interested in learning more about the Canadian ICU Collaborative, contact Ardis Eliason at aelison@telus.net.
Once your ICU joins the Canadian ICU Collaborative, your team will be invited to attend learning sessions, held every four months across Canada. The next meeting is in Montreal, March 28-29, 2007. At this time, new and more experienced teams join together to re-energize, strategize, and develop action plans for making improvements in their respective ICUs.

If you or your ICU is not already involved, seek out information to determine how your ICU would compare to the two success stories previously described. Ask yourself these two questions:

• Is there room for improvement in my ICU?
• Will I take patient advocacy to the next level?

As critical care nurses, each of us can learn from these success stories. Each unit had to confront and eliminate barriers to change, as well as maintain the momentum for change within their multidisciplinary team. Each of these units earned their success through creativity, perseverance, and a commitment to the integration of frontline staff into the change process.

Special thanks to Shari Watson from St. Paul’s, and Jannell Plouffe from Winnipeg Children’s Hospital for sharing their improvement stories and data.

About the authors
Cathy Mawdsley is a Clinical Nurse Specialist in the ICU at London Health Sciences Centre. Tracie Northway is the Quality and Safety Leader for Critical Care at B.C. Children’s Hospital.

References


Roadblock to recovery: The surgical stress response

By Susan Mertin, RN, MN, Jo-Ann V. Sawatzky, RN, PhD, William L. Diehl-Jones, RN, PhD, and Trevor W.R. Lee, MD, FRCPC

Abstract
Inadequately managed post-operative pain and the resulting surgical stress response (SSR) negatively affect patient outcomes. Critical care nurses need to understand that adequate pain management is critical to enabling patient recovery. A review of the physiology and pathophysiology of the SSR provides concrete evidence to substantiate the need for critical care nurses to prioritize nursing care that focuses on the prevention, early detection, and management of pain and the surgical stress response. Critical care nurses equipped with this evidence are capable of improving patient outcomes.

Surgery is a potent stress stimulus. The physiological surgical stress response has the potential to elicit systemic adverse effects. When the stressor is extreme and prolonged in relation to the resistance and strength of the patient, pathophysiological changes can occur. These changes, in turn, result in the erosion of body mass and physiological reserve and can lead to decompensation and negative patient outcomes. The purpose of this article is to provide an overview of the physiology, pathophysiology, and the clinical consequences of the surgical stress response. The key role of critical care nurses in optimizing patient outcomes through the prevention, early detection, and management of the surgical stress response are highlighted.

Background
Selye (1946) developed the general adaptation syndrome (GAS) as a paradigm of biological stress. He defined the GAS as “the sum of all non-specific, systemic reactions of the body which ensue upon long continued exposures to stress” (Selye, 1946, p. 119). Selye described the phases of GAS as alarm, resistance, and exhaustion. In the alarm stage, the central nervous system is stimulated. “It should be emphasized that the alarm reaction is not necessarily a pathologic phenomenon” (Selye, 1946, p. 131). If the stressor is mild and of short duration, the alarm reaction is part of a physiological adaptive process. Resistance is the stage in which the body’s defence systems are mobilized to elicit the preparation for ‘fight or flight.’ The ability of an organism to maintain itself in the resistance stage is limited and, consequently, adaptation energy can become depleted (Selye, 1946). Exhaustion of adaptation energy predisposes the individual to pathologies and even to death (Selye, 1974).

Building on Selye’s work, subsequent stress researchers observed that the stress response varies considerably from one individual to another. This led to the acknowledgement of a psychosocial influence on the stress response. For example, the observation that people respond uniquely to comparable situations led Lazarus and Folkman (1984) to conclude that it is the appraisal of the stress as exceeding personal resources or coping ability that threatens well-being. Pollock (1984) incorporated biological, psychological, and sociological perspectives to define stress as:

the whole set of physiologic and psychologic phenomena including the objective event or stressor, the person’s perception of the stressor, conditioning factors or contextual stimuli, the various intervening processes or the residual stimuli, and the manifestations of the response to the stressor (p. 3).

Thus, although Selye’s physiological focus oversimplified the complex nature of stress, his early laboratory studies established the cornerstone of stress research (Shelby & McCance, 2002).

Major surgery can be viewed as a significant physiological event, or stressor. Clearly, the intensity and duration of the surgical stress response (SSR) is primarily dependent on the severity and duration of the stimulus or stressor (Callahan, 1994). Therefore, more invasive, complex surgical procedures are associated with higher risk of what Selye would have described as exhaustion or the development of pathophysiological consequences. Numerous demographic factors and co-morbidities determine the individual patient’s ability to resist surgical stress. For example, in advanced age, the prevalence of cardiovascular and pulmonary disease increases and is manifested by changes that alter arterial compliance, vasoconstriction, autonomic function, sensitivity of catecholamines, and baroreceptor sensitivity (Smith, Austen, & Souba, 2001).

Although there is no question that psychosocial factors, such as anxiety, fear, and social support also impact on the stress response and, ultimately, on patient outcomes, the focus herein is on Selye’s paradigm of physiologic stress. Critical care nurses are in the ideal position to assess the stress stimuli, recognize the alarm and resistance phases of the stress response, intervene and prevent exhaustion and, thus, optimize outcomes in the surgical patient. Accordingly, the following review of the physiological response to the stress of major surgery provides a context for the early recognition of the clinical manifestations associated with this stress response.
The physiological surgical stress response

The physiological response to stress is well-described in the literature. This stress response will be discussed within the context of the following physiologic systems: sympathetic nervous system (SNS), the adrenal, pituitary and hypothalamic glands, and the immune and inflammatory regulatory systems.

**Sympathetic nervous system.** Stimulation of the SNS is the body’s immediate response to prepare for ‘fight or flight.’ The rapid and brief release of norepinephrine (NE) at nerve endings functions to enable better perfusion of vital organs, including the brain, heart and skeletal muscles. NE directly increases heart rate (HR) and causes peripheral vasoconstriction, which results in an increase in blood pressure (BP) (Smelzer & Bare, 2004).

The SNS stimulates the medulla of the adrenal glands to release catecholamines (i.e., epinephrine and NE), which produce a more prolonged response. This catecholamine release increases HR, BP, mental acuity, skeletal muscle tension, ventilation, and blood coagulability (Smelzer & Bare, 2004). To fuel this prolonged stress response, an increase in circulating blood glucose is also required (Smelzer & Bare).

The initial release of epinephrine stimulates an increase in serum glucose levels through the process of glycogenolysis, or the breakdown of cellular glycogen to glucose. Epinephrine activates the enzyme adenyl cyclase, which subsequently activates the phosphorylase enzyme system which, ultimately, converts glucose to glucose-6-phosphate (G6P). G6P is then hydrolyzed and the resultant free glucose diffuses into the plasma to produce a increase in serum glucose levels (Callahan, 1994; Guyton & Hall, 2000). Epinephrine also stimulates activation of cyclic adenosine monophosphate (cAMP) in liver and muscle cells. As with other second messenger system of cascades, cAMP serves to initiate a sequence of intracellular events which, ultimately, increases myocardial contractility (Piano & Huether, 2002).

**Adrenal, pituitary, hypothalamic systems.** Excessive and persistent stress stimuli, such as post-operative pain and related anxiety, produce a prolonged response of the adrenal, pituitary, and hypothalamic systems. For example, in response to the stress of a fluid volume deficit, aldosterone is secreted from the adrenal cortex. Aldosterone promotes sodium retention and potassium loss from the blood by regulating sodium re-absorption from the distal convoluted tubules, thereby facilitating the osmotic retention of water. The secretion of aldosterone is controlled by the renin-angiotensin-aldosterone system. Renin is an enzyme that is produced by the juxtaglomerular apparatus of the kidney in response to low sodium flow in the distal convoluted tubule and causes the cleaving of endogenous angiotensinogen to angiotensin I. Angiotensin I is converted by angiotensin converting enzyme (ACE) to angiotensin II. Angiotensin II vasoconstricts blood vessels and augments SNS activity which, in turn, releases more epinephrine in the blood vessels. Angiotensin II stimulates the secretion of aldosterone. Increased aldosterone levels serve to increase effective blood volume by causing re-absorption of sodium in the kidneys (Piano & Huether, 2002).

Related to this autonomic reflex, the posterior pituitary gland responds to low blood hydrostatic pressure by releasing antidiuretic hormone (ADH), resulting in increased renal reabsorption of water in the distal convoluted tubule and the collecting duct of the nephron (Callahan, 1994). Anterior pituitary release of growth hormone (GH) helps to mobilize energy stores by stimulating fatty acid uptake, the release of free fatty acids, and increasing blood glucose (Smelzer & Bare, 2004).

The hypothalamus also plays an important role in mobilizing energy stores. It secretes corticotropin releasing factor (CRF), which stimulates the anterior pituitary gland to produce adrenocorticotrophic hormone (ACTH). ACTH stimulates the adrenal cortex to produce glucocorticoids. Cortisol, the primary glucocorticoid, stimulates the production of enzymes, which results in protein catabolism, gluconeogenesis, and inhibition of glucose uptake (i.e., anti-insulin action) by cells other than those of the brain and heart (Smelzer & Bare, 2004). The metabolic actions of epinephrine and cortisol prepare the body to be ‘fight or flight’ ready (Shelby & McCance, 2002).

**Immune and inflammatory systems.** Since Selye’s early stress research, this field of inquiry has evolved to focus on the complexity of the stress response and the interaction of the consciousness, brain, central nervous system and immunology (Shelby & McCance, 2002). The immune system is integrated with the neuroendocrine and autonomic nervous systems. For instance, lymphoid tissue is supplied by autonomic nerves that release a number of different neuropeptides and by-products of the SNS, including: CRF, ACTH, endorphins, substance P, epinephrine, NE, dopamine, serotonin, histamine, GH, vasoactive intestinal hormone, β-endorphins, methionine-enkephalin, leucine-enkephalin, and somatostain (Dunn, 1989; Friedman & Irwin, 1995; Jankovic, 1989; Rabin, Cohen, Ganguli, Lysle, & Cunnick, 1989). All of these mediators can directly influence the immune system function, leukocyte regulation, and the inflammatory response (Shelby & McCance, 2002). For example, neuroendocrine hormones can either inhibit or stimulate leukocyte function, and catecholamines have been shown to increase the numbers of cytotoxic T cells and natural killer lymphocytes circulating in the blood (Rabin, 1999). Further research is needed to clarify the relationship between the immune system and the stress response.

