Workplace Stress Reduction Training Using Mindfulness

New Delirium Prevention Bundle

Norepinephrine Use and Early Mobility

Peripherally Infused 3% Sodium Chloride

Bacteremia After Catheter–Associated Bacteriuria

Tobacco Cessation Interventions and Practice Excellence

Prehospital Delay and Precipitating Factors in Heart Failure

Ongoing Professional Development Program Participation

Research in Review
Your ticket to a great job offer.

Post your CV or résumé today.

You’re admitted to AACN’s Official Career Center. Designed as a comprehensive career resource for nurses of all levels, the Career Center enables you to explore job postings by specialty area, location, and hospital/facility.

→ Search daily job postings on the homepage.
→ Choose from the best career opportunities in nursing.
→ Start now. The perfect job may be waiting for you.

AACNCareerCenter.org
Coming in March …
Bradley and colleagues explore the perceptions of hospitalized adult patients in regard to family presence during cardiopulmonary resuscitation.

Healthy Work Environments

Feasibility of a Mindfulness-Based Intervention for Surgical Intensive Care Unit Personnel
Beth A. Steinberg, Maryanna Klatt, and Anne-Marie Duchemin

Delirium Management

Feasibility and Effectiveness of a Delirium Prevention Bundle in Critically Ill Patients
Claudia DiSabatino Smith and Petra Grami

Early Mobility in Critical Care

Effects of Ambulation and Nondependent Transfers on Vital Signs in Patients Receiving Norepinephrine
Rosario Arcaya Nievera, Ann Fick, and Hilary K. Harris

Abstracts of articles available exclusively online at www.ajcconline.org

Outcomes of Emergency Medical Patients Admitted to an Intermediate Care Unit With Detailed Admission Guidelines
Catherine E. Simpson, Sarina K. Sahetya, Robert W. Bradsher III, Eric L. Scholten, William Bain, Shazia M. Siddique, and David N. Hager
Frank Sinatra famously sang that "love is lovelier the second time around." The same is not always true regarding research. Understanding the research on which critical care practice is based is essential to the provision of evidence-based care. Practicing clinicians and researchers need to know what has worked and what hasn’t. Knowledge about a study’s design, sample, setting, methodology, and analytical strategy can provide important information about whether the results of a study are trustworthy and whether the conclusions are likely to hold true for other groups of patients.

Our knowledge about research findings may come from primary or secondary sources. Publications by the investigators who actually conducted the research are primary sources; these also may be referred to as original sources. Secondary sources report about research done by others, and often offer critique or interpretation.

Evaluate Your Sources of Information

In our roles as clinicians and researchers, many of us rely on secondary sources to provide succinct summaries of research and expert commentary about research results. Use of secondary sources simplifies the complex tasks associated with locating and interpreting relevant research, staying current in a broad discipline as well as specialty practice, and incorporating research into practice. When done well, secondary sources can augment our appreciation of primary research literature. Topical literature reviews can provide overviews of related research in a particular area. The introduction and discussion sections of primary research reports routinely cite and interpret the work of other researchers to provide rationale and context for the study, and study findings are framed in the context of other relevant studies.

Health news coverage is a prevalent secondary source of information about new research. Such news coverage may be offered by professional news organizations, and many news outlets have reporters who specialize in health related topics. Health care and clinical specialty organizations also cover research-related news; the American Association of Critical-Care Nurses’ Bold Voices magazine regularly covers research news, and the Clinical Pearls section of the American Journal of Critical Care (AJCC) provides clinically useful synopses of research (secondary sources) that link directly to the research articles (primary sources) in the same issue.

Using Secondary Sources

Despite the usefulness of secondary sources, we should exercise caution about overreliance on them. Reliance solely on secondary sources may shape our perceptions about research results in ways that do not agree with what primary sources actually reported. Several kinds of errors can occur in secondary sources. Factual errors occur when primary source data (for example, study sample size) are incorrectly reported by a secondary source. Secondary sources cannot include all of the information found in the original
Authors are central to the integrity of secondary sources.

primary source, and what is omitted can change readers’ understanding. For example, a secondary source may fail to describe a research study’s focus on sample characteristics, and readers may assume that the results apply equally well to their patients when that may not be true. Original sources may be misinterpreted or paraphrased incorrectly. The original meaning of direct quotes may be altered if they are presented out of context or subjected to truncation.

Research studies about citations often classify errors in secondary sources as “minor” or “major.” Minor errors do not alter the meaning of the original source. For example, misspelling an author’s name in the description of a research study may make retrieval of the primary source more difficult, but is not likely to affect the interpretation of the findings. Major errors are those that substantially change the message of the primary source, and these are of greatest concern in scientific literature.

A Cautionary Tale

A recent case study by Cleary and colleagues in Nurse Author and Editor illustrates the dangers of overreliance on secondary sources and the magnification of errors perpetuated by indirect references (that is, referencing what a secondary source says about a primary source, rather than referencing the primary source directly). The case study follows the fate of a “Letter to the Editor” by Porter and Jick published in the New England Journal of Medicine in 1980. The letter, which is a brief paragraph long, is reproduced in its entirety in the case study, so that readers can see the primary source as Cleary and colleagues trace its citation history. Based on a computer query of data collected over 2 decades during the 1960s and 1970s in the Boston Collaborative Drug Surveillance Program, Porter and Jick concluded that new narcotic addiction was rare in hospitalized medical patients receiving narcotics.

Astonishingly, the letter had been cited 896 times by April 2016 when the case study was published; many of these citations referenced other secondary sources and offered interpretations that were farther and farther afield from the original letter’s design, data, and conclusion. The body of literature that grew up around this letter influenced health policy for decades. Cleary and colleagues found secondary sources describing the letter as a “landmark report” and “an extensive study.” Cleary and colleagues had this to say, “Like the old-fashioned game of telephone, one research report quoted the next, and it seems that no one bothered to do the essential work of looking up the original citation to see what it said and reference it accurately.”

Find the Balance

So how do we balance the clear benefits provided by secondary sources and the obvious need for caution? Editors, authors, and readers all have parts to play.

As editors, we take the accuracy of citations as an inviolable trust, and AJCC has robust processes in place to ensure that what is published in the journal is accurate and complete. As editors, we carefully read every manuscript, and our processes are bolstered by highly competent peer reviewers. AJCC peer reviewers are experts who are familiar with the primary sources in their specialty areas. It is not uncommon for reviewers to suggest that authors consider specific primary sources, or for peer reviewers to challenge authors’ interpretations of primary sources. The interactions among editors, peer reviewers, and authors as manuscripts are revised prior to publication are essential for ensuring accuracy. The managing editor and copyeditors of AJCC are meticulous in manuscript production, so that the number of minor errors is minimized.

Authors are central to the integrity of secondary sources. Many writing manuals, including those by the American Medical Association, American Psychological Association, and the Modern Language Association, caution authors against using indirect references. These manuals urge authors to use secondary sources sparingly, and to clearly identify secondary source citations. When citing primary sources, authors are obligated to read the entire paper, rather than relying on the abstract! Further, authors should strive to be aware of and
Evaluate the trustworthiness of secondary sources of information.

curb their own biases as they summarize and critique research. Author opinions should be clearly identified as such.

Readers should evaluate the trustworthiness of secondary sources and use the highest quality sources. Obtaining information from more than one source can help readers identify potential errors or biases (assuming, of course that indirect referencing is not involved). Finally, reading the primary sources of research that are the crucial underpinnings of our practice is the best way to build a strong foundation for evidence-based practice.

The statements and opinions contained in this editorial are solely those of the coeditors in chief.

FINANCIAL DISCLOSURES
None reported.

eLetters
Now that you’ve read the article, create or contribute to an online discussion on this topic. Visit www.ajcconline.org and click “Submit a response” in either the full-text or PDF view of the article.

REFERENCES

To purchase electronic or print reprints, contact American Association of Critical-Care Nurses, 101 Columbia, Aliso Viejo, CA 92656. Phone, (800) 899-1712 or (949) 362-2050 (ext 532); fax, (949) 362-2049; e-mail, reprints@aacn.org.

AJCC’s OnlineNOW
Speeds Critical Care Research to the Bedside

The American Journal of Critical Care now posts select cutting-edge critical care research in the most timely and efficient manner possible — exclusively online.

For readers:
- OnlineNOW reduces the acceptance-to-publication time, which means more up-to-date research is available at your fingertips sooner.
- As with print, AJCC OnlineNOW articles are peer reviewed, copy edited, formatted, and citable.

For authors:
- Choosing OnlineNOW means your articles are indexed in PubMed just like print, but faster. Researchers in high acuity and critical care can read and cite your work sooner.
- AACN promotes OnlineNOW articles to its members through blast e-mails, AACN CriticalCare eNewslines, Facebook, and Twitter, reaching the same audience as the print edition.
- Attractive fully formatted reprints for participating authors are available at a sharply reduced cost.
Looking to increase your presence within the nursing community?

AACN content can be tailored to fit your marketing and promotional needs and can be delivered via print or electronic format.

The American Association of Critical-Care Nurses content is available as:

- Customized Article Reprints
- Sponsored Content Collections (by topic, specialty, etc.)
- Licensed content for special publications or marketing campaigns

Electronic content is user friendly, mobile ready, can be posted to your company website, and/or distributed via e-mail or social media campaigns.

Contact us today to discuss the many options available:

Experienced Critical Care Registered Nurses

At Huntington Hospital, in Pasadena California, it is our focus on the delivery of state-of-the-art care and support that sets us apart as a medical center that is differentiated by the depth of our commitment to quality, service, and cutting-edge care. We are continually growing and expanding to meet our community’s needs.

Experienced RNs have a brighter future than ever at Huntington Hospital. Here’s why:

- Magnet® - recognized
- One of the U.S. News & World Report’s Top Hospitals
- Offering increased market-competitive pay rates
- Collaborative leadership
- Enhanced and state-of-the-art facilities

We invite you to learn more about our current opportunities, our organization and benefits, by visiting us online at: www.hhcareers.com

We value diversity in our workforce.

100 W California Blvd, Pasadena, CA 91105

EOE.
Clinical Pearls

Rhonda Board, RN, PhD, CCRN, Section Editor

Clinical Pearls is designed to help implement evidence-based care at the bedside by summarizing some of the most clinically useful material from select articles in each issue. Readers are encouraged to photocopy this ready-to-post page and share it with colleagues. Please be advised, however, that any substantive change in patient care protocols should be carefully reviewed and approved by the policy-setting authorities at your institution.

Nurse-Led Delirium Prevention Bundle

Delirium is a medical condition that occurs in 60-80% of adults treated with mechanical ventilation (MV). Yet, it is undertreated, underdocumented, and unrecognized in most patients. Authors Smith and Grami tested the effectiveness of a 5-component, nurse-led prevention bundle that included: (1) sedation cessation for MV patients (2) pain management (3) sensory stimulation (4) early mobilization and (5) sleep promotion. They found the following:

- Overall, use of the bundle was effective in reducing delirium incidence and preventing delirium.
- Similar to other studies, patients more likely to develop delirium were more than 64 years of age, on MV, in restraints, and spent more than 3 days in the intensive care unit (ICU).

Although there were limitations with some of the bundle components, the authors suggest consistent use of a bundle can decrease delirium incidence and improve both patient and hospital outcomes.

See Article, pp 19-27

Mindfulness-Based Intervention to Reduce Stress

Personnel who work in high stress environments, such as intensive care units (ICU), are at risk for poor physical and mental health. The constant demands of work in an ICU setting can lead to burnout and emotional exhaustion and, in turn, contribute to suboptimal patient care. Steinberg and colleagues tested an 8-week mind-body intervention with surgical ICU staff, that included a weekly 1-hour group session and daily individual activities. They found the following:

- The overall intervention retention rate was 97% with weekly meeting attendance at 90%.
- Work satisfaction increased significantly for the intervention group.
- All participants regarded self-awareness of their stress as the primary benefit of the intervention and delivery of it at the workplace also very important.

Stress reduction interventions for staff are feasible in the hospital setting. However, institutional support is necessary for this type of intervention to be possible in high stress clinical environments.

See Article, pp 10-18

Peripherally Infused Hypertonic Saline

Infusions of hypertonic saline (HTS), such as 3% sodium chloride, have been effective at reducing intracranial pressure and cerebral edema for both adults and children. Current drug literature recommends central line administration of 3% HTS, versus peripheral, although there are no adult studies supporting this practice. Jones and colleagues evaluated the use of peripherally infused 3% HTS in 213 neurocritical care adult patients. They found the following:

- Only 7% of the patients had an infusion-related reaction, either phlebitis or extravasation, and more than half of these resumed the infusion at another peripheral site with no further reaction.
- The most common electrolyte abnormalities were hyperchloremia (49.3%) and hypokalemia (46.9%). Hypernatremia occurred in only 22.1% of the patients.

Whereas further research is needed, the authors recommend reevaluation of current administrative guidelines for HTS infusions. Health care practitioners should consider the use of peripheral 3% HTS to avoid unnecessary placement of central lines.

See Article, pp 37-42

Effects of Ambulation on Vital Signs in Patients Receiving Norepinephrine

Early progressive mobility reduces cardiac complications in critically ill patients and has been endorsed by the American Association of Critical-Care Nurses (AACN). Yet, many nurses limit patient activity for those on vasopressors who are receiving hemodynamic monitoring. Nievera and colleagues studied the effects of ambulation and chair transfers in adult cardiothoracic patients who were being treated with a norepinephrine infusion. They found the following:

- Most of the patients were able to safely walk 50 feet or further.
- Most patients maintained safe vital sign ranges during the activity.
- There was no difference in the activity level of those receiving a low dose versus a higher dose of norepinephrine.

The authors recommend early mobilization of patients who meet the AACN protocol safety screening criteria along with continuous vital sign monitoring before, during, and after the activity.

See Article, pp 31-36

©2017 American Association of Critical-Care Nurses, doi: https://doi.org/10.4037/ajcc2017776
Outcomes of Emergency Medical Patients Admitted to an Intermediate Care Unit With Detailed Admission Guidelines

By Catherine E. Simpson, MD, Sarina K. Sahetya, MD, Robert W. Bradsher III, MD, Eric L. Scholten, MD, William Bain, MD, Shazia M. Siddique, MD, and David N. Hager, MD, PhD

Background  An important, but not well characterized, population receiving intermediate care is that of medical patients admitted directly from the emergency department.

Objective  To characterize emergency medical patients and their outcomes when admitted to an intermediate care unit with clearly defined admission guidelines.

Methods  Demographic data, admitting diagnoses, illness severity, comorbid conditions, lengths of stay, and hospital mortality were characterized for all emergency medical patients admitted directly to an intermediate care unit from July through December 2012.

Results  A total of 317 unique patients were admitted (mean age, 54 [SD, 16] years). Most patients were admitted with respiratory (26.5%) or cardiac (17.0%) syndromes. The mean (SD) Acute Physiology and Chronic Health Evaluation score version II, Simplified Acute Physiology Score version II, and Charlson Comorbidity Index were 15.6 (6.5), 20.7 (11.8), and 2.7 (2.3), respectively. Severity of illness and length of stay were significantly different for patients who required intensive care within 24 hours of admission (n = 16) or later (n = 25), patients who continued with intermediate care for more than 24 hours (n = 247), and patients who were downgraded or discharged in less than 24 hours (n = 29). Overall hospital mortality was 4.4% (14 deaths).

Conclusions  Emergency medical patients with moderate severity of illness and comorbidity can be admitted to an intermediate level of care with relatively infrequent transfer to intensive care and relatively low mortality. (American Journal of Critical Care. 2017;26:e1-e10)

©2017 American Association of Critical-Care Nurses
doi: https://doi.org/10.4037/ajcc2017253

Looking for an Article?

The American Journal of Critical Care has eliminated its printed subject-author index.

It's easy to find an article online at www.ajcconline.org. Enter a keyword, title, or author name in the Search box and the search engine will do the rest.

Do you have a QR scanner app on your iPhone or Android?
Scan this QR code with your phone to access this article instantly.
FEASIBILITY OF A MINDFULNESS-BASED INTERVENTION FOR SURGICAL INTENSIVE CARE UNIT PERSONNEL

By Beth A. Steinberg, RN, MS, Maryanna Klatt, PhD, and Anne-Marie Duchemin, MD

Background Surgical intensive care unit personnel are exposed to catastrophic situations as they care for seriously injured or ill patients. Few interventions have been developed to reduce the negative effects of work stress in this environment.

Objective This pilot study evaluated the feasibility of a workplace intervention for increasing resilience to stress. The intervention was implemented within the unique constraints characteristic of surgical intensive care units.

Methods Participants were randomly assigned to an intervention or control group. The mindfulness-based intervention included meditation, mild yoga movement, and music and was conducted in a group format 1 hour a week for 8 weeks in a surgical intensive care unit during work hours. Assessments were performed 1 week before and 1 week after the intervention.

Results The intervention was well received, with a 97% overall retention rate and 100% retention in the intervention group. Work satisfaction, measured with the Utrecht Work Engagement Scale, increased significantly in the intervention group with no change in the control group. Negative correlations were found between the vigor subscale scores of the Utrecht Work Engagement Scale and scores for emotional exhaustion on the Maslach Burnout Inventory and scores for burnout on the Professional Quality of Life scale. Participants rated recognizing their stress response as a main benefit of the intervention.

Conclusion Workplace group interventions aimed at decreasing the negative effects of stress can be applied within hospital intensive care units. Despite many constraints, attendance at weekly sessions was high. Institutional support was critical for implementation of this program. (American Journal of Critical Care. 2017; 26:10-18)
Surgical intensive care unit (SICU) personnel are exposed repeatedly to high-stress work conditions and are at risk for direct or secondary traumatization by caring for patients with dramatic injuries or extensive surgeries. The constant demand of attending to patients and their families can be emotionally draining and lead to burnout. Stress and burnout affect clinical practice and personal lives, and “appear to be an occupational hazard that can result in permanent damage.”1 Indeed, the deleterious effects of stress, trauma, and burnout affect not only the personnel, by the impact on their physical and mental health, but also the patients they care for, because of the potential impact on quality of care. The effects extend to the institutions, which incur the costs of absenteeism and high turnover of expert personnel, and lower patient satisfaction. Decreasing the effects of work-related stress for SICU personnel may help to decrease or prevent these possible negative outcomes.

Critical care nurses’ stress at work has significant personal and organizational consequences.

The prevalence of high stress and burnout among ICU personnel is well documented. Burnout among nurses, especially intensive care nurses, has been reported.2-6 A recent survey of more than 3000 ICU staff showed that 37% felt highly stressed and 29% had severe burnout.7 Among emergency medicine physicians, levels reached almost 70%, compared with 45% for all other specialties.8 Associations have been found between workplace stressors and poor physical and mental health of nurses.9 A higher rate of sick-leave use leads to recruitment of less experienced personnel or requires extra hours from the remaining personnel. The high level of stress also unfavorably affects job satisfaction and retention, increasing the rate of employee transfers.10 The shortage and high turnover of specially trained individuals contribute to a decrease in the quality of care and an increase in economic costs for the institution. In addition, shortage of staff and working with untrained staff are major stressors for ICU nurses.11 Higher anxiety in ICU nurses correlates with poorer performance,12 and burnout has been associated with self-reported suboptimal patient care practices among residents.13 In a prospective longitudinal study,14 increased burnout was associated with increased odds of residents’ self-perceived errors in the following 3 months. Emotional exhaustion in acute care personnel also has been related to poor patient care,15 and burnout in nurses was associated with increased levels of patient infection.16 In one study,17 patient satisfaction negatively correlated with levels of staff burnout.

Social support confers resilience to stress,18 and wellness factors have been shown to protect against burnout.19 Resilience scores negatively correlated with burnout scores among nurses practicing in high-intensity settings.20 Although personal approaches can be helpful at the level of the individual,21 approaches initiated by the institution itself are effective and have the potential to bring systemic changes. Workplace programs that address coping with stress have been shown to reduce illnesses and health care use.22 Workplace interventions can favorably affect psychological and physical symptoms of stress, such as high blood pressure, and can improve performance and decrease employee turnover.23,24

This small pilot study was designed to determine the feasibility of a workplace intervention to reduce the impact of a stressful environment on SICU personnel. It was structured using a resilience conceptual framework and emphasized the development of behaviors that strengthen the physical and emotional health of ICU staff. Our hypothesis, that increasing resilience in ICU staff through a mind-body intervention would decrease the effects of stress and risk for burnout, was based on prior studies that validated the effects of mindfulness-based stress reduction on work-related stressors. Mindfulness, which can be defined as being in the present without judgment, may reduce the stress response and help regulate emotions in stressful situations.

About the Authors
Beth A. Steinberg is director, Critical Care Nursing, Wexner Medical Center, The Ohio State University, Columbus, Ohio. Maryanna Klatt is a professor, Department of Family Medicine, College of Medicine, The Ohio State University. Anne-Marie Duchemin is a professor, Department of Psychiatry, Stress, Trauma, and Resilience (STAR) Program, College of Medicine, The Ohio State University.

Corresponding author: Anne-Marie Duchemin, MD, 1670 Upham Dr, Columbus, OH 43210 (e-mail: anne-marie.duchemin@osumc.edu).
Methods

Setting
This study was performed in a large academic medical center, designated as a level I trauma center, treating more than 5000 cases of extremely severe illness and more than 10000 cases of major severe illness annually. The SICU is a 44-bed unit that provides care for critically ill patients with diagnoses of severe trauma, burn, and neurosurgical, obstetric, oncologic, and cardiothoracic conditions.

Study Design
This study was approved by the biomedical institutional review board, and all participants signed informed consent. Statistical software (GraphPad Software, Inc), with data stratified by sex and type of work, was used to randomly assign participants 1:1 to the intervention group or the wait-list control group. Most of the participants were female nurses, and stratification allowed distribution of men and nonnursing personnel involved in the study in the 2 groups. Assessments were performed at the same time for all participants 1 week before the date of the first mindfulness-based intervention (MBI; baseline) and 1 week after the last day of the MBI (2-month time point).

Participants and Procedure
Recruitment. Participants were recruited by notices in flyers and communication at staff meetings. Supervisors were informed of the project at meetings of the unit leadership, education, and quality councils and the unit communication committee.

Participants. A total of 32 individuals participated in this pilot study. The number of participants was determined for practical reasons: This number allowed all participants to receive the intervention in 1 of the 2 groups, was feasible for personnel coverage, and was appropriate for the group session size in our setting. Participants were recruited among the more than 200 SICU personnel. Registered nurses account for 75% of the clinical staff and 78% are women. The mean age of the participants was 39.8 years, and the mean years of service was 10.8. The gender ratio for the nonnursing personnel is about 1:1. Participants were at least 18 years old and had direct contact with patients in the SICU and the patients’ families. Individuals involved in yoga, mindfulness, or exercising more than 30 minutes per day were excluded to control activities that can relieve stress. Except for third-trimester pregnancy or recent surgery that limited mobility, there were no other exclusion criteria, because the goal of this study was to determine the feasibility of this intervention in a real-world working population.

Intervention. The intervention was a weekly 1-hour group session comprising a didactic introduction and discussion, and a combination of mindfulness and light yoga practices with music. The detailed step-by-step protocol has been described. In addition, participants were asked to perform 20-minute, daily individual practices to reinforce the weekly group session; these practices were facilitated by listening to a compact disc (CD) recording at least 5 times a week. Frequency of practices was logged in a structured diary. A trained mindfulness teacher and certified yoga instructor (M.K.; 500-hour Yoga Alliance certified), who developed the MBI program, delivered the weekly session, and recorded the CD.

The group sessions were conducted at the workplace in the SICU conference room during work hours (2:00-3:00 PM). This time was chosen by agreement between the unit’s nurse manager and staff to minimize the impact on patient care and to ensure that the intervention was part of the work shift and not an addition to the schedule of an already overburdened staff. Personnel coverage was ensured during the time of the group sessions and assessments via prearranged scheduling.

Data Collection
Responses on questionnaires on burnout and stress (Maslach Burnout Inventory26; Professional Quality of Life [ProQOL] scale27) and levels of biological markers of stress were measured 1 week before and 1 week after the group intervention; these tools have been described previously. Questionnaires on work engagement, work ability, and quality of life were completed at these same time points. Feasibility was assessed by attendance and practice records. Comments on the intervention were solicited on paper at assessment 2 and by an anonymous web-based survey 8 months later.

The Maslach Burnout Inventory analyzes 3 different areas characteristic of burnout: emotional exhaustion, depersonalization, and low personal accomplishment. It has Cronbach α values of 0.90 for emotional exhaustion, 0.79 for depersonalization, and 0.71 for personal accomplishment.

The ProQOL has 30 items referring to the past 30 days. Subscales measure compassion satisfaction, secondary traumatization, and risk for burnout, with Cronbach α between 0.84 and 0.90.

The mindfulness-based intervention was provided in group sessions at the workplace during work hours.
The 9-item Utrecht Work Engagement Scale (UWES) consists of 9 statements rated on a scale ranging from 0 to 6 (never to always) reflecting how often the statement applies to the subject. The scale provides a total score and 1 subscale score each for vigor, dedication, and absorption, with higher scores indicating higher work engagement. Internal consistency of the scale was demonstrated with a Cronbach’s alpha of 0.92 for the total score, 0.86 for vigor, 0.86 for dedication, and 0.79 for absorption subscales.

In addition to 4 questions on satisfaction with life (ie, satisfaction with health, capacity for work, ability to perform daily life activities, quality of life), participants were asked how many days they had missed work or been less effective at work during the previous 2 months.

Attendance at the group intervention was recorded for each session, and diaries were collected for documentation of daily practices. The web-based survey inquired about the importance for participants of type of intervention, location and setting, difficulty of attending, and sustainability.

Statistical Analysis

Intention-to-treat analyses were performed and included all randomly assigned participants. Characteristics of the sample were analyzed using means and standard deviations. Two-tailed t tests and χ² analyses were used to compare groups at baseline. For each measurement, the changes between baseline and 2-month values were assessed in each study arm, using the paired t test or nonparametric repeated-measures analysis of variance. Associations between work engagement and burnout scores were estimated by using a Pearson correlation. Analyses were performed with Graphpad Instat, version 3.10 (GraphPad Software, Inc), and P less than .05 was considered statistically significant.

Results

Participants’ Characteristics

Most participants were women (88%); the mean age was 44 years (Table 1). Although the most common occupation was nurse, others included patient care assistant, family support coordinator, chaplain, janitor, pharmacist, and unit clerk. The range of years of experience on the job varied from 0.5 to 35.0 years (mean, >14 years; median, 15 years), including almost 12 years in the SICU (median, 10 years). No difference was found between the MBI and control groups for the following demographic characteristics: age (P = .93), years of experience (P = .93), and years in the SICU (P = .85). The wait-list group controlled for potential changes in stress levels from day-to-day variations in the work environment.

Scores on the satisfaction with life questionnaire showed that participants considered themselves healthy and satisfied with their quality of life (Table 2). On a scale of 1 (very dissatisfied) to 5 (very satisfied), mean overall scores for the satisfaction with health were 3.92 (SD, 0.72); capacity for work, 4.45 (SD, 0.57); ability to perform daily activities, 4.27 (SD, 0.82); and quality of life, 4.12 (SD, 0.87), with no differences between groups and no changes between first and second assessments.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>MBI assessment</th>
<th>MBI assessment</th>
<th>Control assessment</th>
<th>Control assessment</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health</td>
<td>3.84 (0.81)</td>
<td>3.94 (0.68)</td>
<td>4.00 (0.65)</td>
<td>3.94 (1.18)</td>
<td>.55</td>
</tr>
<tr>
<td>Capacity for work</td>
<td>4.44 (0.63)</td>
<td>4.25 (0.58)</td>
<td>4.37 (0.62)</td>
<td>4.06 (1.12)</td>
<td>.89</td>
</tr>
<tr>
<td>Ability to perform daily activities</td>
<td>4.22 (0.60)</td>
<td>4.25 (0.68)</td>
<td>4.31 (1.01)</td>
<td>4.00 (1.34)</td>
<td>.75</td>
</tr>
<tr>
<td>Quality of life</td>
<td>4.06 (0.77)</td>
<td>4.31 (0.70)</td>
<td>4.19 (0.98)</td>
<td>4.12 (1.31)</td>
<td>.69</td>
</tr>
</tbody>
</table>

a Satisfaction with life questionnaire was completed 1 week before the beginning (assessment 1) and 1 week after the end (assessment 2) of the mindfulness-based intervention (MBI) at the same time for MBI and control groups. Scores were calculated by using a scale from 1 (very dissatisfied) to 5 (very satisfied).
Participants described their work environment as highly stressful (mean [SD] score, 7.15 [1.89] on a scale of 1 to 10), with no significant difference between the two groups ($P = .88$) and no change between the first and second sets of assessments ($P = .23$ and $P = .69$ for the MBI and control groups, respectively). At the time of the study, 33% and 22% of nurses in the SICU reported working extra hours because of staff shortage and patient care, respectively, compared with the hospital averages of 25% and 3%, respectively. The turnover rate among nurses was 5.7%, with a vacancy rate of 6.7%. The percentage of nurses planning to leave was 9%, compared with the 4% hospital average.

**Feasibility of the Onsite MBI**

The intervention was well received, with a 97% overall retention rate and 100% retention in the MBI group. The attendance rate at the weekly meeting was 90%. Although attendance was high, not all participants were able to be on time for the beginning of the sessions. Participants were asked to listen to a CD track 5 times a week during the 8-week intervention. They self-reported listening to 1 of the CD tracks a mean of 4.42 times per week (SD, 1.99; median, 5 times); the mean lowest number of weekly practices was 3.7 times (median, 4) at weeks 1 and 8, and the highest was 5.2 times (median, 6) at week 4. The mean number of practices increased significantly at week 4 ($P < .01$) compared with weeks 1 and 8 (nonparametric repeated-measures analysis of variance).

The data from the diaries suggest that most participants followed the recommended personal mindfulness practice schedules and even exceeded them, with a median of 6 times each for weeks 4, 5, and 6.

On the follow-up survey, 100% of participants considered the workplace intervention very important; 71% considered conducting the intervention with coworkers very important, and 29% considered it important; and 86% considered the person conducting the intervention to be a very important factor, whereas the remaining 14% considered it an important factor.