**Summary.** The physiological stress response serves to enable the threatened or ‘stressed’ individual to adapt and survive. An understanding of the physiological changes that occur in response to stress reaction and resistance enables critical care nurses to assess the SSR and to proactively intercept pathophysiological responses that may ensue. Table One summarizes the body’s normal response to stress and the associated clinical manifestations.

**The pathophysiologic surgical stress response**

A sustained and/or poorly-managed SSR has the potential to cause adverse consequences in the perioperative period, including pain, cardiac ischemia and hemodynamic instability, renal decompensation, pulmonary decompensation, increased...
catabolism, impaired immunity, and hypercoagulability syndromes (Lubenow, Ivankovich, & McCarthy, 2001). An overview of the research evidence related to these pathophysiological responses provides insight for critical care nursing practice.

**Pain.** Pain is a well-known stimulus of the SSR. Post-operative pain can arise from numerous sources, including surgical incisions, chest tubes and endotracheal tubes (Ferguson, Gilroy, & Puntillo, 1997). Pain perception is influenced by physiological, pathophysiological, emotional, psychological, cognitive, environmental and social factors (Holdcroft & Power, 2003). Pain elicits a consistent and well-defined metabolic response, involving the release of neuroendocrine hormones and cytokines, and has the potential to result in detrimental multi-systemic effects (Weissman, 1990). While pain is the initial and, perhaps, the most potent stimulus for the SSR, the sequelae of untreated or poorly managed pain can further potentiate pain and move the patient toward exhaustion.

**Cardiac ischemia and hemodynamic instability.** The sustained SSR and the consequent release of catecholamines from the sympathetic nerve endings and the adrenal medulla, combined with release of aldosterone and cortisol from the adrenal cortex, and activation of the renin-angiotensin system can have direct effects on the cardiovascular system. Angiotensin II causes vasoconstriction. Catecholamines increase HR, myocardial contractility, and systemic vascular resistance. This cascade of events may result in hypertension, tachycardia and dysrhythmias, and may lead to myocardial ischemia in susceptible patients (Lubenow et al., 2001).

Patients who undergo major surgery, such as cardiac surgery, are susceptible to negative consequences resulting from the sustained SSR. For example, research specific to cardiac surgery has found that myocardial ischemia is most severe during the first 18 hours post-cardiopulmonary bypass (Smith, Leung, & Mangano, 1991). Consistent with this finding, in a prospective, randomized trial (N =106), Mangano and associates (1992) concluded that the severity of ischemic episodes following cardiac surgical revascularization can be diminished by prolonged use of a high-dosage, intensive analgesia regimen. This evidence suggests that critical care nurses can play an important role in reducing myocardial ischemia by focusing their efforts on adequate analgesia and pain management strategies.

**Renal decompensation.** Multiple organ failure is often the ultimate consequence of hypermetabolic and hyperdynamic states, resulting from uncontrolled systemic inflammatory and stress responses (Baldwin & Morris, 2002). Acute renal failure (ARF) is often one component of multi-organ failure (Bahar et al., 2005). A variety of underlying causes of ARF post-cardiac surgery have been identified, including low cardiac output, acute tubular necrosis, multiple blood transfusions, renovascular emboli, pre-operative contrast agents, nephrotoxic drugs and prolonged cardiopulmonary bypass (CPB) times (Bahar et al., 2005; Finkelmeier, 1995).

ARF is a serious complication of cardiac surgery. It is characterized by a sudden decrease in glomerular filtration rate and renal function with retention of fluid, decreased urine output, and retention of nitrogenous waste (Bahir et al., 2005). The incidence of post-cardiac surgery ARF varies from 1.16% to 15.1% (Bahar et al., 2005; Zanardo et al., 1994). Unfortunately, the occurrence of post-operative ARF carries a high morbidity and mortality rate. In a large retrospective study (N=14,437) of consecutive patients undergoing cardiac surgery from 1991 to 2001, Bahar et al. (2005) reported the mortality rate secondary to ARF as 79.7%.

<table>
<thead>
<tr>
<th>Table One: The hormonal stress response and clinical manifestations</th>
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<tr>
<td><strong>Stress Response</strong></td>
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<td><strong>↑ Epinephrine</strong></td>
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<td><strong>↑ Glucagon (alpha cells of pancreas)</strong></td>
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<tr>
<td><strong>↓ Insulin (beta cells of pancreas)</strong></td>
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<td><strong>↑ Growth Hormone (mild stress)</strong></td>
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<td><strong>↓ Growth Hormone (more severe stress)</strong></td>
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<td><strong>↑ Renin-angiotensin</strong></td>
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<td><strong>↑ Aldosterone</strong></td>
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<td><strong>↑ Antidiuretic hormone (vasopressin)</strong></td>
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Pulmonary decompensation. Pulmonary decompensation occurs as both a direct and an indirect consequence of the pathophysiological SSR. Directly, the exaggerated SNS activity impacts on pulmonary perfusion. Indirectly, post-operative pain can reduce functional residual capacity. As a result, atelectasis, pneumonia, pulmonary edema and pulmonary emboli are the most common post-operative pulmonary complications (Brashers, 2002). Specific to the surgical patient, absorption atelectasis results directly from removal of air from obstructed or hypoventilated alveoli and is often combined with the negative effects of inhaled high oxygen concentrations (Rothen, Sporre, Engberg, Wegenius, Reber, & Hedenstierna, 1995).

Indirectly, inadequate or excessive administration of pain medications is a contributor to SSR pulmonary decompensation in the surgical patient (Brooks-Brunn, 1995; Brooks, 2001). In a review article, Brooks (2001) identified depressed level of consciousness, immobilization, supine positioning and pain as contributing factors to post-operative nosocomial pneumonia. Furthermore, post-operative pain related to incisions and drainage tubes causes patients to hypoventilate, resist position changes and ambulation and, consequently, to develop respiratory complications (Gust et al., 1999).

Hypoventilation reduces ciliary clearing of secretions and surfactant production, and discourages collateral ventilation through the pores of Kohn, which only open during deep breathing (Brashers, 2002). Alveolar hypoventilation causes both decreased alveolar oxygen and increased carbon dioxide content. Diffusion of oxygen through the alveolar capillary membrane is impaired by pooled secretions, as well as inflammatory changes within the lung that can be triggered by indirect or direct surgical manipulation. For example, indirect surgical manipulation can be due to supine positioning combined with mechanical ventilation and paralytic agents.

The resulting ventilation/perfusion mismatch of shunting causes hypoxemia (Brashers, 2002). When severe, hypoxemia stimulates the drive to increase minute ventilation. Prolonged efforts to increase the minute ventilation result in fatigue and respiratory failure. In this manner, there is a circuitous relationship among atelectasis, dyspnea, hypoxia and pain, thus substantiating the need for adequate, ongoing pain management (Lubenow et al., 2001).

Increased catabolism. Prolonged surgical stress leads to a catabolic state in which insulin concentrations decrease and catabolic hormones such as epinephrine, glucagon, cortisol, and GH increase (Kehlet, 1996; Ouellette, 1998). This hypermetabolism mobilizes energy sources and leads to increased glucose production, resulting in hyperglycemia, lipolysis, and protein breakdown. Catabolism occurs in conjunction with a hyperdynamic response of the cardiovascular system, which is manifested by increased cardiac output and redistribution of blood to the vital organs (Shelby & McCance, 2002).

After glycogen resources have been depleted, protein becomes the source of glucose production. The production and activation of the extra enzymes required to convert protein to glucose are not immediate. Hormones such as GH, ACTH, and cortisol stimulate the release of enzymes that cause protein breakdown and reversal of the glycolytic process. Protease enzymes, which increase over the course of a few hours, produce hydrolysis of protein and an increased availability of free amino acids (Shelby & McCance, 2002). Gluconeogenesis destroys amino acids and is an inefficient system of energy production. Once a negative nitrogen balance has developed, efforts to compensate with the exogenous infusion of proteins, fats, and carbohydrates, insulin, or any combination of hormones or nutrients has only a minimal effect. Therefore, it is an important nursing goal to strive to prevent this delayed stress response (Callahan, 1994).

<table>
<thead>
<tr>
<th>Table Two: Pathophysiological sequelae of pain and surgical stress response</th>
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<tr>
<td><strong>Pathophysiological Stress Responses</strong></td>
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<tr>
<td>cardiovascular</td>
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<td>Respiration</td>
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<td>Endocrine</td>
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<td>Immuneologic</td>
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<td>Gastrointestinal</td>
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<td>Renal</td>
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<tr>
<td>Coagulation Effects</td>
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<td>Central Nervous System (cognitive)</td>
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CACCN 18 • 1 • Spring 2007
Impaired immune and inflammatory system. Although the stress response is designed to maintain homeostasis within the body, an exaggerated SSR can produce negative immune and inflammatory responses that are potentially counterproductive to recovery and may contribute to exhaustion (Bach et al., 2002; Lin, Calvano, & Lowry, 2000). For example, cytokines are polypeptides, or glycoproteins that are produced by cells at the site of injury and by systemic immune cells. Although cytokines are necessary mediators that direct the inflammatory response to the site of infection or injury, exaggerated production of proinflammatory cytokines can manifest systemically as metabolic derangements that can contribute to muscle wasting or the hemodynamic instability of septic shock (Lin et al, 2000).