**Effects of the MBI on Work Engagement**

Participants rated the potential benefits of the intervention by importance, with 100% rating “recognizing my stress response” as No. 1, 85% rating “learning mindfulness as a way to deal with stress” as No. 2, and 60% rating “knowing coworkers in a different way” as No. 3. Although only 7 participants responded to the follow-up survey sent by e-mail, all responders were still practicing mindfulness 8 months later: some occasionally, but 58% every day or several times a week. More than half of the participants (67%) considered duration of the MBI benefits to be long term, whereas 17% thought they lasted only during the intervention. Despite only 14% of participants thinking their coworkers supported the intervention, 50% said that it benefited not just them but the nurses as a group and even all personnel in the SICU.

The mean number of missed days of work during the 2 months before assessments 1 and 2 was approximately 1 day, with no significant difference between groups (Table 3). An overall mean of approximately 2.5 days of decreased ability to work was reported before assessment 1 in both groups; at assessment 2, this decreased to just more than 1 day for the MBI group compared with an increase to almost 4 days for the control group, although the change was not statistically significant because of the large standard deviations.

Work engagement has been defined as a positive state of mind while at work and characterized by feelings of vigor at work, dedication to work, and absorption in the work.26 The mean total UWES score was 4.121 (SD, 0.922). The UWES subscale mean scores were 3.809 (SD, 0.880) for vigor, 4.569 (SD, 1.168) for dedication, and 3.923 (SD, 1.032) for absorption. Total scores in the MBI group increased significantly between the first and second assessments ($P = .006$), with no change in the control group ($P = .30$). This
increase was mostly due to an increase in the scores of the vigor subscale \((P = .005; \text{Figure 1})\). The dedication subscale score was also increased, although to a lesser degree \((P = .04)\), whereas the absorption score was not changed \((P = .10)\). The scores did not change in the control group. There was a strong negative correlation of the vigor subscale scores with the emotional exhaustion score of the Maslach Burnout Inventory \((r = −0.53; 95\% \text{ confidence interval [CI]}, −0.69 \text{ to } −0.33; P < .001; \text{Figure 2})\) and the burnout subscale score of the ProQOL \((r = −0.64; 95\% \text{ CI}, −0.77 \text{ to } −0.47; P < .001; \text{Figure 3})\). Emotional exhaustion and burnout scores were also negatively correlated with dedication \((r = −0.50, 95\% \text{ CI}, −0.66 \text{ to } −0.29, P < .001 \text{ for emotional exhaustion subscale}; \text{and } r = −0.62, 95\% \text{ CI}, −0.75 \text{ to } −0.44, P < .001 \text{ for burnout subscale})\) but not with absorption scores.

**Discussion**

During the patient’s stay in the SICU, the level of care, the use of technology, and the almost continuous intervention to sustain life is extremely intense. It only lessens or stops when patients are transferred from the SICU or die. The mean length of stay for patients in the SICU at the time of the study was 6.56 days, and the high volume of patients, along with quick turnaround times, are thought to be major contributing factors to stress levels of critical care providers. In addition, high turnover and shortage of personnel are considered stressors for very specialized jobs. Although participants described their work environment as highly stressful, they consider themselves healthy and productive, as assessed by the self-reported measures of their satisfaction with health, quality of life, and abilities to work and perform daily activities. The levels of work stress did not change between the first and second assessments, but in the same participants, levels of salivary _α_-amylase, a biomarker reflecting the ability to dampen the sympathetic activation response to those stressors, changed significantly.\(^2^8\) Several studies\(^3^0,3^1\) have shown the deleterious effects of stress on health care professionals. Employees suffering from stress, anxiety, or depression are estimated to take 10 days more than average of sick leave.\(^2^3\) The mean number of days of sick leave was low (0.5 day per month per employee) and did not change during the study. The number of days of self-reported decreased productivity was lower after the MBI, although the difference was not statistically significant. Larger sample size and longer period of follow-up may be necessary to detect these changes. Researchers in previous studies\(^3^2\) have reported that onsite wellness programs do not decrease levels of sick leave but may increase self-reported productivity.

Employees in the SICU have a strong positive connection with their work, as illustrated by high work engagement scores in our study. However, the
Figure 3 Negative correlation between scores for burnout on the Professional Quality of Life scale and scores on the vigor subscale of the Utrecht Work Engagement Scale.

Total score (4.121 [SD, 0.9217]) was slightly lower than those reported in 2 other studies: 4.286 (SD, 9.533) among nurses from 6 medical and surgical units and 4.60 (SD, 0.62) among acute care staff. The distribution of participants' types of work may be a variable.

Palmer et al reported subscale scores of 4.52 (SD, 0.68) for vigor, 4.96 (SD, 0.68) for dedication, and 4.39 (SD, 0.70) for absorption. In our study, the highest scores also were recorded for the dedication subscale, and the most pronounced change in score after the MBI was in the vigor subscale. Work engagement has been negatively associated with burnout. In our sample, 28% of participants scored greater than 26 on the Maslach emotional exhaustion scale; the proportion was 25.9% in a study of emergency nurses. Our study also confirmed a negative correlation between vigor/dedication and burnout/emotional exhaustion. Not surprisingly, a negative association has been shown between work engagement and intention to leave a job, suggesting that interventions that decrease turnover, even if only for a limited number of participants, may benefit other workers indirectly, and the organization as well.

The time of the intervention was chosen to minimize staffing coverage concerns and was the time when staff meetings were usually scheduled. To ensure adequate care of patients in the SICU and equitable work distribution during the assessment and intervention periods, the nursing administration committed to additional staffing. However, coverage for nurses was the most challenging element of the study to implement. The weekly didactic sessions were well attended because coverage was provided. However, circumstances (eg, care for a specific patient, high level of activity) prevented some of the participants from being on time to the sessions. Conducting the intervention with coworkers may have influenced the dynamics of the didactic MBI sessions, with possible positive (eg, social support at work) and negative (eg, peer pressure) influence for workplace interventions. The survey data suggest that participants experienced mostly positive support from the group.

Limitations

Limitations of the study include the small number of participants and that the need for the leadership/administration to support workplace interventions may limit the applicability of such interventions. In larger planned studies, the effect of stress-reduction interventions made available to the staff will be measured at the level of the institution on professional and personal outcomes such as employee health care use and sick leave, as well as patient safety and satisfaction.

Conclusion

Occurrence of work-related stressful events in the SICU will not change, but a change in reaction to the situation may help maintain wellness and prevent the deleterious effects of stress. As identified by participants, one of the important elements of the program during the group sessions was to raise awareness about stress, which allowed participants to identify its negative effects on their lives and discover that it affects them in very similar ways. Mindfulness may be well adapted for occupations with high demand on emotion regulation, such as those in the hospital setting. Mindfulness has been shown to improve attention to patients and self-awareness among primary care physicians, decrease burnout, and strengthen interpersonal communication skills among nurses. Organizational climate is an important determinant of ICU nurses’ intention to leave their job, and organizations have a vested interest in providing quality care for their patients and wellness for their employees. This feasibility study is the first step in the design of workplace interventions for high-stress work settings.

ACKNOWLEDGMENTS

We thank D. R. Marks, K. Vanover, and the participants in this study for their contributions.

FINANCIAL DISCLOSURES

This work was supported in part by the StressTrauma and Resilience (STAR) Program, College of Medicine, The Ohio State University, Columbus, Ohio. No conflicts of interest were reported.

To purchase electronic or print reprints, contact American Association of Critical-Care Nurses, 101 Columbia, Aliso Viejo, CA 92656. Phone, (800) 899-1712 or (949) 362-2050 (ext 532); fax, (949) 362-2049; e-mail, reprints@aacn.org.
Feasibility and Effectiveness of a Delirium Prevention Bundle in Critically Ill Patients

By Claudia DiSabatino Smith, RN, PhD, NE-BC, and Petra Grami, RN, MSN, CCRN, NE-BC, CVRN

Background Strategies for preventing delirium include early identification and avoiding or modifying patient, environmental, and iatrogenic factors. Minimal research exists on a prescriptive delirium prevention bundle that details elements or strategies for each bundle component. Even less research has been focused on nurse-driven interventions or components.

Objective To evaluate the effectiveness of a delirium prevention bundle in decreasing delirium incidence in 2 medical-surgical intensive care units in a large Texas medical center.

Methods Researchers used the Confusion Assessment Method for the Intensive Care Unit to assess delirium incidence by using a controlled interventional cohort design with 447 delirium-negative critically ill patients. Bundle components consist of sedation cessation, pain management, sensory stimulation, early mobilization, and sleep promotion.

Results The intervention, analyzed by using a logistic regression model, reduced the odds of delirium by 78% (odds ratio, 0.22; P=.001).

Conclusions The delirium prevention bundle was effective in reducing the incidence of delirium in critically ill medical-surgical patients. Further validation studies are under way. (American Journal of Critical Care. 2017; 26:19-27)
Delirium is a preventable medical condition\(^1\) that is a symptom of acute brain dysfunction. It occurs in 60% to 80% of critically ill patients who are receiving mechanical ventilation\(^2-5\) and in 20% to 50% of critically ill patients who are not receiving mechanical ventilation.\(^2,3\) These percentages mean that more than 40,000 patients receiving mechanical ventilation in intensive care units (ICUs) in the United States experience delirium every day. Patients receiving mechanical ventilation present a different set of risk factors for development of delirium; those factors include multi-system illness, comorbid conditions, and medications.\(^5\) Delirium has both short-term and long-term adverse effects on patients’ levels of function and cognition.\(^7\)

Delirium continues to plague patients across the care continuum, often resulting in an increase in morbidity and mortality\(^3,8,9\) and a longer hospital stay.\(^4\) As 1 of the 6 leading causes of preventable injury in patients aged 65 years or older,\(^9\) delirium adds approximately 10 days to the patients’ mean length of stay in the hospital.\(^8\) Each additional day spent in delirium is independently associated with a 20% increased risk for prolonged hospitalization, and a 10% increased risk of death.\(^8\) Delirium often develops in patients who have 2 to 6 multifactorial causes\(^2\) and commonly develops in critically ill older patients due to advanced age, critical illness,\(^2,11\) and multiple medical-surgical interventions.\(^12\) In this study, delirium incidence is defined as a change in the patient’s delirium assessment from delirium-negative to delirium-positive.\(^13\)

Delirium remains unrecognized in 66% to 84% of patients in ICUs, acute care, and emergency departments and is underdocumented\(^14\) and undertreated.\(^15\) The national approximation may be grossly underestimated, resulting in poorer outcomes for patients, higher costs, and a staff shortage. As health care braces for the anticipated surge in aging patients, the incidence of delirium is expected to soar.\(^16\) Hospital costs continue to climb, with predictions that delirium will nearly double patients’ hospital costs and will increase US health care costs between $6 billion and $20 billion annually.\(^16\) In the ICU, delirium incidence increases cost per case to $9000 or more per patient.\(^16\)

Delirium prevention outweighs available delirium treatment options. Key strategies for preventing delirium and decreasing its duration include early identification and avoiding or modifying patient-related, environmental, and iatrogenic factors.\(^4\) If hospital staff are able to consistently implement preventive measures on an ongoing basis, delirium incidence may decrease, resulting in improved outcomes for patients and hospitals.\(^17\) Although some research has addressed the feasibility of having ICU nurses assess for delirium, little research has tested the feasibility of nurses consistently adhering to all components of a delirium prevention bundle (DPB).\(^17\) The purpose of this article is to report findings from a controlled interventional cohort study that tested the effectiveness of a prescriptive, nonpharmacological, nurse-led DPB in reducing delirium incidence in critically ill patients in medical-surgical ICUs.

Theoretical Framework
The theoretical framework for the study was Virginia Henderson’s Theory of Need.\(^18\) Henderson described the unique function of the nurse as one who assists sick or well patients to perform activities that they would normally perform themselves, if they possessed the strength, desire, or knowledge to...
do so. Said activities are those that contribute to patients’ health, recovery, or peaceful death in such a way as to help patients regain their independence.\textsuperscript{18} The nurse strives to assist each patient to become independent as quickly as possible, thereby decreasing the patient’s need for the nurse.

In essence, the nurse using the DPB intervenes to provide nursing care in 5 specific domains that contribute to patients’ recovery. During patients’ ICU stay, most have neither the ability nor the desire to perform such activities on their own. The DPB aligns with many of Henderson’s 14 components of basic nursing care, which make up the Theory of Need. Domains within the DPB include sedation cessation, pain control, sensory stimulation, early mobility, and sleep promotion. Components from Henderson’s theory that mirror those in the DPB include the patients’ need to breathe normally, move and maintain desirable positions, sleep and rest, avoid environmental dangers and the injury of others; communicate with others in expressing emotions, needs, fears, or opinions; and participate in various forms of recreation\textsuperscript{18} (Table 1).

**Methods**

The study was approved by the nursing research council and institutional review board at the study site. Researchers conducted a controlled interventional cohort study in 2 similar medical-surgical ICUs in a large medical center in Houston, Texas. Patients admitted to an 18-bed medical-surgical ICU were in the control group and received standard ICU care. Patients admitted to a 10-bed medical-surgical ICU were in the intervention group, for whom the nursing staff consistently implemented the entire DPB.

Using both didactic and practical methods, researchers taught the licensed staff in both groups to administer the Confusion Assessment Method for the ICU (CAM-ICU) and the Richmond Agitation-Sedation Scale (RASS) at least once per shift.\textsuperscript{19} Interrater reliability was established. Licensed and unlicensed staff received training on the DPB in the intervention unit. The research team delayed data collection for approximately 4 weeks to enable the staff to become proficient in the use of the CAM-ICU and to ensure adoption by at least 4 of 5 categories of adopters.\textsuperscript{20}

Nurses in the control group provided standard ICU care. The study groups had similar patient acuity, ICU length of stay, and comorbid conditions (Table 2). Nurses collected patient data (\(N = 447\)) every shift during patients’ ICU stay, not to exceed 30 days. Nurses assessed patients for delirium at least twice daily, resulting in 1533 observations. Patients were considered delirium-positive if assessed as positive for delirium at least once during a 24-hour period.

Because the control group has fewer patients receiving mechanical ventilation, researchers theorized that the census in that larger unit would compensate for the smaller percentage of ventilator-dependent patients. The 2 groups were configured similarly, including a combination of medical and surgical patients, study-supporting leaders, willing staff nurses, and a homogeneous patient mix with projected high rates of delirium.

Researchers randomized by group rather than by participant because of the likelihood that the

---

**Table 1**

| Components of Henderson’s theory that align with components of the delirium prevention bundle |
|---|---|
| **Bundle components** | **Characteristics** |
| Sedation cessation | Breathe normally |
| Pain management | Participate in various forms of recreation |
| Sensory stimulation | Communicate with others in expressing emotions, needs, fears, or opinions |
| Early mobility | Move and maintain desirable positions |
| Sleep promotion | Sleep and rest |
| Avoid environmental dangers and injury of others | Avoid environmental dangers and injury of others |

**Table 2**

| Characteristics of patients admitted without delirium by unit |
|---|---|---|
| **Characteristic** | **Control group** | **Intervention group** | **P** |
| Total | 298 (66.7) | 149 (33.3) | .79 |
| Female | 145 (49.0) | 75 (50.3) | .62 |
| Race | | | |
| White, non-Hispanic | 150 (51.4) | 76 (52.8) | |
| African American | 99 (33.9) | 42 (29.2) | |
| Hispanic | 32 (11.0) | 21 (14.6) | |
| Other | 11 (3.8) | 5 (3.5) | |
| Age category, y | | | .14 |
| <45 | 52 (17.4) | 26 (17.4) | |
| 45-64 | 116 (38.9) | 66 (44.3) | |
| 65-74 | 67 (22.5) | 21 (14.1) | |
| 75-84 | 40 (13.4) | 28 (18.8) | |
| ≥85 | 23 (7.7) | 8 (5.4) | |
| Comorbid conditions | | | .63 |
| <3 | 124 (41.6) | 55 (36.9) | |
| 3-5 | 117 (39.3) | 63 (42.3) | |
| >5 | 57 (19.1) | 31 (20.8) | |
| Case mix index | 2.92 | 3.07 | |
| Days in intensive care unit, mean | 3.12 | 3.88 | |
intervention would cross over into the care of control group participants. When scoring the CAM-ICU, “unable to assess” consisted of non-English-speaking adult patients, patients with inadequately corrected hearing such that the patient was unable to hear the nurses’ commands, and patients with a RASS19 score of -4 to -5.