High levels of cortisol, produced by the adrenal cortex in response to stress, result in the inhibition of protein synthesis. This includes a reduction in the synthesis of immunoglobulins and consequent immunosuppression (Sapolsky, Romero, & Munck, 2000). Research evidence substantiates the contention that cortisol has the ability to inhibit the inflammatory response and provides the basis for the perioperative clinical use of steroids to reduce systemic inflammatory reactions (Yeager et al., 2005). While inhibition of systemic inflammation may be beneficial, cortisol also inhibits fibroblast proliferation and function at wound sites. This may negatively affect wound healing and increase susceptibility to infection (Shelby & McCance, 2002).

Hypercoagulability syndrome. There is consistent research evidence that undergoing surgery causes changes in hemostasis, which leads to a hypercoagulable state and is manifested by increased circulating coagulation proteins, increased platelet reactivity, decreased circulating coagulation inhibitors, and decreased fibrinolysis (Liu, Carpenter, & Neil, 1995; Rosenfeld et al., 1993). In a prospective, randomized study of 12 healthy volunteers, Rosenfeld and associates (1994) concluded that stress hormone infusion causes changes that resemble those seen post-operatively. They suggested that cytokines and tissue thromboplastins may be other components of the hypercoagulable state. Increases in perioperative coagulation are associated with vaso-occlusive and thromboembolic events, such as deep vein thrombosis, pulmonary embolus, myocardial infarction, and stroke. These complications contribute substantially to post-operative morbidity and mortality (Liu et al., 1995).

Summary. A sustained pathophysiological stress response has clinical consequences that result in the exhaustion stage of the GAS. A summary of the pathophysiological stress responses and clinical consequences is presented in Table Two. An awareness of these pathophysiological sequelae provides insight for critical care nurses to assess, plan, and intervene, thus minimizing this threat to morbidity and mortality in the surgical patient population.

Nursing implications

Comprehensive knowledge of the physiological stress response facilitates the early recognition of the alarm and resistance phases of the GAS. This empowers critical care nurses to act proactively, to implement strategies to reduce the pathophysiological stress response, and to prevent the exhaustion phase and the consequent negative outcomes in the surgical patient. Thus, critical care nurses can play a key role in minimizing the SSR and, thereby, serve to optimize outcomes of major surgery.

While there are many factors that impact on the cascade of the SSR, pain is perhaps the most significant stimulus. A report from the National Institute of Nursing Research (1994) identified pain as a major contributing factor for prolonging hospital length of stay and recovery time, and negative patient outcomes. Critical care nurses have the capacity to use therapeutic relationships with critically ill patients and their families to assess, implement, and evaluate interventions aimed at reducing surgical stress and optimizing outcomes (Mitchell, Gallucci, & Fought, 1991; Stannard et al., 1996). Therefore, it is paramount that these nurses are at the forefront of current, innovative pain management techniques and integrate this knowledge into their practice (Erkes, Parker, Carr, & Mayo, 2001). Unfortunately, recent research of critical care nurses’ knowledge and attitudes regarding pain management supports earlier research evidence of inadequate pain management (Erkes et al., 2001).

In a large survey of acute care, surgical and medical hospitalized patients (n=5150), Bruster et al. (1994) reported that 61% of patients suffered from pain at some point during their hospitalization; 33% suffered from pain for the majority of their hospital stay. Similarly, in a pain management study of cardiac surgery patients (n=102), Yorke, Wallis, and McLean (2005) reported that 92% of patients experienced severe pain in their chest surgery area and fewer than half of the patients always told the nurses that they were in pain.

Because of the complex nature of pain, critical care nurses must be aware of the stimulus and the response multidimensional components of pain, the factors that influence the cyclic nature of pain, as well as its drastic impact on the physiologic and pathophysiological stress responses. Understanding the pathophysiology of the stress response facilitates a comprehensive assessment of the objective components of pain (Lome, 2005). Research indicates that there is a need for more education regarding the pain sequelae in both the student and practising nursing populations (Erkes et al., 2001).

In their review of evidence of the immune-suppressive nature of pain, Page and Ben-Eliyahu (1997) conclude that the implications for nursing practice are that adequate pain relief may not only be a primary concern for patient comfort, but may also be a matter of physiological necessity. Supporting this contention, this review of the physiology and pathophysiology of the SSR including the negative patient outcomes of cardiac ischemia and hemodynamic instability, pulmonary decompensation, increased catabolism, impaired immune and inflammatory responses, and hypercoagulability states supports the need for critical care nurses to focus their nursing care measures on the provision of adequate analgesia and promotion of patient comfort.
Conclusion
Ongoing learning is paramount to improving critical care patient management. Accordingly, this article has provided an overview of the physiology, pathophysiology, and the clinical consequences of the SSR. The key role of critical care nurses in optimizing patient outcomes through the prevention, early detection, and management of the SSR has been highlighted. Empowered with an awareness of the negative outcomes that are associated with the SSR, critical care nurses should focus their attention on proactive pain prevention strategies, early detection of physiological consequences of pain, and improved holistic pain management that includes measures to alleviate the psychological, social, and physical components of pain. Thus, critical care nurses can play a key role in minimizing the SSR and in optimizing the outcomes of major surgery.

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References


Continuing education (CE) hours from this article will be granted by CACCN. The CE hours can be applied to recertification in the critical care specialty [CNCC(C) and CNCCP(C)] as designated by the Canadian Nurses Association certification program.

Quiz topic: Roadblock to recovery: The surgical stress response

Educational objectives:
Based on the content of the article, you should be able to: 1. Describe the pathophysiological consequences of the surgical stress response. 2. Describe the management strategies for intervening in the stress response. 3. Describe one important nursing intervention that may ameliorate the surgical stress response.

Instructions:
To receive CE hours for this quiz, mark your answers on the enrolment form. Complete the form and submit it with the $12.00 processing fee to CACCN, P.O. Box 25322, London, Ontario, N6C 6B1. This enrolment form must be postmarked by April 1, 2008. Three weeks after the enrolment form and payment are received by CACCN, a corrected answer form will be sent to you. If you receive a passing score, a CE hour certificate will be enclosed.

Credit: You can earn 2.0 CE hours with a passing mark of 12/13 (92 per cent) correct answers on this quiz (ID #CACCN 07-1).

Questions

1. According to the General Adaptation Theory of biological stress, the goal of critical care nurses should be to prevent which pathophysiological phase?
   A. alarm
   B. resistance
   C. exhaustion
   D. decompensation

2. Cardiac ischemia and hemodynamic instability can be the result of which of the following hormones?
   A. aldosterone
   B. cortisol
   C. angiotensin II
   D. all of the above

3. Pulmonary decompensation can occur as a result of:
   A. direct and indirect consequences of the surgical stress response
   B. adequate psychological coping mechanisms
   C. inadequate or excessive administration of pain medications
   D. both a and c

4. Catabolism that occurs in conjunction with a hyperdynamic response of the cardiovascular system is a hypermetabolic response to stress that leads to:
   A. increased glucose production and hyperglycemia
   B. lipolysis
   C. hydrolysis of protein
   D. all of the above

5. The system that is first and perhaps the most prominent body system to respond to surgical stress is the:
   A. immune and inflammatory system
   B. respiratory system
   C. sympathetic nervous system
   D. cardiovascular system

6. Select the correctly paired gland and hormone:
   A. the adrenal cortex secretes aldosterone
   B. the hypothalamus secretes antidiuretic hormone
   C. the adrenal cortex secretes adrenocorticotropic hormone
   D. the hypothalamus secretes growth hormone

7. Select the correct statement.
   A. aldosterone promotes sodium loss from the kidneys
   B. aldosterone promotes potassium retention
   C. the angiotensin converting enzyme stimulates aldosterone production
   D. the secretion of aldosterone is controlled by the renin-angiotensin-aldosterone system

8. Pulmonary decompensation can occur as a result of:
   A. inadequate or excessive administration of pain medications
   B. effective deep breathing and coughing
   C. adequately controlled postoperative pain
   D. all of the above

9. A prolonged surgical stress response has the potential ability to result in negative outcomes including:
   A. potentiated pain
   B. cardiac ischemia
   C. a hypercoagulable state
   D. all of the above

10. The first postoperative energy stores to be used in catabolism are those that consist of:
    A. glycogen
    B. lipids
    C. protein
    D. amino acids

11. In prolonged catabolic states, energy is produced by:
    A. lipolysis
    B. gluconeogenesis
    C. glycolgenolysis
    D. diffusion

12. Critical care pain management should be focused on:
    A. proactive pain prevention and management strategies
    B. early detection of physiological consequences of pain
    C. holistic pain management strategies
    D. all of the above

13. Select the true statement.
    A. Physical pain is the only stimulus for the surgical stress response
    B. Pain is best managed with a unilateral pharmacological approach
    C. Pain perception is influenced only by physical stimulus
    D. Pain perception is a multidimensional phenomenon
CE Quiz

Dynamics, the Official Journal of the Canadian Association of Critical Care Nurses

CE Quiz Enrolment Form  CACCN07-1  CE Hours = 2.0

Photocopy this form and mark your answers in the appropriate spaces.
This form expires on April 1, 2008.

Quiz topic: Roadblock to recovery
The surgical stress response

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Program Evaluation

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How long did this program take to complete? ________ minutes/hours.

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The standardization of critical care nursing education and training: Strategies for advancing clinical practice in Ontario’s adult ICUs

By Patricia Hynes, RN, MA, CNCC(C), Nursing Unit Administrator, ICU, Mount Sinai Hospital, Toronto, ON, Marsha Pinto, MSc, Policy Analyst, Critical Care Secretariat, Ontario Ministry of Health & Long-Term Care, Wendy Fortier, RN, BScN, Clinical Director, Critical Care, The Ottawa Hospital, Ottawa, ON, and Jocelyn Bennett, RN, MScN, CON(C), Senior Director, Acute & Chronic Medicine & Nursing, Mount Sinai Hospital, Toronto, ON

Abstract
In 2004/2005, the Ontario Ministry of Health and Long-Term Care (MOHLTC) launched a critical care transformation strategy with a goal to enhance service delivery through improved access, quality and system resource management. Health human resources planning was seen as essential to the success of the strategy, particularly recruitment, education/training and retention of critical care nurses. A nursing task group was invited to articulate core competencies and practice standards that can be applied across Ontario’s adult ICUs and to make recommendations for implementation and the training needed to encourage compliance with the initiative. In this article, the opportunity to position nursing within the Ontario MOHLTC vision is described, as well as the work undertaken to prepare for a province-wide approach to critical care nursing education and training.