Data collected on patients who received the DPB, but failed to meet inclusion and exclusion criteria, were excluded from analysis. Excluded patients included ICU patients who were delirium-positive on admission, resided in the ICU for 4 months or longer, or were transferred to a lower level of care or laterally transferred from the intervention group to the control group.

Statistical Methods

STATA statistical software (version 11.2, Stata Corp) was used for data analysis. The sample size was powered to be at least 80% (2-sided α of 0.05) for a medium effect size. The phi coefficient was used to establish interrater reliability with the CAM-ICU, which consisted of nominal level data. Demographic and comorbidity data from both groups of patients were compared by using t tests and contingency-table χ² analyses. Multivariate longitudinal logistic regression was used to obtain adjusted odds ratios and to model the effect of the intervention on the development of delirium, along with other selected variables.

Statistical analysis was conducted on data of patients who were delirium-negative when admitted to the study ICUs. Patients’ delirium status and other characteristics were monitored daily for a maximum period of 30 days or until the patients were discharged from the study ICUs.

Technical Information: Instruments

The RASS19 is a dichotomous scoring system with 4 agitation scores on one end of the scale and 4 sedation scores on the other. A score of zero, which lies in the middle, means “alert and calm.” Assessing the patient for agitation or arousal is the first step in the delirium assessment. One cannot assess the “attentive” and “disorganized thinking” features of the CAM-ICU15 if the patient is deeply sedated or highly arousable. The RASS is a valid and reliable instrument for the measurement of arousal and is stable over time.21

The CAM-ICU is a valid and reliable tool that is widely used to assess critically ill patients for the presence or absence of delirium.2,6 It is easy to use and quick to administer and has an administration time of approximately 2 minutes.2 The instrument is used to assess changes in 4 key criteria: acute change from baseline or fluctuating course, inattention, disorganized thinking, and altered level of consciousness.11

Nurses used a researcher-generated patient data collection tool to document demographics, comorbid conditions, risk factors, and significant clinical events. The research team authenticated and recorded daily compliance with DPB components via weekly random audits. Compliance regularly ranged from 80% to 88%.

Components of the DPB

Prevention is currently the best method of delirium treatment. The DPB consists of 5 components, each of which contains evidence-based nursing interventions. The etiology of delirium is multifactorial; therefore, researchers devised a multifaceted prevention strategy. The 5 components of the DPB are (1) sedation cessation for patients receiving mechanical ventilation, (2) pain management, (3) sensory stimulation, (4) early mobilization, and (5) sleep promotion. Researchers organized the DPB to mimic the flow of nursing care during a typical ICU day (Table 3). Implementing all components leads to a more positive result than if individual components are implemented independently.1 The consistent practice of all component elements is critical in reducing delirium incidence.

Sedation Cessation for Patients Receiving Mechanical Ventilation. Delirium occurs in patients who recover from a sedated or oversedated state.22 The depth of sedation is independently associated with the duration of mechanical ventilation, in-hospital mortality, and 180-day death rates.23 Sedation cessation is an evidence-based ventilator management protocol for patients undergoing mechanical ventilation. It incorporates a spontaneous awakening trial that is performed daily on nonexcluded patients. For qualifying patients, nurses stop administration of sedatives for 1 hour. If patients open their eyes to verbal

<table>
<thead>
<tr>
<th>Table 3 Daily flow of nursing care when the delirium prevention bundle is used</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Sedation cessation</td>
</tr>
<tr>
<td>2. Pain control</td>
</tr>
<tr>
<td>3. Sensory stimulation</td>
</tr>
<tr>
<td>4. Early mobility</td>
</tr>
<tr>
<td>5. Sleep promotion</td>
</tr>
<tr>
<td>Repeat:</td>
</tr>
<tr>
<td>1. Sedation cessation</td>
</tr>
<tr>
<td>2. Pain control</td>
</tr>
</tbody>
</table>
stimuli without exhibiting any of the criteria for a failed spontaneous awakening trial, then respiratory therapists initiate a spontaneous breathing trial. Failure criteria for a spontaneous breathing trial include a RASS score of +2 to +4 during sedation cessation, a respiratory rate greater than 35/min for 5 minutes or longer, acute dysrhythmia, or 2 or more of the following: heart rate greater than 100 or less than 60 beats per minute; using accessory muscles; paradoxical abdominal movement; diaphoresis; or marked dyspnea. In failure cases, the nurse restarts the sedation at half the previously ordered rate and notifies the physician.

**Pain Management.** Pain is the most common memory patients have of their experience in the ICU, and sedatives and analgesics are the most commonly administered ICU drugs. Short-term consequences of unrelied pain are higher energy expenditure and immunomodulation. Unrelenting pain leads to post-traumatic stress disorder in the long term. Nurses routinely assessed and documented pain by using a numeric rating scale of 0 to 10. Nurses recorded patient-reported comfort goals (0-10), patients’ perceived pain scores (0-10), time of analgesic administration, and patients’ follow-up pain score 1 hour later. Patients’ comfort goals were compared with their follow-up pain scores to assess pain management. Pain was considered adequately managed if the comfort goal was within 1 unit of the follow-up level.

**Sensory Stimulation.** Sensory stimulation includes visible and accurate clocks and calendars, opening and closing window blinds during daytime and nighttime hours, and orienting patients to time, place, and date. Wearing personal vision and hearing aids improves patients’ sensorium. Age-appropriate television and radio programs that are suited to patients’ personal taste are important, as is offering slow, soothing music to reduce pain and anxiety, foster relaxation, and improve mood and movement.

**Early Mobilization.** Weakness and muscle wasting often occurs in ICU patients who lack physical activity, which may result in marked consequences. ICU patients may lose up to 20% of muscle strength in 1 week of bed rest. The effectiveness of an ICU mobility protocol in preventing delirium has not been studied; however, a mobility program for elderly non-ICU patients realized a 40% reduction in delirium. The patients’ clinical condition determined the amount and type of exercise introduced. Early ICU mobilization included frequently turning bed-bound patients, conducting passive and active range-of-motion exercises, having patients dangle their legs at the edge of the bed with feet planted, actively transferring patients to a chair, and ambulating patients. Nurses and unlicensed staff were primarily responsible for implementing early mobilization. Clinical instability generally precludes mobility progression beyond passive range-of-motion exercises. Early mobility, a DPB component, includes mobilizing patients undergoing mechanical ventilation with a fraction of inspired oxygen less than 70% and a positive end-expiratory pressure that is 10 cm H₂O or less; patients with multiple catheters, tubes, wires, and drains, including orally intubated patients; and patients undergoing continuous renal replacement therapy. Early mobilization requires a team approach of licensed and unlicensed nursing staff along with other nonnursing disciplines.

**Sleep Promotion.** Sleep deprivation is a common ICU problem that may induce delirium. The mean sleep time for an ICU patient may be as little as 1 to 2 hours per day, with less than 60% of ICU patients achieving rapid eye movement sleep. Environmental factors such as noise, crowded conditions, and bright lights contribute to sleep deprivation. The DPB promotes uninterrupted sleep by clustering patient care interventions (eg, measurement of vital signs, radiographs, phlebotomy) around the designated sleep period (midnight to 4 AM), not administering hypnotic agents after 2 AM; dimming overhead lights; closing window blinds; and minimizing ambient noise (< 80 decibels) by turning off televisions and radios. A Sound Level Meter (RadioShack) was used to monitor ambient noise level. Sleep promotion was achieved if at least 4 of 5 interventions were documented.

**Results**

Comparison of patients’ admitting demographic, morbidity, and comorbidity characteristics indicated no significant difference between the control and intervention groups (Table 2). Consistent with published reports, the adjusted logistic regression model indicated that delirium was more likely to develop in patients who were receiving mechanical ventilation, were in restraints, were more than 64 years of age, or who had spent more than 3 days in the ICU (Table 4). The number of patients who were unable to be assessed did not differ significantly between the 2 groups. The median RASS score was 1 in the intervention group and 2 in the control group.
Longitudinal (repeated-measures) multivariate logistic regressions (Table 5) indicate that patients in the intervention group experienced highly significant reductions (78%) in the relative risk for delirium (odds ratio, 0.22; 95% CI, 0.08-0.56; \( P = .001 \)). Additionally, increases in age, length of stay in the ICU, and use of mechanical ventilation and restraints were associated with significant increases in the relative risk of delirium. Patients' race, number of comorbid conditions, and sex were not significant risk contributors.

Staff nurses from the control group crossed to the intervention group for 6 shifts during the 244 days (488 shifts) of data collection (January through August 2012), and intervention group nurses crossed to the control group for 7 shifts. This results in a 2.7% (13/488) possibility of crossover.

**Discussion**

Descriptive statistics validate the randomization of the study sample and that participants were representative of the hospital’s ethnic distribution. Study findings are consistent with published reports that the incidence of delirium is higher in patients receiving mechanical ventilation than in patients who do not require ventilator support.²⁻⁴,¹¹ Findings from this study indicate that the odds of delirium developing are more than 3 times (\( P < .001 \)) as high in patients receiving mechanical ventilation as in patients not receiving it. Likewise, study findings further suggest that patients in restraints are 2.82 times more likely (\( P = .002 \)) to have delirium develop than are patients who have been liberated. Although not an aim of the study, 1 other predisposing factor for delirium emerged from the analysis. Patients with an ICU stay greater than 3 days were 3 times more likely (\( P = .007 \)) to have delirium develop than were patients with shorter ICU stays. Variables that contributed to a reduction in the odds of delirium include the DPB and age less than 64 years, and variables that increase the likelihood of delirium developing include treatment-specific items such as use of mechanical ventilators and restraints and an ICU stay longer than 3 days. Patients' race, number of comorbid conditions, and gender did not exhibit any significant effect.

The DPB was effective in reducing delirium incidence and preventing delirium. Some DPB components, however, were problematic to achieve because of limiting factors. Sensory stimulation was problematic because many family members refused to leave hearing aids and eyeglasses in patients' rooms to avoid losing them. Nurses’ comments on the patient data collection form validated the limitation, “Patients and family members were reluctant to bring and/or leave patients’ glasses or hearing aids for fear of losing the expensive assistive devices.” As a result, patients who normally wore such devices had difficulty with sensory stimulation. Despite efforts to encourage family members to provide the patients’ sensory devices, few were available for patients to use. The

<table>
<thead>
<tr>
<th>Variable</th>
<th>No delirium incidents (n = 369)</th>
<th>≥1 Delirium incident (n = 78)</th>
<th>( P )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Days of mechanical ventilation, mean (SD)</td>
<td>0.18 (0.58)</td>
<td>3.79 (7.07)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Days in restraints, mean (SD)</td>
<td>0.02 (0.21)</td>
<td>2.32 (4.87)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Stay in ICU &gt; 3 days</td>
<td>107 (29)</td>
<td>56 (72)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>No. of comorbid conditions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;3</td>
<td>157 (42)</td>
<td>22 (28)</td>
<td>.02</td>
</tr>
<tr>
<td>3-5</td>
<td>147 (40)</td>
<td>33 (42)</td>
<td></td>
</tr>
<tr>
<td>&gt;5</td>
<td>65 (18)</td>
<td>23 (29)</td>
<td></td>
</tr>
<tr>
<td>Female sex</td>
<td>181 (49)</td>
<td>39 (50)</td>
<td>.82</td>
</tr>
<tr>
<td>Age category, y</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;45</td>
<td>74 (20)</td>
<td>4 (5)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>45-64</td>
<td>156 (42)</td>
<td>26 (33)</td>
<td></td>
</tr>
<tr>
<td>65-74</td>
<td>68 (18)</td>
<td>20 (26)</td>
<td></td>
</tr>
<tr>
<td>75-84</td>
<td>53 (14)</td>
<td>15 (19)</td>
<td></td>
</tr>
<tr>
<td>≥85</td>
<td>18 (5)</td>
<td>13 (17)</td>
<td></td>
</tr>
<tr>
<td>Days of mechanical ventilation &gt;0</td>
<td>43 (12)</td>
<td>33 (42)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Days in restraints &gt;0</td>
<td>6 (2)</td>
<td>29 (37)</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

Values in second and third columns are number (percentage) of patients in group unless otherwise indicated in first column.

**Table 4**

Analyses by delirium status for all patients admitted with no delirium

Patients who received the delirium prevention bundle experienced 78% less incidence of delirium.
use of personal assistive devices is a fundamental strategy for improving sensory stimulation in the prevention of delirium.

Sedation cessation, the first step in the delirium prevention bundle, was difficult to achieve because physicians infrequently used the sedation cessation protocol. A protocol led by a nurse or respiratory therapist may make sedation cessation more achievable. Sedation cessation is commonly used to decrease mechanical ventilator days, ICU length of stay, and patient mortality rates.23

Despite efforts to promote sleep in the ICU at night by reducing environmental noise and clustering patient care, that DPB component was difficult to achieve. Sleep promotion suffered from a large amount of missing data on hypnotic agents administered after 2 AM. The aim of the sleep promotion component was to ensure patients got at least 4 hours of sleep per night. Patients had trouble not only falling asleep, but also staying asleep because of the lights and sounds in the ICU.

Likewise, missing data on pain management items compromised findings on nearly 70% of patients. Missing data elements included patients’ comfort goals, reported level of pain, analgesia administration time, and number of analgesic doses administered relative to patients’ complaint of pain.

Mobilizing patients was problematic because of staffing challenges, incongruity between physical therapy and aggressive mobilization guidelines, and lack of appropriate mobilization equipment. Aggressive mobilization efforts by the nursing staff in the intervention group produced impressive, significant results. The nurse manager and unit staff accomplished aggressive mobilization without additional equipment or personnel resources. The nurse manager spent approximately 30% of the workday physically assisting the nursing staff with mobilization of patients and securing additional equipment as needed.