Background
Concerns about the delivery of critical care services are not a new development. A general understanding of ICU care as expensive and, at times, difficult to access is well-entrenched in the vernacular of most acute care institutions (Bell & Robinson, 2005). However, when as few as 80 critically ill patients overwhelmed available ICU resources during Severe Acute Respiratory Syndrome (SARS) in Toronto in 2003, the fault lines in the existing models of critical care delivery were illuminated.

Recognizing the potential implications of unmet demands for adult critical care services and concerned with demographics and also recent global events leading to sudden surges in the demand for ICU care, a critical care transformation strategy was launched by the Ontario Ministry of Health and Long-Term Care (MOHLTC) as part of the broader Access to Services and Wait Times Strategy. A critical care steering committee was charged with reviewing the current situation and making recommendations for greater efficiencies and quality improvements in the delivery of adult critical care services in Ontario (Bell & Robinson, 2005). While the number of critical care beds was an obvious item for consideration, the need to improve access, quality and resource management was also recognized as a priority.

Nurse training standards task group
A comprehensive plan to address human resource issues (nursing) in critical care led to the establishment of a Critical Care Nurse Training Standards Task Group. The mandate of this group was to identify and articulate critical care core competencies for nurses working in adult ICUs to reflect achievable expectations, to which actual nursing performance can be compared. A secondary objective was to propose methods of determining that training programs and graduates of those programs meet the identified standards.
Of note, other jurisdictions have also recognized the importance of investing in critical care nursing resource management. In Britain, for example, efforts to develop a planned approach to ICU nursing workforce development and the delivery of critical care nursing services were initiated based on recommendations in a document called Comprehensive Critical Care (Department of Health, 2000). A published report followed a year later, in which a nursing expert group responded with a series of considerations necessary to maximize the nursing contribution to a more effective critical care delivery model, including access to competency-based education and training to ensure that nurses are appropriately skilled to meet the needs of patients and families in their care (Department of Health, 2001). The World Federation of Critical Care Nurses (WFCCN) has recently employed an evidence-informed, consultative process to develop a position statement and guidelines for appropriate critical care nursing education. Key recommendations include the preparation of critical care nurses at the post-graduate or post-registration level and the articulation of common standards and outcomes that critical care nursing course curricula must meet when preparing graduates (Williams, Schmollgruber, & Alberto, 2006).

In preparation for the development of a standardized core competency document for Ontario ICU nurses, we accessed a number of resources including a snapshot survey on the current practices of Ontario ICUs as they pertain to nurse training and competency assessment, communications with professional associations and a review of the literature. This next section will provide an overview of findings that we found useful to our discussions and that subsequently informed our recommendations for a standardized competency document.

Survey of Ontario ICUs

In November of 2005, a survey was e-mailed to Ontario hospitals known to have critical care units (n = 84) with a goal to capture information about 1) existing standards of practice, and 2) the training programs currently used to prepare nurses new to critical care for practice in that setting. We were interested in knowing whether written standards of practice were available to nursing staff and, if so, which national or provincial standards they most reflected. We asked about competency statements and the frequency of evaluation of the standards document and, also, evaluation of nurses, including whether documentation was provided, both from the nurse manager and as a peer review component of the process.

With respect to training, we inquired as to whether nurses were educated by an external higher-education provider, resulting in the awarding of a critical care certificate on successful completion of the program, or through an in-house program. The duration of the course, expressed as the total number of didactic and clinical weeks, was also requested.

Results. Results based on responses from 68 Ontario ICUs, mostly medical-surgical (Figure One), showed that the majority of units (85%) do have written standards of practice (Figure Two). Most ICUs (93%) referred to the published standards of the Canadian Association of Critical Care Nurses (CACCN) and also incorporated those of the College of Nurses of Ontario (CNO) (86%). In-house programs appear to be most widely used for training nurses new to critical care (89%), followed next in frequency by preceptorship (64%) and, lastly, college certificate programs (33%). The frequency with which unit standards were updated varied, with most responses (55%) falling within two categories encompassing the one- to five-year range (43% missing data). Many, but not all of the ICUs, reported inclusion of competency statements and a documented nurse evaluation component (70%). Nurses were evaluated every one to two years and, in most cases, there was not a required peer review component.

Professional associations

In the interest of remaining within the scope of this paper, the following discussion will be limited to an overview of the two key documents that we relied on as primary resources, those being the CACCN Standards for Critical Care Nursing Practice (CACCN, 2004) and the CNO Competency Review Tool (CRT) for Nurses in Direct Practice (CNO, 2003). There are other excellent resources available through organizations such as the American Association of Critical Care Nurses (AACN), the WFCCN, and the Australian College of Critical Care Nurses (ACCCN). All are worthy of a full review and are available on-line in full-text format or can be purchased for a nominal fee.
CACCN Standards for Critical Care Nursing Practice
According to the CACCN, critical care nursing practice is a research-based, holistic patient- and family-centred model of care that is committed to optimal outcomes, best achieved through partnerships and the appropriate use of resources (CACCN, 2004). The CACCN published standards provide a means by which professional accountability and adherence to these goals can be demonstrated. They are classified according to two broad categories: 1) the structure of the critical care unit including the physical layout, but also processes for unit governance and opportunities for professional development (see Table One), and 2) the critical care nursing process (see Table Two).

As the CACCN document was referenced by most Ontario ICUs represented in our survey findings, these standards were distributed to members of the Critical Care Nurse Training Standards Task Group for consideration as a proposed working template. We were aware also that the competency basis for the Canadian Nurses’ Association (CNA) critical care certification exam was congruent with the competencies outlined in the CACCN document. On review, we concluded that the document is sound and agreed it would form one of the pillars of our recommendations.

CNO Competency Review Tool (CRT) for Nurses in Direct Practice
CNO Mission
“To protect the public’s right to quality nursing services by providing leadership to the nursing profession in self-regulation” (College of Nurses of Ontario, 2005)

CNO Vision
“Excellence in nursing practice everywhere in Ontario” (College of Nurses of Ontario, 2005)

<table>
<thead>
<tr>
<th>Table One. Structure of the critical care unit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Outcome Standard 2</strong></td>
</tr>
<tr>
<td>Opportunities for critical care nurses to maintain the knowledge and skill necessary to deliver safe and knowledgeable nursing care, within the context of the chosen conceptual model of nursing practice, are provided by the health care facility.</td>
</tr>
</tbody>
</table>

**Criteria**

1. The health care facility develops criteria for hiring nurses based on the knowledge and skill requirements of the job.

2. The health care facility provides an orientation program in which the orientee is supernumerary and the orientation program:
   - 2.2.1 Is based on a learning needs assessment
   - 2.2.2 Includes specific unit philosophy, goals, policies and procedures, as well as an organizational chart
   - 2.2.3 Includes physical layout and instructions in the use of unit equipment
   - 2.2.4 Includes a clinical and theoretical component, the content and length of which are based on the level and type of the unit.

3. The health care facility provides continuing education programs on the following:
   - 2.3.1 New or revised policies and procedures
   - 2.3.2 The use of new or updated equipment
   - 2.3.3 Roles and responsibilities of the critical care nurse, including the role of charge nurse and preceptor
   - 2.3.4 Role of the critical care nurse on the health care team
   - 2.3.5 Theory pertinent to the patient population and needs of critical care nurses
   - 2.3.6 Critical incident stress management for all staff members
   - 2.3.7 The use and fitting of personal protective equipment for all staff involved in patient care

4. The health care facility evaluates the knowledge and competencies of the critical care nurse.

5. The health care facility establishes/maintains a current and accessible library of reference materials relevant to the patient population.

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Discussion

The CACCN and CNO documents will provide the foundation for the articulation of standards and core competencies for critical care nurses who practise in Ontario’s adult ICUs. However, these documents do not explicitly outline a format for how practice standards can be implemented and otherwise integrated into the practice of critical care nurses, and then evaluated. The Ontario document will be unique in this respect. It was developed with training and evaluation options considered and in consultation with a nurse in direct practice (HB), also a member of the Ontario Nurse Training Standards Task Group. We believe that nurses involved in the provision of direct patient care are ideally positioned to ensure the applicability of such a document to nurses’ work.

We would like to highlight the parallel between this initiative and the development of any document that espouses best practice standards. With the emergence of new evidence, changes in human resource strategies and in societal norms, there is a need for the content to be assessed, updated and/or retained as deemed appropriate. A scheduled review is one option, but there are circumstances in which this is not sufficient, such as when the benefits of a particular therapy are called into question or the potential for harm is identified (Shekelle, Eccles, Grimshaw, & Woolf, 2001). Upon considering the rate with which new information becomes available in the clinical setting, prudent professional practice would require that a pre-determined process is available and clearly communicated to all stakeholders.

We recognize that ICUs are complex environments and that some offer specialized therapies that are not available in all centres. For example, although high-frequency oscillation is an established therapy in the neonatal ICU setting, its use with adults is limited to patients with Acute Respiratory Distress Syndrome (ARDS) who are failing conventional ventilatory management and centres where the technology and expertise is available. Similarly, continuous renal replacement therapy (CRRT) is most appropriately available in ICUs where the volume of patients requiring the therapy is sufficient to support the ongoing competence of the nurses who initiate, monitor and otherwise administer the therapy. In advancing a framework for standardized competencies for Ontario nurses, we are not overlooking the important work that individual ICUs may undertake to ensure that the nurses they employ are assessed based on expectations that accurately reflect their day-to-day work. Where this means adding to the standardized document additional unit-specific competencies, we would support this as an appropriate application of the tool.

One of the strengths of our work is that it integrates provincial general nursing competencies with those published by the national critical care nurses’ association, the CACCN. In adopting this approach, our intention was to portray critical care nursing practice within the context of a system resource. An additional strength was the task group’s balance of university-based and community-based hospital nursing representatives and the varied perspectives that were represented as a result.

In this article, we have sought to share our work on the preparation and articulation of a standardized core competency document for Ontario nurses who are employed or seeking employment in adult ICUs. A process for determining appropriate training programs and that graduates of those programs meet the identified standards is still to be decided. We recognize the complexity of the task that this implies. It is an important area to consider and, like our work in preparation for the development of provincial standards, one that deserves to be examined in great depth.

Table Two: The Critical Care Nursing Process

<table>
<thead>
<tr>
<th>Outcome Standard 7</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Criteria</strong></td>
<td></td>
</tr>
<tr>
<td>7.1 The critical care nurse contributes positively to the image of nursing.</td>
<td></td>
</tr>
<tr>
<td>7.2 The critical care nurse contributes positively to the image of the critical care unit (e.g. education and ongoing information about care).</td>
<td></td>
</tr>
<tr>
<td>7.3 The critical care nurse ensures confidentiality of the patient/family information and reports infractions.</td>
<td></td>
</tr>
<tr>
<td>7.4 The critical care nurse maintains professional competence through education.</td>
<td></td>
</tr>
<tr>
<td>7.5 The critical care nurse ensures patient and family privacy within the limits of the environment.</td>
<td></td>
</tr>
<tr>
<td>7.6 The critical care nurse follows guidelines for notification of reportable incidents (e.g. communicable diseases, abuse).</td>
<td></td>
</tr>
<tr>
<td>7.7 The critical care nurse follows guidelines for reporting data to appropriate agencies (e.g. coroner, police).</td>
<td></td>
</tr>
<tr>
<td>7.8 The critical care nurse identifies potential candidates for tissue and organ procurement.</td>
<td></td>
</tr>
<tr>
<td>7.9 The critical care nurse responds to environmental, physical and psychosocial stress factors that impact interdisciplinary team members in the critical care setting.</td>
<td></td>
</tr>
<tr>
<td>7.10 The critical care nurse participates in critical care nursing research and incorporates research findings into practice.</td>
<td></td>
</tr>
<tr>
<td>7.11 The critical care nurse recognizes the delineation between the practices of critical care nursing and the practice of critical care medicine.</td>
<td></td>
</tr>
<tr>
<td>7.12 The critical care nurse responds to professional, legal and ethical issues.</td>
<td></td>
</tr>
</tbody>
</table>

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Acknowledgements

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The authors would like to acknowledge the CACCN Board of Directors 2005-2006.

The authors would like to acknowledge Ged Williams of the WFCCN.

References


Figure Three: CNO Categories of Competency Review
College of Nurses of Ontario (2003).

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Neuromuscular blocking agents: Enhancing safety by reducing the risk of accidental administration

By Christine Koczmara, RN, BScPsy, and Valentina Jelincic, RPh, BscPhm

Abstract

Neuromuscular blocking agents (NMBAs) are often found as ward stock in critical care units to ensure their availability in case of urgent need. The unintentional administration of an NMBA to a non-intubated and non-ventilated patient can result in severe permanent injury or death. Incidents involving mix-ups with NMBAs have occurred within and outside of critical care units. Case reports are highlighted with the intent to increase practitioner awareness of situations that could lead to similar errors and to promote changes in the critical care environment in order to enhance medication safety with NMBAs.

Background

Neuromuscular blocking agents (NMBAs) are considered high-alert drugs: “…drugs that bear a heightened risk of causing significant patient harm when they are used in error.” (ISMP, 2005). Focusing on high-alert medications is a good starting point to assess and enhance safety in medication use processes (prescribing, transcription, dispensing, administration, and monitoring). NMYMBA guidelines identifying the potential adverse events associated with use of these medications (e.g., prolonged recovery and acute quadriplegic myopathy syndrome [AQMS]) have been discussed (American College of Critical Care Medicine of the Society of Critical Care Medicine [ACCM], American Society of Health-System Pharmacists [AHSC], American College of Chest Physicians [ACCP], 2002; Murray et al., 2002). This article shares reports of adverse events, resulting from medication incidents where NMBAs were inadvertently administered, for the purpose of learning and taking action to implement medication system safeguards.

NMBAs are commonly found in critical care unit stock for indications requiring respiratory and skeletal muscle paralysis in circumstances such as to manage increased intracranial pressure, or to manage critically ill patients by decreasing oxygen consumption when other therapies have failed (ACCM et al., 2002; Murray et al., 2002). (Refer to Table One for a sample list of neuromuscular blocking agents available in Canada.)

In cases where NMBAs have been inadvertently administered to non-intubated, non-ventilated patients, incidents have resulted in death or severe permanent harm (ISMP, 2006; Phillips & Williams, 2006). Regardless of where NMB medication incidents occur, they can provide valuable lessons for enhancing NMB safety. The following cases are provided to increase awareness of potential system-based failures.

Reports of inadvertent administration of neuromuscular blocking agents

Critical care unit

“Pancuronium [requiring refrigeration] …was misplaced among heparin flush stock. A nurse inadvertently administered 5 mL of the neuromuscular blocking agent instead of heparin... The patient, who was in the intensive care unit, experienced the effects of the pancuronium administration, but recovered after 10 hours on a respirator.” (United States Pharmacopeia [USP], 2000, p. 2).

“A ventilated ICU patient was receiving vecuronium and a potassium chloride infusion. After the patient was extubated, vecuronium was discontinued. The infusion bag containing vecuronium remained in the room and was mistaken to be potassium chloride. Soon after the medication was started, the patient arrested, requiring intubation and ventilation for six hours.” (ISMP, 2006, p. 1).

“The names NARCAN (naloxone) and NORCURON (vecuronium) look alike when orders are handwritten and sound alike when orders are transmitted verbally. We have been alerted to three cases where patients in respiratory distress from opiate overdoses needed Narcan, but inadvertently received Norcuron, a neuromuscular blocker …a physician wrote ‘Narcan 1 amp IV.’ An ICU nurse tried to obtain the drug from an automated dispensing module where drugs were listed by their generic names. She mentally confused Narcan with Norcuron. She asked a colleague, ‘What is the generic name for Norcuron?’ When her coworker said vecuronium, she removed the neuromuscular blocking agent from the cabinet and gave the patient an unknown quantity from the 10 mg vial. The

Table One: Sample list of neuromuscular blocking agents available in Canada

<table>
<thead>
<tr>
<th>Generic Name</th>
<th>Common Trade Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>atracurium</td>
<td>Tracrium</td>
</tr>
<tr>
<td>cisatracurium</td>
<td>Nimbex</td>
</tr>
<tr>
<td>mivacurium</td>
<td>Mivacron</td>
</tr>
<tr>
<td>pancuronium</td>
<td>Pavulon</td>
</tr>
<tr>
<td>succinylcholine†</td>
<td>Quelicin†</td>
</tr>
<tr>
<td>tubocurarine</td>
<td>Tubarine</td>
</tr>
<tr>
<td>vecuronium</td>
<td>Norcuron</td>
</tr>
</tbody>
</table>

† Depolarizing neuromuscular blocking agent.
patient experienced respiratory and cardiac arrest, but was resuscitated, placed on mechanical ventilation, and transferred to ICU.” (ISMP, 1998, p. 1).

Operating room
“...respiratory compromise suddenly developed in a patient undergoing a minor surgical procedure requiring only local anesthesia and sedation. Immediate interventions included intubation and ventilatory support. The patient required ventilation for approximately 10 minutes. The anesthesiologist later surmised that... atracurium might have been administered to the patient instead of the intended midazolam... the atracurium and midazolam vials were both 10 mL in size and located adjacent to each other... Practitioners at this hospital were presumably accustomed to having the neuromuscular blocker in the smaller 5 mL vial and the midazolam in a 10 mL vial... the substitution of rocuronium (a commonly used neuromuscular blocker in a 5 mL vial) with atracurium (10 mL vial)... in the anesthesia drug cart due to a national (manufacturer) shortage [was also identified as a contributing factor].” (ISMP Canada, 2004, p. 1).

“...the inadvertent administration of rocuronium from an unlabelled pre-filled syringe... The intended drug was a sedative. The patient was successfully resuscitated after suffering a respiratory arrest.” (ISMP Canada, 2004, p. 1).

Emergency department
“...in a pediatric emergency department (ED) where vecuronium was administered to an alert three-year-old child who was not ventilator-supported. In this case, commercially prepared, prefilled saline syringes were not available in the ED, so nurses drew up supplies of saline flush syringes from multiple-dose vials, labelling them by hand. Prior to the child’s admission, vecuronium syringes had been prepared for another patient. An unused syringe of vecuronium, hand-labelled similarly to the saline syringes, somehow found its way into the saline supplies. As a result, the syringe containing vecuronium was mistakenly used to flush the child’s IV line. The child became frightened and flaccid. All respiratory efforts ceased, and he was quickly intubated and ventilated... The child was treated supportively and sustained no serious harm.” (ISMP, 1999, August 25, p.1).

“A nurse, intending to select epoetin alpha (Procrit) from the medication refrigerator, mistakenly chose a vial of pancuronium. The nurse realized her error as she was preparing the dose and corrected her mistake. Tragically, this near miss was not reported, and a co-worker later prepared and administered an inadvertent dose of pancuronium from the same refrigerator.” (Paparella, 2004, p. 251).

“A trauma patient was admitted to the ED for stabilization before transfer to a local trauma centre. The physician gave a verbal order for vecuronium and midazolam, and intubated the patient after the medications had been administered. He then mistakenly entered electronic orders for these medications onto an oncology patient’s record. While this patient’s nurse was taking a break, another ED nurse administered medications to the oncology patient without recognizing that vecuronium would paralyze the respiratory muscles. After she left the room, the patient arrested. The ED team responded, but the patient could not be resuscitated.” (ISMP, 2005, September 22, p. 2).