Limitations

One might consider the study design as a limitation because researchers randomized by patient care unit, instead of by individual patients. Researchers intentionally randomized by unit to minimize crossover of the DPB into the control group. Although

---

Table 5
Results from longitudinal logistic regression models of bundle elements

<table>
<thead>
<tr>
<th>Variable</th>
<th>No. of patients (observations)</th>
<th>Odds ratioa</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intervention unitb (P &lt; .001)</td>
<td>447 (1578)</td>
<td>0.21 (0.08-0.53)</td>
<td>.001</td>
</tr>
<tr>
<td>Total adjusted modelb (P &lt; .001)</td>
<td>433 (1533)</td>
<td>0.22 (0.08-0.56)</td>
<td>.001</td>
</tr>
<tr>
<td>Age category,c by 5 y</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>45-64</td>
<td>3.38 (0.77-14.8)</td>
<td>.11</td>
<td></td>
</tr>
<tr>
<td>65-74</td>
<td>5.58 (1.16-26.9)</td>
<td>.03</td>
<td></td>
</tr>
<tr>
<td>75-84</td>
<td>7.34 (1.41-38.4)</td>
<td>.02</td>
<td></td>
</tr>
<tr>
<td>&gt; 85</td>
<td>17.9 (3.0-108.2)</td>
<td>.002</td>
<td></td>
</tr>
<tr>
<td>Racec</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>African American</td>
<td>1.79 (0.81-3.96)</td>
<td>.15</td>
<td></td>
</tr>
<tr>
<td>Hispanic</td>
<td>1.28 (0.34-4.80)</td>
<td>.72</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>1.85 (0.35-9.89)</td>
<td>.47</td>
<td></td>
</tr>
<tr>
<td>No. of comorbid conditionsd</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-5</td>
<td>1.26 (0.54-2.98)</td>
<td>.59</td>
<td></td>
</tr>
<tr>
<td>&gt; 5</td>
<td>1.72 (0.64-4.65)</td>
<td>.28</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>1.22 (0.59-2.52)</td>
<td>.59</td>
<td></td>
</tr>
<tr>
<td>Mechanical ventilation</td>
<td>3.15 (1.67-5.97)</td>
<td>&lt; .001</td>
<td></td>
</tr>
<tr>
<td>Restrains</td>
<td>2.82 (1.48-5.35)</td>
<td>.002</td>
<td></td>
</tr>
<tr>
<td>&gt; 3 days in intensive care unit</td>
<td>3.02 (1.35-6.80)</td>
<td>.007</td>
<td></td>
</tr>
</tbody>
</table>

---

a Odds ratio is defined as ratio of the odds of a delirium incident in the test group relative to the odds of a delirium incident in the comparison group, also known as “relative risk.”
b Includes adjustment with “days of stay” term and “day x ICU unit” interaction term.
c Intervention unit uses category “Control unit” as comparison group.
d Age odds ratios use category “< 45” as comparison group.
e Race odds ratios use category “White, non-Hispanic” as comparison group.
f Comorbidity odds ratios use category “< 3” as comparison group.
efforts were made to minimize crossover, the nurses in the control group were occasionally pulled to work in the intervention group, where they encountered the DPB. This situation increased the likelihood that the DPB may have influenced those nurses’ nursing practice once they returned to work in the control group.

The lack of a daily sedation cessation protocol for patients receiving mechanical ventilation that was led by a nurse or a respiratory therapist was a limitation of the study, as was the failure of the data collection tool to capture data regarding pain management. The unavailability of patients’ assistive sensory devices limited study findings, and finally, the clinical needs of the critically ill patients made adherence to the designated sleep time challenging.

**Research Implications**

The study design did not allow for study of the relative contribution of the individual bundle elements to the reduction of delirium risk. In future research, one should consider exploring the contribution of each bundle element to avoid excessive staff burden. Revision of the pain management data elements will provide richer, more meaningful, measurable data, after which one should consider replication and validation of study findings. Future research should include refining the DPB to include the use of unlicensed workers who are not part of the nursing staff to support the direct-care nurses and unlicensed support staff in early mobilization of critically ill patients. Researchers should consider a multisite design that includes community hospitals. Replicating the study in specialized critical care units (eg, cardiovascular surgery ICU, pulmonary ICU, neuroscience ICU) is another area for future research, as is the use of the DPB as the standard of care while testing a revised DPB.

**Clinical Implications**

Effective mobilization is burdensome for unit staff to accomplish, particularly for patients receiving mechanical ventilation, who may have multiple catheters, wires, tubes, and drains. Physical therapists do not necessarily participate in the mobilization of such patients because of the lack of a requisite skill that is required in billing for their service. The engagement of trained nonnursing staff to facilitate strength building, endurance, and mobilization may provide a more individualized prescriptive approach to early mobilization.

It is feasible for staff nurses to use the CAM-ICU to assess patients for delirium. Use of the DPB is an effective and feasible strategy to prevent delirium in medical-surgical ICU patients. Hospitals should consider implementing a core model of delirium prevention care that combines evidence-based strategies with nursing interventions that integrate into routine ICU care.

**ACKNOWLEDGMENTS**

We thank the staff of 7 South 3, who worked tirelessly on the development and implementation of the delirium prevention bundle. A special acknowledgement goes to Charles L. Baimbridge for statistical support and expertise. We acknowledge Jan Foster, RN, PhD, for her intellectual contribution and assistance in providing education to the core team on utilization of the CAM-ICU assessment tool. We acknowledge the support of Rick Pozda, RN, BSN, and the staff in 7 South 1 and 2 in the conduct of the study.

**FINANCIAL DISCLOSURES**

Funding support for this study was received from the Friends of Nursing (Houston, Texas).

**eLetters**

Now that you’ve read the article, create or contribute to an online discussion on this topic. Visit www.ajcconline.org and click “Submit a response” in either the full-text or PDF view of the article.

**REFERENCES**

1. Describe the components of an effective delirium prevention bundle.
2. Discuss outcomes of the implementation of a delirium prevention bundle.
3. List at least 3 risk or precipitating factors related to delirium incidence.

To complete evaluation for CE contact hour(s) for test #A172601, visit www.ajcconline.org and click the “CE Articles” button. No CE test fee for AACN members. This test expires on January 1, 2019.

To purchase electronic or print reprints, contact American Association of Critical-Care Nurses, 101 Columbia, Aliso Viejo, CA 92656. Phone, (800) 899-1712 or (949) 362-2050 (ext 532); fax, (949) 362-2049; e-mail, reprints@aacn.org.
Evidence-Based Review and Discussion Points

By Ronald L. Hickman, RN, PhD, ACNP-BC

Evidence-Based Review (EBR) is the journal club feature in the American Journal of Critical Care. In a journal club, attendees review and critique published research articles: an important first step toward integrating evidence-based practice into patient care. General and specific questions such as those outlined in the “Discussion Points” box aid journal club participants in probing the quality of the research study, the appropriateness of the study design and methods, the validity of the conclusions, and the implications of the article for clinical practice. When critically appraising this issue’s EBR article, found on pp 19-27, consider the questions and discussion points outlined in the “Discussion Points” box.

Delirium, a state of confusion and reduced awareness, is a preventable form of brain dysfunction that may affect acutely or critically ill patients. Among hospitalized patients, critically ill older adults (aged > 65 years) and those who receive mechanical ventilation with concurrent sedation have the highest risk of developing delirium. Patients with delirium have longer hospital lengths of stay, sustained impairments in cognitive function, and an increased risk of death. Despite the known damaging effects of delirium among the critically ill, delirium is often unrecognized and undertreated in more than two-thirds of acutely and critically ill patients.

In an effort to provide a systematic screening method and implement evidence-based nursing care, authors Smith and Grami designed an interventional cohort study to assess the effectiveness of a nurse-led bundle. The Grami-Smith Delirium Prevention Bundle is a multi-component intervention that contains a set of evidence-based nursing interventions to prevent delirium in critically ill patients. The authors state that their delirium prevention bundle provides recommended nursing care to facilitate sedation cessation for patients receiving mechanical ventilation, pain management, sensory stimulation, early mobilization, and sleep promotion.

To examine the effects of their delirium prevention bundle, the authors recruited patients from an 18-bed medical-surgical intensive care unit (ICU, control group) and a 10-bed medical-surgical ICU (intervention group). Nurses working in the 10-bed medical surgical ICU intervention group were trained on the use of the delirium prevention bundle. A total of 447 critically ill patients who did not meet criteria for delirium on admission were included in this study and 149 (33%) of these patients were exposed to the delirium prevention bundle. A total of 447 critically ill patients who did not meet criteria for delirium on admission were included in this study and 149 (33%) of these patients were exposed to the delirium prevention bundle. Staff nurses collected patient data on all eligible patients, which included the Confusion Assessment Method-ICU to assess delirium and the Richmond Agitation-Sedation Scale to describe a patient’s level of sedation, twice a day.

Claudia Smith, PhD, RN, NE-BC, is a retired nurse scientist and director of nursing research at Baylor St. Luke’s Medical Center in Houston, Texas. She has more than 2 decades of nursing experience as a staff nurse, administrator, and nurse scientist.

Although an experienced nurse scientist, Smith notes that “conducting a project of this magnitude in a dynamic ICU setting was challenging.” Smith says that there were several unanticipated challenges, such as modifying the morning radiograph schedule and maintaining nurse engagement in the data collection process. Even after overcoming these challenges, “We experienced a particularly difficult time addressing the suggestions of the peer-reviewers,” adds Smith.

For Smith, a salient lesson learned from conducting this research was the need to form collaborative partnerships. “Whereas frontline healthcare professionals often pose important clinical questions, they need the expertise and support of nurse scientists to mentor and help conceptualize a sound study,” she says.
The authors report that critically ill patients who received nursing care guided by their delirium prevention bundle had a 78% reduction in their likelihood of delirium. Despite the overall effect of the delirium prevention bundle on a patient’s risk for delirium, the authors note that their research design did not allow them to describe the relative contributions of each component of the bundle. However, they report that the Grami-Smith Delirium Prevention Bundle is feasible for staff nurses to integrate into their practice and is a promising approach to prevent delirium.

Information From the Authors
Claudia Smith, RN, PhD, NE-BC, lead author for this EBR article provides additional information about the study. For Smith and Grami, the journey toward implementing a delirium prevention bundle was a response to the mounting frustration among critical care nurses trying to identify evidence-based nursing interventions for patients with ICU delirium.

“A few of the critical care nurses initially approached coauthor Petra Grami after a particularly difficult shift with several confused patients. The nurses expressed their frustration with the numbers of patients that they were seeing shift after shift,” Smith recalls. In fact, we began to explore the literature on confusion in the ICU patients and we quickly identified that what we were seeing was in fact manifestations of delirium, she says.

After searching the literature on delirium, Grami and the ICU nurses reached out to nursing colleagues nationwide to assess delirium prevention practices. Surprisingly, they learned that few hospitals had implemented delirium prevention strategies. Committed to improving the outcomes of the critically ill, Smith and Grami, explored the effectiveness of their Grami-Smith Delirium Prevention Bundle.

“Unlike most studies, we didn’t have issues with recruiting nurses to participate in our study,” says Smith. She adds, “it was important to involve nursing staff in the design and flow of the data collection forms in an effort to make data collection the nursing staff less burdensome and efficient.” According to Smith, the best strategy for assembling a committed team of nurses is to motivate and create opportunities for nurses to actively contribute to team.

Implications for Practice
Smith encourages the readers of the American Journal of Critical Care to screen for delirium and implement preventative strategies to help reduce the occurrence of delirium among their patients. Using the Grami-Smith Delirium Prevention Bundle is a promising strategy to help prevent and reduce ICU delirium. However, Smith and Grami recognize that delirium prevention requires an interdisciplinary approach to facilitate sedation cessation, pain management, sleep promotion, early mobilization, and sufficient sensory stimulation. The Grami-Smith Delirium Prevention Bundle is an effective and feasible approach for delirium prevention that can be easily integrated into routine care practices in the ICU.

Discussion Points
A. Description of the Study
- What is the impact of delirium on patient outcomes?
- What did the authors propose to address by conducting this study?
B. Literature Evaluation
- What is known about how to prevent delirium in the ICU?
- How do the authors justify the need for delirium prevention in the ICU?
C. Sample
- Who was eligible to participate in this study?
- Who was excluded from this study and why?
D. Methods and Design
- How did the authors randomize patients to standard care or the delirium prevention bundle?
- Describe how data were collected for this study.
E. Results
- What were the major findings of this project?
- How can you use the findings of this project to positively impact the quality of nursing care at your hospital?
PREVENTING DELIRIUM IN CRITICALLY ILL PATIENTS

By Sarah A. Delgado, RN, MSN, ACNP-BC

We know from the evidence that delirium is bad for patients; it leads to longer hospital stays and increases their risk of injury. We know from our experience that delirium is also bad for caregivers; providing care for patients with delirium is stressful and can affect health-care team dynamics.

The best treatment for delirium is prevention, which can be achieved through a multipronged approach, often called a “bundle,” to address the diverse causes of delirium simultaneously.

In describing the implementation of a nurse-led delirium prevention bundle, authors Smith and Grami offer important lessons. Their project demonstrates the impact nurses have on patient safety. The second lesson comes from some of the challenges they faced in implementing their bundle, which included sedation cessation, pain management, sensory stimulation, early mobility, and sleep promotion. Staffing issues, family concerns, and doctors’ orders can affect implementation of the bundle.

Whereas nurse leadership can effect change, we can extend our impact if we garner support from others. Patients, families, and the health care team all benefit from delirium prevention and can all play a part in implementing change.

Here’s what you can do:

• Think about how delirium prevention strategies could be incorporated into your unit’s existing workflow.
• Discuss delirium and the barriers it creates among your colleagues, including nurses, doctors, physical therapists, and unlicensed personnel.
• Identify an interprofessional team interested in delirium prevention and schedule time to touch base routinely, through electronic communication or face-to-face huddles.
• Examine how a standardized delirium assessment could be incorporated into the documentation system on your unit.
• Provide staff and families with information about delirium.

Other helpful resources:


Based on material from and published as a supplement to the article by Smith and Grami, “Feasibility and Effectiveness of a Delirium Prevention Bundle in Critically Ill Patients,” (American Journal of Critical Care. 2017;26:19-27).
**Purpose** To assess the safety of mobilizing patients receiving low-dose norepinephrine (0.05 μg/kg per min) by examining mean arterial pressure and heart rate before and after activity with parameters set by the physician.

**Background** Norepinephrine is a peripheral vasoconstrictor administered for acute hypotension. During activity, blood flows to the periphery to supply muscles with oxygen, which may oppose the norepinephrine vasoconstriction. The safety of mobilizing patients receiving norepinephrine is unclear.

**Methods** Heart rate, mean arterial pressure, norepinephrine dose, and activity performed were extracted retrospectively from charts of 47 cardiothoracic surgery patients during the first patient transfer to chair or ambulation with norepinephrine infusing. Mean arterial pressure and heart rate were compared before and after physical therapy (paired t tests). Differences among norepinephrine doses and physical activity levels were evaluated (Kruskal-Wallis test).

**Results** Forty-one of the 47 patients (87%) tolerated the activity within safe ranges of vital signs. The change in patients’ mean arterial pressure from before to after activity was not significant ($P=.16$), but a significant increase in heart rate occurred after activity ($P<.001$). A Kruskal-Wallis test showed no significant difference in the norepinephrine dose and activity level ($\chi^2 = 6.34$, $P=.17$). No instances of cardiopulmonary or respiratory arrest occurred during any physical therapy sessions.

**Conclusions** Infusion of low-dose norepinephrine should not be considered an automatic reason to keep patients on bed rest. *(American Journal of Critical Care. 2017; 26:31-36)*
Critically ill patients maintained on bed rest for days to weeks experience blood volume, cardiac, and vascular changes that lead to decreased cardiac and vasomotor function with potential for hemodynamic instability upon mobilization. Successful early mobilization of critically ill patients can prevent or reduce cardiac complications such as increased cardiac workload with increased heart rate and decreased stroke volume. A long-standing perceived challenge to successful mobilization of critically ill patients is the safety concern of hemodynamic instability. In cardiac surgery patients, ventricular and vascular dysfunction are common. Hypotension is initially treated with volume expanders, colloids, and crystalloids. If the systemic arterial pressure is inadequate despite fluid/volume administration, vasoactive drugs become the mainstay of hemodynamic management.