“An emergency room physician treating a combative patient ordered a neuromuscular blocker (vecuronium, Norcuron®) without first assuring the patient was appropriately ventilated. The patient, who was not intubated, received the drug and developed respiratory arrest. The patient suffered an anoxic insult.” (ISMP, 1996, p. 2).

General medical/surgical patient care areas
“...an order to ‘continue same meds’ upon transfer from a critical care unit has led to continued use (sometimes fatal) of neuromuscular blocking agents for restless, but extubated patients.” (ISMP, 2000, p. 1).

“Unknown to pharmacy, an anesthesiologist had ordered trial supplies of mivacurium from a drug representative. When the product was delivered to the pharmacy, it was stocked next to look-alike bags of metronidazole. Both solutions were encased in foil wrappers. Believing metronidazole was the only product in foil wrappers in the pharmacy, a technician labelled several mivacurium bags as metronidazole... four patients received mivacurium instead of metronidazole; all experienced respiratory arrest. One patient died, another was seriously injured, and two recovered.” (ISMP, 2005, September 22, p. 2).

“...cisatracurium infusion had been delivered by accident to a medical unit along with three bags of antibiotics. A nurse had verified that the first three bags in the stacked pile of piggybackes were the prescribed antibiotics, but she was interrupted before checking the fourth bag, which contained cisatracurium. When she returned to the medication room, the nurse glanced at the yellow label, similar to the other labels on the antibiotics, and administered the...
neuromuscular blocking agent, believing it was an antibiotic. The patient experienced a respiratory arrest and required ventilation for a few hours.” (ISMP, September 22, 2005, p.1).

“Atracurium was administered subcutaneously instead of hepatitis B vaccine to seven infants. The infants developed respiratory distress within 30 minutes. Five infants recovered, one sustained permanent injury, and another died. Neuromuscular blocking agents had never been available as floor stock in the nursery. For convenience, an anesthesiologist from a nearby OR had placed the vial of atracurium in the unit refrigerator near vaccine vials of similar appearance.” (ISMP, 2005, September 22, p. 2).

**Contributing factors**

Multiple contributing factors often underlie medication incidents with NMBAs (i.e., inadvertent administration). For example, confirmation bias can cause a health care professional to read a label or select a drug product and “see” what they expect to see, rather than what is actually selected. Lack of differentiation between NMBAs and other medications (refer to Figure One), look-alike packaging and labelling, and unexpected changes to labelling or packaging (e.g., in cases of drug shortage or when a product is purchased from an alternate manufacturer) can contribute to confirmation bias and predispose to human error.

ISMP Canada, as part of the Canadian Medication Incident Reporting and Prevention System (CMIRPS), has been involved in a national collaboration with multiple stakeholders to identify and promote improvements to the packaging and labelling of medications to better distinguish them (ISMP Canada, 2005, October 30). NMBAs were identified as an important starting point. Agreement regarding the ideal features for packaging and labelling of neuromuscular blocking agents, some of which have already been implemented in the United States, are summarized in Table Two. Some of the participating Canadian manufacturers already have select features incorporated into their labelling and others are evaluating the feasibility of incorporating some or all of these (ISMP Canada, 2006).

Distinctive packaging and labelling are key safety features, but are only part of the solution. Contributing factors to the occurrence of N MBA medication incidents can also include: storage and access to these drugs outside of specialty areas, lack of an independent double check by a pharmacist prior to dispensing, not segregating N MBA storage (in patient care areas as well as in pharmacy), miscommunication, lack of readily available information at point of care, lack of practitioner knowledge, failure to discontinue/remove NMBAs from patient rooms or from medication administration records before patient transfer from critical care, and look-alike/sound-alike medication names.

**Prevention strategies**

Medication systems and processes need to be continuously assessed and enhanced in order to reduce error potential. Some examples of safety recommendations and prevention strategies to promote safer use of NMBAs are outlined below. It may be helpful to consider the *Hierarchy of Effectiveness* when developing and implementing safety solutions, where the most effective have been identified as those “…high-leverage error prevention tools that are designed to fix the system, not just people, whenever possible.” (ISMP, 1999, June 2, p. 1).

**Restrict access**

Restrict floor stock of NMBAs to critical care, the operating room and the emergency department, where patients can be mechanically ventilated and monitored (Cohen, 2007; ISMP, 1999; ISMP, 2005; ISMP, 2006; ISMP Canada, 2005, April; Paparella, 2004; Phillips & Williams, 2006).

**Segregate storage**

Segregate NMBAs from all other medications in all areas they are stored (Cohen, 2007; ISMP, 1999; ISMP, 2005; ISMP, 2006; ISMP Canada, 2005; Paparella, 2004; Phillips & Williams, 2006).

If intubation kits or anesthesia kits containing NMBAs must be kept in areas outside of the operating room, seal the kits to restrict access until the time of intubation (Phillips & Williams, 2006).

Remove NMBAs from a patient’s room as soon as they are discontinued, and dispose of them promptly. Do not return unopened vials to stock. Return vials to pharmacy immediately or place them into a return bin that is sequestered (Cohen, 2007; ISMP, 1999; ISMP, 2005; ISMP, 2006; ISMP Canada, 2002; Paparella, 2004).

**Apply warning labels**

Have pharmacy:
- affix clearly visible warning labels, such as “Warning: Paralyzing Agent – Causes Respiratory Arrest”, on each vial, syringe, admixed intravenous (IV) bag, and storage box

<table>
<thead>
<tr>
<th>Table Two: Ideal features of neuromuscular blocking agent labelling and packaging include (ISMP Canada, 2006):</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red cap with white lettering: “Paralyzing agent” or “Warning: Paralyzing Agent”</td>
</tr>
<tr>
<td>Red ferrule with white lettering: “Paralyzing agent”</td>
</tr>
<tr>
<td>Red lettering on the product label: “Paralyzing agent” or “Warning: Paralyzing Agent”</td>
</tr>
<tr>
<td>Peel-off label, using the colour scheme and content information recognized by the ASA/CAS recommended standards, for application to a prepared syringe (ASA = American Society of Anesthesiologists) [<a href="http://www.asahq.org">www.asahq.org</a>]; CAS = Canadian Anesthesiologists’ Society [<a href="http://www.cas.ca">www.cas.ca</a>])</td>
</tr>
<tr>
<td>Space on the product label for bar-code application</td>
</tr>
</tbody>
</table>
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of NMBAs (including those stocked in pharmacy) (Cohen, 2007; ISMP, 1996; ISMP, 1999; ISMP, 2005; ISMP, 2006; ISMP Canada, 2002; ISMP Canada, 2005). Ensure that the labels are placed without obscuring important information (Cohen, 2007).

• communicate changes in manufacturer, packaging, and labelling to frontline staff (e.g., where a product shortage requires a medication substitute or a change in supplier) (ISMP Canada, 2004; ISMP Canada, 2005).

• consider including preprinted drug name labels and warning labels where NMBAs are stored, for use by practitioners who administer NMBAs (ISMP Canada, 2004).

Computerize and automate

Work towards implementing computerization of the medication use process at the point of care (e.g., bar-coding, computerized physician order entry [CPOE]) in an effort to automate manual independent double check processes (ISMP, 1999; ISMP, 2005; ISMP, 2006).

Work to implement or optimize built-in clinical alerts. For example, an on-screen pop-up box that states “Ensure patient is intubated and ventilated” whenever an NMA is selected for removal from an automated dispensing cabinet (Cohen, 2007; ISMP, 2006; Paparella, 2004).

Use single-item access drawers for storage of NMBAs in an automated dispensing cabinet (Paparella, 2004; Phillips & Williams, 2006).

Standardize prescribing

Establish and use standard order sets (preprinted, computerized) for NMBAs to prevent misinterpretation of handwritten orders. Include the need for full ventilation support during and after administration and a protocol stipulating automatic discontinuation of NMBAs after extubation or on removal of full ventilator support (e.g., patient is now required to trigger the ventilator) (Cohen, 2007; ISMP, 2005; ISMP, 2006).

NMBAs should never be referred to as “muscle relaxants” (Cohen, 2007; Phillips & Williams, 2006).

Do not accept orders such as “Resume the same medications” upon discharge from critical care (Cohen, 2007; ISMP, 2005; ISMP, 2006).

Do not accept indications such as “prn for agitation” (Cohen, 2007; ISMP, 2005; ISMP, 2006; Phillips & Williams, 2006).

Educate and inform

Share this article to increase staff awareness of medication incidents that have occurred with NMBAs, including the need to:

• label medication syringes, even when only one product is to be administered (ISMP Canada, 2004); and

• report medication incidents, near misses, and potentially hazardous conditions to prompt medication safety improvements.
Provide up-to-date drug information readily available to practitioners at various points in the medication use process (including having generic and trade names) of NMBAs available.

Summary

Inadvertent administration of neuromuscular blocking agents can be fatal. It is well-known that “to err is human”. Critical care practitioners are encouraged to take this opportunity to learn from organizations that have experienced paralyzing incidents involving NMBAs. Assess potential areas of risk related to the stock and use of these agents in your own practice, in your critical care unit, and in your organization as a whole. Design and implement safeguards to enhance system safety. Awareness of hazards associated with the use of NMBAs and of strategies for safer use can reduce the potential for harmful events to occur with these medications.

This article was written using materials from ISMP Canada, with permission.

ISMP Canada gratefully acknowledges the valuable lessons learned and information reported by professionals in the Canadian health care community that can then be shared to enhance medication system safety. All ISMP Canada Safety bulletins are available from http://www.ismp-canada.org/ISMPCSafetyBulletins.htm

ISMP Canada is a national voluntary medication incident and ‘near miss’ reporting program founded for the purpose of sharing the learning experiences from medication errors. Implementation of preventative strategies and system safeguards to decrease the risk for error-induced injury and thereby promote medication safety in healthcare is our collaborative goal.