Norepinephrine constricts peripheral blood vessels to increase central circulation volume to raise the blood pressure to improve cardiac perfusion. Norepinephrine also increases heart rate. The resulting increase in vascular resistance can trigger a compensatory reflex that overcomes its direct stimulatory effects on the heart, called the baroreceptor reflex, which can result in a decrease in heart rate called reflex bradycardia. Baroreflex responsiveness is lessened with bed rest, thus contributing to postural hypotension and tachycardia with activity. Hence heart-rate response to norepinephrine can lead to tachycardia or bradycardia. In addition, during activity, blood flows to the periphery to supply muscles with oxygen, which may oppose norepinephrine vasoconstriction and cause a decrease in blood pressure. The American Association of Critical-Care Nurses (AACN) developed an early progressive mobility protocol for nurses to implement in the intensive care unit (ICU). Often acute hypotension prohibits this crucial mobilization. Therefore, in the initial screening for safety, no new vasopressor use or increase in vasopressor dose for the past 2 hours is viewed as safe for progressive mobility to sit upright and sit on the edge of the bed. However, nurses frequently limit even head-of-bed elevation for patients receiving vasopressors. Nurses perceive that hemodynamic monitoring, low blood pressure, and infusion of vasopressors are reasons to limit head-of-bed elevation to less than 30°. Many nurses believe that mobilizing patients out of bed is not possible if the patient is receiving vasopressor agents. In addition, ICU mobility experts could not reach consensus on the safe dose of vasoactive medications and recommended that mobilization decisions be based on changes in dose and overall picture of perfusion. Therefore, more research is needed on the safety of progressive mobility in patients receiving vasopressors.

The purpose of this study was to assess the safety of ambulation and chair transfers in cardiothoracic surgery patients receiving norepinephrine by examining mean arterial pressure, heart rate, and oxygen saturation values before and after activity.

Methods

Approval for the study was obtained from the Human Research Protection Office at Washington University, Barnes Jewish Hospital, St Louis, Missouri. All patients in the 21-bed cardiothoracic surgery ICU received a physical therapy screening and evaluation order on postoperative day 1. A retrospective chart review was conducted on 150 cardiothoracic surgery ICU patients from November 2010 to July 2011. Inclusion criteria included patients who were concurrently receiving norepinephrine while actively transferring to a chair or ambulating during the initial physical therapy session in the first 24 to 72 hours postoperatively. Exclusion criteria included patients requiring mechanical ventilation or a ventricular assist device as well as those who were pregnant, mentally disabled, or a prisoner. Medical records from 47 patients met the inclusion criteria; 103 patients were no longer receiving norepinephrine at the time of physical therapy or required...
increasing doses of norepinephrine just before the physical therapy visit. Patients who were hemodynamically unstable with arrhythmias or increasing requirements for norepinephrine or other vasoactive agents were not included. This population of patients may still have been seen by the physical therapist; however, advancement to active transfers out of bed and ambulation were not performed. Passive lifts to a chair or range-of-motion activities may have been performed, and thus these patients were excluded from data collection.

Mean arterial pressure, heart rate, and oxygen saturation values measured with a portable monitor during and immediately upon completion of mobility session were recorded in the physical therapy notes. A noninvasive cuff pressure was used to measure mean arterial pressure. If not documented in the physical therapy notes, vital signs were extracted from the electronic flow sheet within 15 minutes of physical therapy activity at the time of reconnection to the bedside monitor. Target vital sign parameters ordered by the physician and individualized to the patient’s condition were used to determine mobility tolerance and advancement. A goal for mean arterial pressure of at least 60 to 65 mm Hg was the most common target parameter. The AACN mobility protocol was not in use at the time of our study. We did not differentiate vital signs obtained from the physical therapy record from vital signs obtained from the electronic flow sheet. Norepinephrine dose and fraction of inspired oxygen were extracted from the vital signs flow sheet. The list of other medications the patient received was taken from the nursing notes. Activity levels were extracted from the physical therapy notes. Activity level was categorized into 1 of 5 categories: (1) sit to stand, (2) transferred to chair, (3) ambulated up to and including 50 feet (15 m), (4) ambulated up to and including 150 feet (45 m), and (5) ambulated more than 150 feet (45 m). Other demographic data were extracted from the patient information sheet.

Nominal, categorical, and ratio data were analyzed descriptively. Paired t-tests were used to compare mean arterial pressure, heart rate, and oxygen saturation shown by pulse oximetry before and after physical therapy. A Kruskal-Wallis test was conducted to evaluate differences among norepinephrine doses and physical activity levels. The P value was set at an alpha of .05 or less.

Results

The patients were primarily male (62%) with ages ranging from 24 to 87 years (mean, 64.3 years; SD, 13.6 years). Their body mass index (calculated as weight in kilograms divided by height in meters squared) ranged from 17.2 to 40.8, with a mean of 29.0 (SD, 6.0). Most patients had undergone cardiac surgery: coronary artery bypass graft (n = 19); valve replacement or repair (n = 9); valve and coronary artery graft bypass (n = 6); maze procedure (n = 1), maze procedure and valve (n = 2), heart and lung transplant (n = 2); and other cardiopulmonary and cardiovascular procedures (n = 8). Fraction of inspired oxygen delivery ranged from 0.28 to 1.00 with a mean of 0.395 during activity. Medications with potential hemodynamic effect that patients were receiving in addition to norepinephrine and comorbid conditions are found in Figures 1 and 2.

Most patients (56%) were able to ambulate 50 feet (15 m) or further (Figure 3). A Kruskal-Wallis test showed no statistically significant difference in the norepinephrine dose and activity level ($F = 6.34$, $P = .17$). The dosage of norepinephrine during therapy was from 0.01 to 0.28 μg/kg per minute with a mean of 0.056 (SD, 0.05) μg/kg per minute. Norepinephrine dosage and mobility level achieved can be found in Figure 4.

Thirteen percent of patients were outside the target range for mean arterial pressure before mobilization. The mobility activity was tailored on the basis of the team’s discussion and the patient’s assessment of response to edge-of-bed activity before transferring out of bed. Once the patient demonstrated tolerance to edge-of-bed activity, the patient was actively transferred out of bed. All of the patients demonstrated maintenance of mean arterial pressure within the target range.
during out-of-bed activity. Most patients remained within target parameters as set by the physician during and shortly after physical therapy, indicating a tolerance for activity (see Table). Mean arterial pressure and oxygen saturation were not significantly different before and after physical therapy. Thirteen percent of patients experienced a decrease in mean arterial pressure, which was observed in different patients than the 13% with vital signs outside of ordered parameters before activity discussed earlier. A significant change in heart rate was observed; however, a mean increase of 10 beats per minute in heart rate or a heart rate increase of 20% or less is a normal and expected response to activity, demonstrating that heart rate can increase while norepinephrine is infusing. Also, no new dysrhythmias were observed and no instances of cardiopulmonary or respiratory arrest occurred during any of the physical therapy sessions.

**Discussion**

With our selected cohort of relatively stable postoperative cardiac surgery patients receiving low-dose norepinephrine infusion, we demonstrated safe mobility with active transfers and ambulation. The 13% of patients with a decrease in mean arterial pressure could be the result of mobilization or factors not related to norepinephrine, such as prolonged bed rest, comorbid conditions, medications, and blood loss from surgery. No significant relationship was found in norepinephrine dose and activity level, suggesting that differences in norepinephrine dosage may not directly affect the level of activity that the patient can perform. The activity level achieved may be related more to other factors such as comorbid conditions and baseline physical fitness.

Our findings are consistent with the AACN protocol for advancing mobility of patients. In patients receiving stable doses of vasopressors, mobilization should be considered. Nurses and physical therapists should collaborate when mobilizing patients and monitor closely for patients’ tolerance of activity. Although researchers in previous studies found
that vasopressor medication was a limiting factor for activity perceived by nurses,11 our results suggest that infusion of vasopressors should not be considered an automatic reason to keep patients on bed rest.

To balance risks and benefits of mobilizing critically ill patients, Vollman1 suggests the following steps: (1) determining the timing of the mobility session in relation to other care activities and (2) monitoring for tolerance of activity 5 to 10 minutes after the mobilization. In addition, awareness of the potential for cardiovascular compromise with norepinephrine infusion can help in the decision of activity advancement in patients.4,10 Future research using a prospective, controlled design with a larger sample is needed to confirm the findings of this study.

Limitations

This study has several limitations, including use of a retrospective, uncontrolled design. Another limitation is the lack of consistent documentation of vital signs after activity in the physical therapy notes, which required data extraction from the vital sign flow sheet in the nursing documentation, which may not have been precisely at the end of mobility. The study was conducted with cardiothoracic surgery, primarily cardiac, patients only. Last, only doses of norepinephrine were recorded. Patients were receiving other medications that could affect heart rate and mean arterial pressure in addition to the norepinephrine, but these medications were not analyzed.

Conclusion

From our study findings, it appears that transfers and ambulation are safe for patients receiving norepinephrine who meet the safety screening criteria of the AACN’s early mobility protocol.4 It is important to continually monitor vital signs before, during, and after physical therapy interventions, specifically mean arterial pressure values, to ensure these values remain within target parameters and to obtain an overall picture of the patient’s response to therapy while receiving norepinephrine. In our study, the activity level achieved did not directly relate to the norepinephrine dose. This topic warrants further investigation.

ACKNOWLEDGMENTS

The authors thank students Jennifer Kim, Nicole Leuchtman, Rachel Phillips, Inna Rakmanova, and Jenni Taylor from Maryville University in St Louis, Missouri, for their assistance with the analysis of results and Lynn Schallom, RN, PhD, CCNS, for mentoring the article publication.

FINANCIAL DISCLOSURES

None reported.

eLetters

Now that you’ve read the article, create or contribute to an online discussion on this topic. Visit www.ajcconline.org and click “Submit a response” in either the full-text or PDF view of the article.

SEE ALSO

For more about early mobilization, visit the Critical Care Nurse website, www.ccnonline.org, and read the article by Castro et al, “Early Mobilization: Changing the Mindset” (August 2015).

<table>
<thead>
<tr>
<th>Vital sign</th>
<th>Mean value (% vital signs within target)</th>
<th>P&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean arterial pressure, mm Hg</td>
<td>Before physical therapy (n = 47) 76.5 (87)</td>
<td>After physical therapy (n = 47) 75.8 (87)</td>
</tr>
<tr>
<td>Heart rate, beats per minute</td>
<td>89.6 (100)</td>
<td>98.5 (72)</td>
</tr>
<tr>
<td>Oxygen saturation, %</td>
<td>96 (100)</td>
<td>97 (100)</td>
</tr>
</tbody>
</table>

<sup>a</sup> Paired t test.
REFERENCES

To purchase electronic or print reprints, contact American Association of Critical-Care Nurses, 101 Columbia, Aliso Viejo, CA 92656. Phone, (800) 899-1712 or (949) 362-2050 (ext 532); fax, (949) 362-2049; e-mail, reprints@aacn.org.
SAFETY OF CONTINUOUS PERIPHERAL INFUSION OF 3% SODIUM CHLORIDE SOLUTION IN NEUROCRITICAL CARE PATIENTS

By G. Morgan Jones, PharmD, BCPS, BCCCP, Lauren Bode, PharmD, Heidi Riha, PharmD, and Michael J. Erdman, PharmD, BCPS

Background  Numerous drug information resources recommend that continuous intravenous 3% sodium chloride solution be administered via a central catheter. Objectives  To evaluate the incidence of infusion-related reactions and electrolyte abnormalities in neurocritical care patients treated with continuous intravenous infusion of 3% sodium chloride solution via a peripheral catheter. Methods  Data on patients treated with continuous intravenous infusion of 3% sodium chloride solution at 2 academic medical centers were evaluated retrospectively to determine the administration site. Electronic notes on catheter status were reviewed to determine the occurrence of infusion-related reactions. Prespecified thresholds were used to assess electrolyte abnormalities. Results  Of 213 patients who had peripheral continuous intravenous infusions of 3% sodium chloride solution, 15 (7%) had infusion-related reactions. Administration was changed to a central catheter in 56 patients (26.3%), but only 5 changes were due to an infusion-related reaction. Most (157 patients, 73.7%) received their entire treatment peripherally, for a median duration of 44 hours, 3 minutes. The most common electrolyte abnormalities were hyperchloremia in 49.3% and hypokalemia in 46.9% of patients. Conclusion  Current recommendations that a central catheter is required for continuous intravenous infusion of 3% sodium chloride solution should be reevaluated. Only a few patients who had peripheral infusions had infusion-related reactions. Electrolyte abnormalities occurred frequently with peripheral infusion, but the clinical importance of the abnormalities remains unclear. (American Journal of Critical Care. 2017;26:37-42)
Various concentrations of hypertonic saline are effective in reducing intracranial pressure and cerebral edema associated with numerous neurological injuries.1-3 One treatment with hypertonic saline often used is a continuous intravenous infusion of 3% sodium chloride solution.4 However, few studies have evaluated the safety of this treatment in neurocritical care patients.4 Complications such as hypernatremia, hyperchloremic acidosis, and hypokalemia have been reported.4-6

In addition, no data are available on the proper site for administration of a continuous intravenous infusion of 3% sodium chloride solution in adults. Tertiary references suggest administration via a large-bore central catheter, although this recommendation is not based on actual safety evaluations in adult patients.7 Peripheral intravenous administration of 3% sodium chloride solution has been studied in children, and results of a few studies8,9 have indicated limited safety concerns. Proposed safety concerns associated with peripheral administration of a continuous intravenous infusion of 3% sodium chloride solution include extravasation, phlebitis, tissue ischemia, and venous thrombosis.7,10-12 Despite these proposed concerns, no studies have been done on the expected incidence of adverse effects when the continuous infusion is given peripherally.

On the basis of available drug references and the theoretical safety concerns, patients may have a central catheter placed solely for the continuous intravenous infusion of 3% sodium chloride solution. In the multicenter, retrospective, cohort study described here, our aim was to determine the incidence of infusion-related reactions requiring intervention in patients who received continuous intravenous infusions of 3% sodium chloride solution via a peripheral catheter.

**Methods**

We conducted a retrospective, multicenter cohort study of all patients who had continuous intravenous infusion of 3% sodium chloride solution via a peripheral catheter and were discharged from 1 of the 2 included institutions between September 15, 2011, and September 14, 2014. Approval of the study was obtained from the institutional review boards at both sites before data collection began, and all work was carried out according to the ethical standards set forth in the Helsinki Declaration of 1975. The 2 medical centers are large, urban, teaching hospitals with dedicated neurocritical care teams. Both institutions allow peripheral administration of continuous intravenous infusion of 3% sodium chloride solution; the maximum infusion rate is 75 mL/h at one hospital and 30 mL/h at the other hospital.

At both institutions, daily documentation of all intravenous sites is required and any change or complications associated with an intravenous site must be noted by the bedside nurse, allowing ready assessment of infusion-related reactions. One hospital requires documentation of the score on the visual infusion phlebitis scale13; as a standard practice, a peripheral catheter is removed if the score is greater than 1. Data on all patients who had continuous intravenous infusion of 3% sodium chloride solution were evaluated to determine if the infusion was administered via a peripheral catheter at any point during the hospitalization, because both institutions require that the site of administration be included in the charting of continuous intravenous infusions of 3% sodium chloride solution. We excluded data on patients who were less than 18 years old or more than 89 years old, pregnant, or currently lactating. We also excluded data on patients with a history of end-stage renal disease, syndrome of inappropriate antidiuretic hormone, or diabetes insipidus because of the inability to accurately assess electrolyte abnormalities in these patients that might have been associated with continuous intravenous infusion of 3% sodium chloride solution.

**About the Authors**

G. Morgan Jones is a clinical pharmacy specialist, Methodist University Hospital, and an assistant professor of clinical pharmacy, neurology, and neurosurgery, University of Tennessee Health Sciences Center, Memphis, Tennessee. Lauren Bode is a postgraduate year 1 pharmacy resident, University of North Carolina Hospitals and Clinics, Chapel Hill, North Carolina. Heidi Riha is a postgraduate year 2 pharmacy resident, Methodist University Hospital. Michael J. Erdman is a clinical pharmacist, University of Florida Health, Jacksonville, Florida.

Corresponding author: G. Morgan Jones, PharmD, BCPS, BCCCP, Assistant Professor, Clinical Pharmacy, Neurology, and Neurosurgery, University of Tennessee Health Sciences Center, 1265 Union Ave, Memphis, TN 38104 (e-mail: morgan.jones@mlh.org).
The primary observation was the occurrence of any infusion-related reaction requiring intervention. We collected information on the site of administration that included needle gauge, intravenous location, any change in administration site, various administration rates (initial, maximum, and weighted mean), and the duration of infusion. Information on infusion-related reactions was obtained from required documentation in the electronic medical record and from supplemental physician documentation if clarification was needed.

The secondary objective was to assess the incidence of electrolyte abnormalities associated with continuous intravenous infusion of 3% sodium chloride solution. Although we did not expect any difference associated with the site of the infusion, limited data are available on the exact incidence of these abnormalities in patients receiving continuous intravenous infusions of 3% sodium chloride solution. All recorded measurements of electrolytes obtained during continuous intravenous infusion of 3% sodium chloride solution were assessed and were classified as abnormal if they met the following definitions: hypokalemia (serum level of potassium < 3.5 mEq/L), hyperchloremia (serum level of chloride > 110 mEq/L), hypernatremia (serum level of sodium > 155 mEq/L), and hypobicarbonatemia (serum level of bicarbonate < 20 mEq/L).

We recorded whether an abnormality occurred and the total number of episodes. Other information collected to characterize the patient sample included age, height, weight, sex, race or ethnicity, type of neurological injury, requirement for mechanical ventilation, hospital and intensive care unit lengths of stay, and in-hospital mortality. The lowest score on the Glasgow Coma Scale documented within 24 hours of continuous intravenous infusion of 3% sodium chloride solution was also recorded to classify the severity of neurological injuries. Medical history of chronic kidney disease not requiring hemodialysis and chronic heart failure were also collected because of the potential of these conditions to affect secondary outcomes.

**Results**

A total of 213 neurocritical care patients received peripheral continuous intravenous infusion of 3% sodium chloride solution. Most of the patients were African American males admitted with intracerebral hemorrhage (37.1%) or acute ischemic stroke (36.2%). Only a few patients had chronic kidney disease (2.3%) or chronic heart failure (7.5%). A total of 105 patients (49.3%) required mechanical ventilation, and 53 patients (24.9%) died during their admission. Of those patients who survived, the median duration of hospitalization was 11.3 days, with 6.1 days spent in the neurocritical care unit (Table 1).

Median duration of treatment with continuous intravenous infusion of 3% sodium chloride solution (hours:minutes) for the whole population regardless of change in infusion site was 51:07 (interquartile range [IQR], 26:32-81:54). Peripheral intravenous sites were exclusively used for administration in 157 patients (73.7%), for a median duration of 44:43 (IQR, 21:15-74:48). The site of administration was changed to a central catheter in 56 patients (26.3%) after a median duration of 19:32 (IQR, 7:11-37:54; Table 2). If a central catheter is placed, common practice at both institutions is to administer continuous intravenous infusions of 3% sodium chloride solution via the central catheter. Most patients had an 18-gauge (47.4%) or a 20-gauge (46.5%) needle used for catheter placement at an antecubital site (64.3%). The primary outcome, infusion-related reaction, occurred in only 15 patients (7%); phlebitis 9 times and extravasation 6 times. No documented episodes of thrombophlebitis occurred.

Table 3 is a detailed description of all 15 events and treatments. Of note, 8 of the 15 patients who experienced an infusion-related reaction had continuous

**Table 1**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male, No. (%) of patients</td>
<td>127 (59.6)</td>
</tr>
<tr>
<td>African American, No. (%) of patients</td>
<td>114 (53.5)</td>
</tr>
<tr>
<td>Age, median (IQR), y</td>
<td>59 (51-71)</td>
</tr>
<tr>
<td>Height, median (IQR), cm</td>
<td>172.7 (165.1-180.0)</td>
</tr>
<tr>
<td>Weight, median (IQR), kg</td>
<td>80.7 (67.8-97.5)</td>
</tr>
<tr>
<td>Score on Glasgow Coma Scale at admission, median (25%-75% interquartile range)</td>
<td>10 (6-13)</td>
</tr>
<tr>
<td>Neurological injury, No. (%) of patients</td>
<td></td>
</tr>
<tr>
<td>Acute ischemic stroke</td>
<td>77 (36.2)</td>
</tr>
<tr>
<td>Intracerebral hemorrhage</td>
<td>79 (37.1)</td>
</tr>
<tr>
<td>Traumatic brain injury</td>
<td>16 (7.5)</td>
</tr>
<tr>
<td>Other</td>
<td>41 (19.2)</td>
</tr>
<tr>
<td>Length of stay, median (IQR), d</td>
<td></td>
</tr>
<tr>
<td>Hospital</td>
<td>11.3 (6.1-18.4)</td>
</tr>
<tr>
<td>Intensive care unit</td>
<td>6.1 (3.3-12)</td>
</tr>
<tr>
<td>Medical history, No. (%) of patients</td>
<td></td>
</tr>
<tr>
<td>Chronic kidney disease</td>
<td>5 (2.3)</td>
</tr>
<tr>
<td>Chronic heart failure</td>
<td>16 (7.5)</td>
</tr>
</tbody>
</table>

Abbreviation: IQR, interquartile range.

The primary observation was for the occurrence of any infusion-related reaction requiring intervention.
Table 2
Information on infusion of 3% sodium chloride solution in 213 patients

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infusion rate, median (IQR), mL/h</td>
<td></td>
</tr>
<tr>
<td>Initial</td>
<td>30 (20-30)</td>
</tr>
<tr>
<td>Maximum</td>
<td>30 (25-40)</td>
</tr>
<tr>
<td>Weighted mean&lt;sup&gt;a&lt;/sup&gt;</td>
<td>30 (24.4-34.7)</td>
</tr>
<tr>
<td>Peripheral administration site, No. (%) of patients</td>
<td></td>
</tr>
<tr>
<td>Antecubital</td>
<td>137 (64.3)</td>
</tr>
<tr>
<td>Forearm</td>
<td>36 (16.9)</td>
</tr>
<tr>
<td>Hand</td>
<td>22 (10.3)</td>
</tr>
<tr>
<td>Wrist</td>
<td>18 (8.5)</td>
</tr>
<tr>
<td>Peripheral administration site needle gauge, No. (%) of patients</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>8 (3.8)</td>
</tr>
<tr>
<td>18</td>
<td>101 (47.4)</td>
</tr>
<tr>
<td>20</td>
<td>99 (46.5)</td>
</tr>
<tr>
<td>22</td>
<td>5 (2.3)</td>
</tr>
<tr>
<td>Initial peripheral catheter switched to central administration, No. (%) of patients</td>
<td>56 (26.3)</td>
</tr>
<tr>
<td>Duration of infusion, median (IQR), h:min</td>
<td></td>
</tr>
<tr>
<td>Total (n=213)</td>
<td>51:07 (26:32-81:54)</td>
</tr>
<tr>
<td>Peripheral site only (n=157)</td>
<td>44:43 (21:15-74:48)</td>
</tr>
<tr>
<td>Peripheral site before switch to central site (n=56)</td>
<td>19:32 (7:11-37:54)</td>
</tr>
</tbody>
</table>

Abbreviation: IQR, interquartile range.
<sup>a</sup>Calculated by assessing the duration of treatment at each infusion rate used, then dividing the mean of the total volume received by the duration of treatment.

Table 3
Infusion-related reactions requiring documentation and intervention (n=15)

<table>
<thead>
<tr>
<th>Event</th>
<th>Infusion rate, mL/h</th>
<th>Needle gauge</th>
<th>Infusion site</th>
<th>Reaction type</th>
<th>Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20</td>
<td>20</td>
<td>Antecubital</td>
<td>Extravasation</td>
<td>Changed to alternative peripheral catheter; no further reactions documented</td>
</tr>
<tr>
<td>2</td>
<td>40</td>
<td>18</td>
<td>Forearm</td>
<td>Phlebitis</td>
<td>Changed to central catheter</td>
</tr>
<tr>
<td>3</td>
<td>20</td>
<td>18</td>
<td>Wrist</td>
<td>Phlebitis</td>
<td>Changed to central catheter</td>
</tr>
<tr>
<td>4</td>
<td>20</td>
<td>20</td>
<td>Antecubital</td>
<td>Extravasation</td>
<td>Changed to alternative peripheral catheter; no further reactions documented</td>
</tr>
<tr>
<td>5</td>
<td>35</td>
<td>18</td>
<td>Hand</td>
<td>Phlebitis</td>
<td>Changed to central catheter</td>
</tr>
<tr>
<td>6</td>
<td>30</td>
<td>20</td>
<td>Antecubital</td>
<td>Phlebitis</td>
<td>Changed to alternative peripheral catheter; no further reactions documented</td>
</tr>
<tr>
<td>7</td>
<td>15</td>
<td>20</td>
<td>Hand</td>
<td>Phlebitis</td>
<td>Changed to alternative peripheral catheter; no further reactions documented</td>
</tr>
<tr>
<td>8</td>
<td>15</td>
<td>20</td>
<td>Forearm</td>
<td>Extravasation</td>
<td>Changed to alternative peripheral catheter; no further reactions documented</td>
</tr>
<tr>
<td>9</td>
<td>75</td>
<td>18</td>
<td>Antecubital</td>
<td>Extravasation</td>
<td>Infusion stopped completely</td>
</tr>
<tr>
<td>10</td>
<td>30</td>
<td>18</td>
<td>Wrist</td>
<td>Phlebitis</td>
<td>Changed to central catheter</td>
</tr>
<tr>
<td>11</td>
<td>30</td>
<td>18</td>
<td>Antecubital</td>
<td>Phlebitis</td>
<td>Changed to central catheter</td>
</tr>
<tr>
<td>12</td>
<td>75</td>
<td>20</td>
<td>Antecubital</td>
<td>Phlebitis</td>
<td>Changed to alternative peripheral catheter; no further reactions documented</td>
</tr>
<tr>
<td>13</td>
<td>50</td>
<td>20</td>
<td>Antecubital</td>
<td>Extravasation</td>
<td>Changed to alternative peripheral catheter; no further reactions documented</td>
</tr>
<tr>
<td>14</td>
<td>25</td>
<td>18</td>
<td>Antecubital</td>
<td>Phlebitis</td>
<td>Changed to alternative peripheral catheter; no further reactions documented</td>
</tr>
<tr>
<td>15</td>
<td>20</td>
<td>20</td>
<td>Hand</td>
<td>Extravasation</td>
<td>Infusion stopped completely</td>
</tr>
</tbody>
</table>

Discussion
Because of current recommendations included in various drug information resources, patients may have a central catheter placed solely for the purpose of intravenous infusion of 3% sodium chloride solution resumed at an alternative peripheral intravenous site with no further documented reactions. Only 5 patients had the site of administration changed to a central catheter because an infusion-related reaction occurred. Furthermore, 8 events occurred in a catheter with a 20-gauge needle and 7 in catheters with an 18-gauge needle. Last, the rate of infusion varied across all infusion reactions. Only 3 events occurred at rates greater than 50 mL/h; most of the majority of events (10) occurred at rates of 30 mL/hr or less.

The most commonly occurring electrolyte abnormalities were hyperchloremia in 105 patients (49.3%) and hypokalemia in 100 patients (46.9%) (Table 4). Baseline serum level of sodium among all patients was 139 mEq/L (IQR, 135-142 mEq/L), with values peaking at 149 mEq/L (IQR, 142-155 mEq/L) during treatment. Median serum osmolarity was 290 mOsm/L (IQR, 278-298 mOsm/L) at baseline; the peak level was 308 mOsm/L (IQR, 291-319 mOsm/L).
of administering continuous intravenous infusions of 3% sodium chloride solution. Our study is the first on the safety of peripheral administration of 3% sodium chloride solution in adults. We observed a limited number of infusion-related reactions even when 3% sodium chloride solution was administered peripherally as a continuous infusion for a prolonged duration. We also determined various sites of administration, needle gauges, and infusion rates that might aid in characterizing the safety of continuous intravenous infusion of 3% sodium chloride solution via a peripheral catheter.

Commonly, the maximum osmolarity of peripherally infused solutions is limited to 900 mOsm/L to avoid infusion-related reactions such as extravasation, thrombophlebitis, and tissue necrosis. This threshold most likely is extrapolated from published evaluations of peripheral administration of various osmolar loads of total parenteral nutrition formulas. Few clinical data are available on solutions outside of those related to parenteral nutrition. Because a 3% solution of sodium chloride solution has an osmolarity of 1026 mOsm/L, numerous tertiary references recommend that the solution be infused through a central catheter to avoid infusion-related reactions. Administration via a central catheter is preferred, but peripheral administration is acceptable in critically ill patients when immediate therapy is needed. In the United States alone, more than 5 million central catheters are placed, accounting for 15 million days of treatment with central access. Although these catheters are valuable tools in patient care, they are associated with numerous complications that may worsen mortality and increase associated health care costs. Research has indicated that catheter-associated complications, ranging from infection and symptomatic thrombosis to pneumothorax, can occur with up to 15% to 20% of catheters, depending on the site of placement. The Centers for Disease Control and Prevention estimates that the mean additional cost for 1 central catheter–associated bloodstream infection is $16,550, indicating the marked impact these complications can have on health care costs. Because few infusion-related reactions occurred in our study even when infusion rates were high as 75 mL/h, we think that using literature on peripheral administration of formula for total parenteral nutrition to determine recommendations for peripheral administration of 3% sodium chloride solution may not be appropriate and that current tertiary references should be reevaluated. Safe administration of continuous intravenous infusions of 3% sodium chloride solution via a peripheral catheter may help avoid unnecessary placement of central catheters, facilitating a reduction in associated complications and unnecessary health care costs.

Although no previous studies have been done on peripheral administration of 3% sodium chloride solution in adults, the results of several studies support the safety of peripheral administration in children. In a retrospective cross-sectional study, Brenkert et al investigated administration of a bolus of 3% sodium chloride solution in 56 pediatric patients at an urban children’s hospital, with 87% of doses administered via a peripheral catheter. No patient had indications of phlebitis or local tissue destruction. Bolus doses given in as short a time as 3 minutes were well tolerated, without apparent adverse effects. In a second retrospective study, Luu et al evaluated 101 children who received a 3% sodium chloride solution during the course of critical care transport, primarily as a bolus dose infused over wide duration of time (4-180 minutes). A peripheral catheter was used in 95% of patients, and no infusion reactions occurred.