Medication Incidents (including near misses) can be reported to ISMP Canada:
(i) through the website http://www.ismp-canada.org/err_report.htm or
(ii) by phone: 416-733-3131 or toll free: 1-866-544-7672.
ISMP Canada can also be contacted by e-mail: cmirps@ismp-canada.org.

ISMP Canada guarantees confidentiality and security of information received, and respects the wishes of the reporter as to the level of detail to be included in publications.

About the authors

Christine Koczmar, RN, BScPsy, is an analyst with ISMP Canada. She also holds a casual position as a bedside nurse in an intensive care unit (ICU).

Valentina Jelincic, RPh, BScPhm, is a pharmacy and management consultant and medical writer, with varied experience in the private and public sectors and with professional and nonprofit associations.

References


CACCN Chapter of the Year Award Program

Purpose
The Chapter of the Year Award is to recognize the effort, contributions and dedication of a chapter of CACCN in carrying out the purposes and goals of the association.

Criteria for the award program
1. The award program will be for the period of April 1-March 31 each year.
2. Chapters may win the award for one year followed by a two-year lapse before entering again.
3. A point system has been developed to evaluate chapter activities during the year. The chapter with the most points will be the winner of the Chapter of the Year Award. CACCN reserves the right to adjust points depending upon supporting materials submitted.
4. The award winner will be announced at Chapter Connections Day and at the annual awards ceremony at Dynamics.

Conditions for the award program:
All chapters of CACCN are eligible to participate provided they have on file at national office all of their financial (quarterly) and activity (annual) reports required for the qualifying period.

In the case of a tie, CACCN reserves the right to determine the winner. Good luck in your endeavours!

Sorin Group sponsors this award

CACCN Research Grant

Grant available:
A CACCN research grant has been established to provide funds ($1,000.00) to support the research activities of a CACCN member that are relevant to the practice of critical care nursing. A grant will be awarded yearly to the investigator of a research study that directly relates to the practice of critical care nursing.

Eligibility:
The principal investigator must:
• Be a member of CACCN in good standing for a minimum of one year.
• Be licensed to practise nursing in Canada.
• Conduct the research in Canada.
• Publish an article related to the findings in Dynamics, the Official Journal of the Canadian Association of Critical Care Nurses.

CACCN members enrolled in graduate nursing programs may also apply. Members of the CACCN board of directors and the awards committee are not eligible.

Application requirements:
• A completed application form.
• A grant proposal not in excess of five pages exclusive of appendices. Appendices should be limited to essential information, e.g., consent form, instruments and budget.
• A letter of support from the sponsoring agency (hospital, clinical program) or thesis chairperson/adviser (university faculty of nursing).
• Evidence of approval from an established institutional ethical review board for research involving human subjects and/or access to confidential records. Refer to the CNA publication Ethical Guidelines for Nursing Research Involving Human Subjects.
• Brief curriculum vitae for the principal investigator and co-investigator(s) describing educational and critical care nursing background, CACCN participation, and research experience. An outline of their specific research responsibilities is to be included.
• Proof of CACCN active membership.
**Budget and financial administration:**
- Funds are to be issued to support research expenses.
- Funds must be utilized within 12 months from the date of award notification.

**Review process:**
- A research review committee will review each proposal. Its recommendations are subject to approval by the board of directors of CACCN.
- Proposals are reviewed for potential contribution to the practice of critical care nursing, feasibility, clarity and relevance.
- Deadline for receipt of application in CACCN national office is February 15. The recipient of the research grant will be notified by mail.

**Terms and conditions of the award:**
- The research award is to be initiated within six months of the receipt of the grant. Any changes to the study timelines require notification in writing to the board of directors of CACCN.
- All publications and presentations arising from the research study must acknowledge CACCN.
- A final report is to be submitted to the board of directors of CACCN within three months of the termination date of the grant.
- An article related to the research study is to be submitted to *Dynamics, the Official Journal of the Canadian Association of Critical Care Nurses*, for publication.

**Deadline for submission February 15**

**Editorial Awards**

The awards will be presented to the authors of two written papers in *Dynamics, the Official Journal of the Canadian Association of Critical Care Nurses*, which demonstrate the achievement of excellence in the area of critical care nursing. A $750.00 award, provided by Edwards Lifesciences, will be given to the author(s) of the best article, and $250.00, provided by 3M, is given to the author(s) of the runner-up article. It is expected that the money will be used for professional development. More specifically, the recipient must use the funds:

1. Within 12 months following the announcement of the winners, or within a reasonable time;
2. To cover and/or allay costs incurred while attending critical care nursing-related educational courses, seminars, workshops, conferences or special programs or projects approved by the CACCN, and
3. To further one’s career development in the area of critical care nursing.

**Eligibility**
1. The author is an active member of the Canadian Association of Critical Care Nurses (minimum of one year). Should there be more than one author, at least one has to be an active member of the Canadian Association of Critical Care Nurses (minimum of one year).
2. The author(s) is prepared to present the paper at Dynamics of Critical Care (optional).

**Spacelabs Innovative Project Award**

The Spacelabs Innovative Project Award will be presented to a group of critical care nurses who develop a project that will enhance their professional development. The primary contact person for the project must be an active member of CACCN (for at least one year). If the applicant(s) are previous winners of this award, there must be a one-year lapse before submitting again. Applications must be received in CACCN national office on or before January 15. Presentation of the award will be made at Dynamics.

Applications will be judged according to the following criteria:

1. The number of nurses who will benefit from the project
2. The uniqueness of the project
3. The relevance to critical care nursing
4. Consistency with current research/evidence
5. Ethics
6. Feasibility
7. Timeliness
8. Impact on quality improvement.

Within one year, the winning group of nurses is expected to publish a report that outlines their project in *Dynamics, the Official Journal of the Canadian Association of Critical Care Nurses*.

**Do you have a unique idea?**
SMITHS

Educational Awards

The CACCN Educational Awards have been established to provide funds ($750.00 each) to assist critical care nurses to attend continuing education programs at the baccalaureate, masters and doctorate of nursing levels. All critical care nurses in Canada are eligible to apply, except members of the CACCN board of directors.

Criteria for application
1. Be an active member of CACCN in good standing for a minimum of one (1) year.
2. Demonstrate the equivalent of one (1) full year of recent critical care nursing experience in the year of the application.
3. Be an active member (minimum of one [1] year) of CACCN committee(s) and/or participate in other chapter-related activities. Past participation is acceptable.
4. Submit a letter of reference from his/her current employer.
5. Be accepted to an accredited school of nursing or recognized critical care program of direct relevance to the practice, administration, teaching and research of critical care nursing.
6. Incomplete applications will not be considered; quality of application will be a factor in selecting winners.
7. Was not the recipient of this award in the past two years?
8. Deadlines for receipt of applications in national office are: September 1 and January 31 of each year.

Application process
1. Submit completed CACCN educational award application forms to national office (forms package can be requested from national office).
2. Obtain a minimum of 250 merit points (preference will be given to members with the highest number of merit points).
3. Keep a record of his/her own merit points, dating back three (3) years (forms included in package).
4. Submit all required documentation outlined in criteria. Candidate will be disqualified if documentation is not submitted with application.

Post-application process
1. All applications will be acknowledged in writing from the awards committee.
2. The awards committee will notify unsuccessful applicants individually.

 Winners will be acknowledged at the awards ceremony at the annual Dynamics conference and their names will be published in Dynamics, the Official Journal of the CACCN.

Recruitment and Retention Award

This CACCN initiative was established to recognize members and the chapters for their outstanding achievements with respect to recruitment and retention. Individual members will be recognized for long-standing service to the association as well.

Recognition Initiative
Members will receive recognition at Dynamics for their long service to CACCN.

Membership must be renewed within a two-month window in order to qualify for continuous membership. Note: In the new national membership database, all members’ “date of joining” is March 1996 or after.

In addition, new members from the previous 12 months prior to each Dynamics will be given ribbons on their name tags if they attend Dynamics that year.

Recruitment Initiative
This initiative will benefit the chapter if the following requirements are met:

- If the chapter recruits 25-49 new members from April 1 to March 31 of the next year, they receive one full tuition to Dynamics of that year.
- If the chapter recruits 50-100 new members from April 1 to March 31 of the next year, they receive one full tuition and one $100.00 coupon to Dynamics of that year.

Retention Initiative
This initiative will benefit the chapter if the following requirements are met:

- If the chapter has 100% renewal of its previous year’s members, the chapter will receive three $100.00 coupons to Dynamics of that year.
- If the chapter has greater than 80% renewal of its previous year’s members, the chapter will receive two $100.00 coupons to Dynamics of that year.
- If the chapter has greater than 60% renewal of its previous year’s members, the chapter will receive one $100.00 coupon to Dynamics of that year.

B Braun Mentorship Award

This award (valued at $1000) will be presented to an individual who exhibits stellar leadership and mentoring abilities in critical care. The candidate is an individual who supports, encourages, and teaches colleagues. The candidate must demonstrate a strong commitment to the practice of critical care nursing and the nursing profession. These qualities may be demonstrated by continuous learning, professional involvement, and a commitment to guiding novice nurses in critical care. Each nomination must have the support of another colleague and the individual’s manager. It is not necessary for the candidate to be in a formal leadership or education role to qualify for this award.

Criteria:
- Nominee must be a CACCN member
- The nominee must have at least three years of critical care nursing experience
- CACCN board of directors are not eligible
- At least one nomination letter must be written by a CACCN member
- Preference is given to a mentor who has CNA certification
- The nominee must demonstrate an awareness of and adherence to the standards of nursing practice as determined by the provincial nursing body, and the Standards of Critical Care Nursing (2004)
Three letters of support are required:
• The nominator must outline the qualities of the candidate, and reasons the candidate should be chosen to receive the award.
• Two additional letters must testify to the eligibility of the candidate as well as outline his/her attributes (one must be written by the nominee’s manager).
• All three letters must be sent by electronic mail by each person on the same day with the subject matter: “Braun Mentorship Award – Candidate’s Name” to the director responsible for awards at National Office.

Selection Process:
• Each nomination will be reviewed by the awards committee in conjunction with the CACCN director of awards & sponsors.
• The successful candidate will be notified by mail, recognized at the annual awards ceremony at the Dynamics conference and her/his name will be published in Dynamics, the Official Journal of the CACCN.
• The awards committee reserves the right to withhold the award if no candidate meets the criteria.
• The funds may be used to attend educational programs or conferences related to critical care.

Deadline for nominations: March 1

The Guardian Scholarship – Baxter Corporation Award for Excellence in Patient Safety

The Baxter Corporation Guardian Scholarship will be presented to an individual or an interdisciplinary team who propose to make, or who have made, significant contributions toward patient and/or caregiver safety in the critical care environment. Recipients of this award will identify ideas that encompass safety and improve the quality of care in their practice area.

Eligibility
The principal investigator (or applicant) must:
• Be a member of CACCN in good standing for a minimum of one year.
• Be licensed to practise nursing in Canada.
• CNA certification preferred.
Members of the awards committee or the board of directors are not eligible.

Application Requirements:
• The projects will be consistent with the theme of the upcoming Dynamics conference.
• The project will describe an innovative approach, to develop new or revised processes, to encompass patient safety and improve the quality of care at the unit, hospital or health care system level.
• The project/proposal will show evidence of collaboration among team members.

Terms and Conditions of the Award
• A proposed project must be initiated within three months of the receipt of the scholarship.
• Any changes to the timelines require written notification to the board of directors of CACCN.
• All publications and presentations must recognize The Baxter Corporation and CACCN.
• An article related to the project is to be submitted to Dynamics, the Official Journal of CACCN, for publication and the project will be presented at a future Dynamics conference.

Budget and Financial Administration
• One-half of the awarded funds will be available to support the project expenses immediately.
• The remaining funds will be awarded upon the publication of an article describing the project in Dynamics, the Official Journal of CACCN.
• The total funds available are $5,000.00. The award funds may be granted to a maximum of two applicants ($2,500.00 each).

NOTE: The CACCN Board of Directors & Baxter Corporation retain the right to amend the award criteria.
The voice for Canadian critical care nurses involved in practice, education, research and administration in:

- Medical ICU
- Cardiovascular ICU
- Neonatal and Pediatric ICU
- Burn Units
- Trauma Units
- Surgical ICU
- Neurosurgical ICU
- CCU
- Recovery Room

**Mission Statement**
The Canadian Association of Critical Care Nurses is a non-profit, specialty organization dedicated to maintaining and enhancing the quality of care provided to critically ill patients and their families. We serve the public, our members and the critical care nursing community by meeting the professional and educational needs of critical care nurses.

These needs are met by:

- developing and implementing standards of critical care nursing practice
- providing educational opportunities
- supporting and facilitating critical care nursing research
- providing opportunities for networking
- identifying and addressing political and professional issues
- collaborating with other professional organizations

**Objectives**

i) to provide informed guidance in shaping the delivery system as it relates to the care of the critically ill

ii) to determine standards for critical care nursing

iii) to determine certification standards for national testing for the specialty of critical care nursing

iv) to promote and provide educational opportunities

v) to improve the quality of patient care through the promotion of nursing research in critical care

vi) to promote membership and chapter development.

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**Application for membership**

Name: __________________________________________________________

Address: __________________________________________________________

______________________________________________________________

W (____) ____ - ________  H (____) ____ - ________ F (____) ____ - ________

Employing Agency: _________________________________________________

Position: __________________________________________________________

Area of Employment: _______________________________________________

Nursing Registration No.: ____________________ Province: _____________

Chapter Affiliation: _________________________________________________

Sponsor’s Name: ___________________________________________________

Please check one:

- [ ] New Member $75.00 (includes 6% GST)
- [ ] Renewal $75.00 (includes 6% GST) - Present Number ______________

Are you a CNA member? [ ] Yes, [ ] No

Signature: ________________________________________________________

Date: ____________________________________________________________

Please Note: This application is for both national and chapter membership.

Make cheque or money order payable to:
Canadian Association of Critical Care Nurses (CACCN)
Mail to: CACCN, P.O. Box 25322, London, Ontario, N6C 6B1
Telephone: (519) 649-5284, Fax: (519) 649-1458
E-mail: caccn@caccn.ca
www.caccn.ca

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WHY CACCN?
DYNAMICS
The Official Journal of the Canadian Association of Critical Care Nurses

Information for Authors

Dynamics, the Official Journal of the Canadian Association of Critical Care Nurses (CACCN), is distributed to members of the CACCN, to individuals, and to institutions interested in critical care nursing. The editorial board invites submissions on any of the following: clinical, education, management, research and professional issues in critical care nursing. Critical care encompasses a diverse field of clinical situations which are characterized by the nursing care of patients and their families with complex, acute and life-threatening biopsychosocial risk. While the patient’s problems are primarily physiologic in nature, the psychosocial impact of the health problem on the patient and family is of equal and sometimes lasting intensity. Articles on any aspect of critical care nursing are welcome. The manuscripts are reviewed through a blind peer review process. Manuscripts submitted for publication must follow the following format:

1. Title page with the following information:
   • Author(s) name and credentials • Place of employment • If there is more than one author, the names should be listed in the order that they should appear in the published article • Indicate the primary person to contact and address for correspondence.

2. A brief abstract of the article on a separate page not to exceed 100 words.

3. Body of manuscript:
   • Length: a maximum of 15 pages including tables, figures and illustrations, and references • Format: double spaced, 1 1/2 inch margins on all sides. Pages should be numbered sequentially including tables, figures and illustrations. Prepare the manuscript in the style as outlined in the American Psychological Association’s (APA) Publication Manual 5th Edition. • Tables, figures, illustrations and photographs must be submitted each on a separate page after the references. • References: the author is responsible for ensuring that the work of other individuals is acknowledged accordingly. Direct or indirect quotes must be acknowledged according to APA guidelines • Permission to use copyrighted material must be obtained by the author and included as a letter from the original publisher when used in the manuscript.

4. Copyright:
   • Manuscripts submitted and published in Dynamics become the property of the CACCN. Authors submitting to the journal are asked to enclose a letter stating that the article has not been previously published and is not under consideration by another journal.

5. Submission:
   • Please submit the manuscript electronically as a Word attachment to the editorial office as printed in the journal. Accepted manuscripts are subject to copy editing.
EMBRACE THE SPIRIT OF COMMUNITY

Discover the rewards of an innovative, diverse and welcoming workplace. Embrace a progressive environment, where passionate professionals work with a network of health partners to promote patient-centred care. Be part of a team dedicated to ensuring the health and wellness of everyone who calls us their hospital. A multi-site organization, Markham Stouffville Hospital is a place where every contribution matters advancement towards creating a centre of community care.

This is where you can belong

Our highly diverse communities are growing and changing rapidly, and so are their needs. This means opportunities in many clinical areas at our Markham and Uxbridge sites for Registered Nurses who share our commitment to progressive community care. Discover what makes us a top choice for health care professionals: from personal and professional development initiatives to self-scheduling, a generous education bursary program, and competitive compensation and benefits.

Opportunities for Professional Development

We partner with Seneca College for Emergency and Critical Care Nursing education, and will be pleased to sponsor RNS interested in Emergency and ICU/CCU to the 12- or 13-week program. Completion of Coronary Care I and/or II is a prerequisite. We also offer a specialized 12-week, enriched orientation program for new graduates.

To find out more about us and our nursing opportunities, please visit our website.

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...in our piece of paradise

VIHA provides a comprehensive range of progressive health services to the 700,000 residents of Vancouver island through hospital, community and home care.

Vancouver Island is truly a piece of paradise. It has cities brimming with cultural events, festivals, shopping and restaurants as well as friendly towns with vibrant communities and world-class outdoor adventure... and all of this in a place where we enjoy breathtaking mountains, the sparkling Pacific Ocean and Canada’s mildest year-round climate.

In addition to the amazing lifestyle this part of the world provides, Vancouver Island Health Authority (VIHA) offers excellent work environments. We know you want to work in a place where your skills will be recognized and valued, where you’ll have opportunities for ongoing training and professional growth and where you can work on committed teams alongside great people. VIHA is pleased to offer you those things, and so much more, in our forward-thinking organization.

We are currently accepting applications for the following Critical Care areas for anticipated full-time and part-time positions: adult intensive care, cardiovascular care, coronary care, emergency, medical and surgical telemetry, and post-anesthetic recovery.

Opportunities are available in a variety of locations across Vancouver Island. Relocation assistance is available for qualified applicants.

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Fax: 250.370.8570 • Email: jobs@viha.ca

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One of Canada’s largest health care providers, Vancouver Coastal Health (VCH) delivers $2 billion in community, hospital and residential care to over one million people in communities from Richmond through Vancouver, the North Shore, Sunshine Coast, Sea to Sky Corridor, Powell River, Bella Bella and Bella Coola.

VCH operates leading hospitals, including BC’s largest. Our specialties include: Trauma, Neurosciences, Bone Marrow Transplant, Solid Organ Transplant, Burns and Plastics, Mental Health, Pediatrics and Perinatal.

Whether you choose to practice in a large urban centre or a more close-knit community, critical care nursing at VCH means a client and family centred care model where your expertise is valued, lifelong learning is supported and opportunities for career growth abound.

We have both permanent and temporary positions available in ICU, Neuro ICU, Spine ICU, Neonatal ICU, Cardiac Sciences, Post Anesthetic Recovery, Radiology and Emergency. Ask us about relocation assistance!

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Each current member of CACCN that recruits one member will receive a $10.00 coupon toward their next year’s membership. (You are able to recruit up to 7 members, equaling $70.00 off your next membership.)

Members are eligible for $10.00 coupons from January to April 2007.

Let’s work on doubling our membership!

Note: Make sure your name is written in the “Sponsor’s Name” field of the recruited member’s form to be eligible for coupons.