Additionally, evidence is limited on the incidence of electrolyte disturbances associated with continuous intravenous infusion of 3% sodium chloride solution. In our study, the most common electrolyte disturbance was hyperchloremia, which occurred in 49.3% of patients. However, a much smaller percentage (16.9%) of the patients in whom hyperchloremia developed actually had an intervention initiated to treat this disturbance. Hypokalemia requiring intervention was also common (46.9% overall, 43.6% requiring intervention). Hypernatremia, however, occurred much less frequently (22.1%). In a previous study in patients with cerebrovascular diseases, the overall incidence of severe electrolyte imbalances was low; only 5 patients had severe hypokalemia (serum potassium level < 3 mmol/L). Overall, 21% of patients in the study experienced

### Table 4

<table>
<thead>
<tr>
<th>Electrolyte Abnormality</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypokalemia (potassium &lt; 3.5 mEq/L)</td>
<td>No. (%) of patients: 100 (46.9)</td>
</tr>
<tr>
<td></td>
<td>No. of episodes, median (IQR): 2 (1-2)</td>
</tr>
<tr>
<td>Hyperchloremia (chloride &gt; 110 mEq/L)</td>
<td>No. (%) of patients: 105 (49.3)</td>
</tr>
<tr>
<td></td>
<td>No. of episodes, median (IQR): 2 (1-4)</td>
</tr>
<tr>
<td>Hypernatremia (sodium &gt; 155 mEq/L)</td>
<td>No. (%) of patients: 47 (22.1)</td>
</tr>
<tr>
<td></td>
<td>No. of episodes, median (IQR): 1 (1-4)</td>
</tr>
<tr>
<td>Hypobicarbonatemia (bicarbonate &lt; 20 mEq/L)</td>
<td>No. (%) of patients: 19 (8.9)</td>
</tr>
<tr>
<td></td>
<td>No. of episodes, median (IQR): 1 (1-2)</td>
</tr>
</tbody>
</table>

Abbreviation: IQR, interquartile range.
a sodium level greater than 159 mmol/L, although no adverse sequelae occurred. Hauer et al22 did not report information on hyperchloremia associated with continuous intravenous infusion of 3% sodium chloride solution. The definitions used in the study22 were less stringent than the definitions we used, a characteristic that may explain the difference in rates between their study and our study. However, because of the large amount of sodium and chloride administered with prolonged continuous intravenous infusion of 3% sodium chloride solution, further research on the clinical implication of marked electrolyte abnormalities is needed.

Our study has several limitations. First, our prospective design was reliant on accurate nurses’ documentation of assessment of the primary outcome. Additionally, we cannot provide information on the clinical importance of electrolyte abnormalities. Our study also has several notable strengths. It was conducted at 2 centers with dedicated neurocritical care units. Both medical centers also have documentation policies in place on changes to the sites of intravenous catheters that help increase the likelihood of accurate documentation of all infusion-related events. Finally, both institutions commonly administer 3% sodium chloride solutions as prolonged continuous infusions, providing valuable data on the safety of this intervention when used for longer durations.

Conclusions

Few infusion-related reactions occurred among patients treated with continuous intravenous infusion of 3% sodium chloride solution via a peripheral catheter, even at rates as high as 75 mL/h. Current recommendations suggesting that a central catheter is required for administration of continuous intravenous infusions of 3% sodium chloride solution should be reevaluated, and providers should consider a peripheral site when the sole reason for placement of a central catheter is infusion of 3% sodium chloride solution. Electrolyte abnormalities occurred frequently, but the clinical importance of the abnormalities remains unclear. Further research is needed to elucidate the impact of the electrolyte disturbances on clinical outcomes.

ACKNOWLEDGMENTS

This research was performed at Methodist University Hospital, Memphis, Tennessee, and at University of Florida Health, Jacksonville, Florida. Results from this study were previously presented at the 2015 Neurocritical Care Annual Meeting in Scottsdale, Arizona.

FINANCIAL DISCLOSURES

None reported.

REFERENCES


To purchase electronic or print reprints, contact American Association of Critical-Care Nurses, 101 Columbus, Aliso Viejo, CA 92656. Phone, (800) 899-1712 or (949) 362-2050 (ext 532); fax, (949) 362-2049; e-mail, reprints@aacn.org.

eLetters

Now that you’ve read the article, create or contribute to an online discussion on this topic. Visit www.aajcconline.org and click “Submit a response” in either the full-text or PDF view of the article.
Risk Factors for Bacteremia in Patients with Urinary Catheter–Associated Bacteriuria

By Laurie J. Conway, RN, PhD, CIC, Jianfang Liu, PhD, MAS, Anthony D. Harris, MD, MPH, and Elaine L. Larson, RN, PhD, CIC

Background  Catheter-associated bacteriuria is complicated by secondary bacteremia in 0.4% to 4.0% of cases. The directly attributable mortality rate is 12.7%.

Objective  To identify risk factors for bacteremia associated with catheter-associated bacteriuria.

Methods  Data were acquired from a large electronic clinical and administrative database of consecutive adult inpatient admissions to 2 acute care hospitals during a 7-year period. Data on patients with catheter-associated bacteriuria and bacteremia were compared with data on control patients with catheter-associated bacteriuria and no bacteremia, matched for date of admission plus or minus 30 days. Urine and blood cultures positive for the same pathogen within 7 days were used to define catheter-associated bacteriuria and bacteremia. Multivariable conditional logistic regression was used to determine independent risk factors for bacteremia.

Results  The sample consisted of 158 cases and 474 controls. Independent predictors of bacteremia were male sex (odds ratio, 2.76), treatment with immunosuppressants (odds ratio, 1.68), urinary tract procedure (odds ratio, 2.70), and catheter that remained in place after bacteriuria developed (odds ratio, 2.75). Patients with enterococcal bacteriuria were half as likely to become bacteremic as were patients with other urinary pathogens (odds ratio, 0.46). Odds of secondary bacteremia increased 2% per additional day of hospital stay (95% CI, 1.01-1.04) and decreased 1% with each additional year of age (95% CI, 0.97-0.99).

Conclusions  The results add new information about increased risk for bacteremia among patients with catheters remaining in place after catheter-associated bacteriuria and confirm evidence for previously identified risk factors. (American Journal of Critical Care. 2017; 26:43-52)
Urinary catheters are common in the intensive care unit (ICU); 50% to 78% of adult ICU patients have a urinary catheter in place. During the first week of catheterization, bacteriuria develops in 8% of patients per day, and after the 10th day of catheterization, half of patients are bacteriuric. Such catheter-associated bacteriuria (CAB) can result in marked morbidity, mortality, and cost, particularly if complicated by bacteremia. Prospective studies have indicated that 0.4% to 4% of patients with CAB become bacteremic. The mortality rate directly attributable to hospital-acquired bacteremic CAB is 12.7%. In an estimate published in 2000, the cost of bacteremic CAB was $2836 per episode.

Little evidence is available to help clinicians identify which patients with CAB are at risk for bacteremia. The results of a few studies suggest that patients who have received immunosuppressant medications or red blood cell transfusion; smokers; and patients with neutropenia, malignant neoplasms, liver disease, diabetes, or underlying renal disease may be at increased risk. However, evidence is conflicting for some risk factors, and only single studies have been done on other risk factors. Whether or not leaving a catheter in place after the onset of bacteriuria affects the risk for subsequent bacteremia has not been examined. Identifying patients at high risk for bacteremia would enable clinicians to target those patients for interventions such as early catheter removal or use of alternatives such as intermittent catheterization. Distinguishing patients at low risk for bacteremia could reduce inappropriate use of antimicrobial agents for asymptomatic bacteriuria. Our aim therefore was to determine risk factors for secondary bacteremia among adult patients with nosocomial CAB.

Methods

We used a matched case-control design and compared case patients with nosocomial CAB and concurrent bacteremia with control patients with nosocomial CAB without bacteremia. Three controls were randomly selected from among all patients with CAB who were admitted within 30 days before or after the case patient. Cases and controls were matched on admission date to account for any unmeasured changes in clinical care that occurred over time, such as culturing practices or catheter materials used.

Setting and Sample

Data were obtained from a large database that merged electronic clinical and administrative data for the years 2006 through 2012 from all inpatient admissions to an academic medical system in the northeastern United States. All consecutive admissions of patients more than 18 years old to 2 hospitals were included. Facility A is a 300-bed community hospital, and facility M is a 745-bed tertiary care hospital. Approval for the study, with a waiver of individual consent, was obtained from the appropriate institutional review board.

Measures

Results of clinical cultures were used for the study. Nosocomial CAB was defined as a urine culture positive for bacteria on or after hospital day 3 in a patient who had no previous positive urine culture during the admission and who had an indwelling urethral catheter in place on the date of the culture or within 72 hours before the culture. A urine culture was considered positive if it had either of the following: more than $10^5$ colony-forming units per milliliter of urine with no more than 2 species of microorganisms or fewer than $10^9$ colony-forming units per milliliter of urine with no more than 2 species of microorganisms and pyuria (>3 pus cells per...

About the Authors

Laurie J. Conway is an assistant professor, Lawrence S. Bloomberg Faculty of Nursing, University of Toronto, Canada. Jianfang Liu is a senior data analyst, Columbia University School of Nursing, New York, New York. Anthony D. Harris is a professor of epidemiology and public health, School of Medicine, University of Maryland, Baltimore. Elaine L. Larson is associate dean for research and professor of therapeutic and pharmaceutical research, School of Nursing, and professor of epidemiology, Mailman School of Public Health, Columbia University, New York, New York.

Corresponding author: Laurie J. Conway, RN, PhD, CIC, Assistant Professor, Lawrence S. Bloomberg Faculty of Nursing, University of Toronto, 130-155 College St, Toronto, ON M5T 1P8 Canada (e-mail: laurie.conway@utoronto.ca).
Concurrent bacteremia was defined as growth of the same species from a blood culture taken within 7 days after a positive urine culture.
We analyzed the frequency of risk factors for bacteremia among cases and controls with catheter-associated bacteriuria (CAB). Table 1 presents the frequencies of various risk factors.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Cases (n = 158)</th>
<th>Controls (n = 474)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, median (IQR), y</td>
<td>66 (52-77)</td>
<td>70 (58-80)</td>
<td>.009</td>
</tr>
<tr>
<td>Male sex</td>
<td>93 (58.9)</td>
<td>165 (34.8)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Charlson Comorbidity Index, median (IQR)</td>
<td>3 (1-5)</td>
<td>2 (1-4)</td>
<td>.02</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>36 (22.8)</td>
<td>139 (29.3)</td>
<td>.11</td>
</tr>
<tr>
<td>Malignant neoplasm</td>
<td>45 (28.5)</td>
<td>85 (17.9)</td>
<td>.005</td>
</tr>
<tr>
<td>Urinary tract disease</td>
<td>92 (58.2)</td>
<td>254 (53.6)</td>
<td>.31</td>
</tr>
<tr>
<td>Antimicrobial agent within 3 days before CAB</td>
<td>77 (48.7)</td>
<td>165 (34.8)</td>
<td>.002</td>
</tr>
<tr>
<td>Immunosuppressant within 14 days before CAB</td>
<td>66 (41.8)</td>
<td>126 (26.6)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Statin within 6 weeks before CAB</td>
<td>58 (36.7)</td>
<td>194 (40.9)</td>
<td>.35</td>
</tr>
<tr>
<td>Urinary tract procedure</td>
<td>17 (10.8)</td>
<td>18 (3.8)</td>
<td>.001</td>
</tr>
<tr>
<td>Resistant organism in urinec</td>
<td>16 (10.1)</td>
<td>41 (8.6)</td>
<td>.57</td>
</tr>
<tr>
<td>Two organisms in urine</td>
<td>4 (2.5)</td>
<td>22 (4.6)</td>
<td>.35</td>
</tr>
<tr>
<td>Enterococcus in urine</td>
<td>22 (13.9)</td>
<td>107 (22.6)</td>
<td>.02</td>
</tr>
<tr>
<td>Escherichia in urine</td>
<td>56 (35.4)</td>
<td>169 (35.7)</td>
<td>.96</td>
</tr>
<tr>
<td>Klebsiella in urine</td>
<td>42 (26.6)</td>
<td>78 (16.5)</td>
<td>.005</td>
</tr>
<tr>
<td>Facility A (vs M)</td>
<td>20 (12.7)</td>
<td>50 (10.6)</td>
<td>.46</td>
</tr>
<tr>
<td>Length of stay before CAB, median (IQR)</td>
<td>10 (5-22)</td>
<td>7 (5-12)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Catheter days before CAB, median (IQR)</td>
<td>8 (3-20)</td>
<td>4 (2-8)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Catheter in place after CAB</td>
<td>125 (79.1)</td>
<td>266 (56.1)</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

Abbreviation: IQR, interquartile range.

More case patients had catheters in place at the time of bacteremia than did control patients at an equivalent time period (79.1% vs 56.1%; P < .001). To illustrate this point further, the Figure shows the percentage of cases and controls with a catheter left in place after CAB developed. The number of case patients in whom bacteremia developed and their matched controls were removed from the denominator for subsequent days. On the day of a positive urine culture (day 0), 84% of cases and 68% of controls had a catheter in place. On subsequent days, more than 70% of cases in whom bacteremia had not yet developed still had a catheter in place, whereas the proportion of the matched controls with a catheter in place was steadily declining.

A single organism was responsible for CAB in most patients (96%). Table 2 lists causative organisms for CAB and bacteremia. The most common urinary pathogens were Enterobacteriaceae (Escherichia coli, 34.2%; Klebsiella pneumoniae, 17%) and Enterococcus species (Enterococcus faecalis, 14%; Enterococcus faecium, 5.5%). CAB caused by Klebsiella was more common among case patients than among control patients (26.6% vs 16.5%; P = .005), and enteroococcal CAB was less common among cases than among controls (13.9% vs 22.6%; P = .02). The proportion of resistant urinary pathogens did not differ significantly between cases and controls (10.1% vs 8.6%; P = .57).

Results of a conditional logistic regression model are displayed in Table 3. Duration of catheterization and length of stay were collinear; therefore, only length of stay was included in the model. The final model included age, sex, value on the Charlson Comorbidity Index, diabetes, malignant neoplasm, urinary tract disease, treatment with immunosuppressants, urinary tract procedure, Enterococcus in the urine, Klebsiella in the urine, length of stay before CAB, and catheter in place after CAB. With controls for other factors in the model, the odds of bacteremia were more than 2.7 times higher for males than for females (odds ratio [OR], 2.76; 95% CI, 1.80-4.21), for patients who underwent a urinary tract procedure (OR, 2.70; 95% CI, 1.09-6.74), and for those with a catheter left in place (OR, 2.75; 95% CI 1.65-4.56). Patients treated with immunosuppressants had 1.68 times the odds for development of bacteremia (95% CI, 1.06-2.66). Patients with enteroococcal CAB were half as likely to become bacteremic compared with patients with CAB caused by other genera (OR, 0.46; 95% CI, 0.25-0.83).

The odds for development of secondary bacteremia increased 2% per additional day of stay in hospital before the onset of CAB (95% CI, 1.01-1.04) and decreased 1% with each addition year of age (95% CI, 0.97-0.99).

**Discussion**

Our results indicated several independent predictors of bacteremia in patients with CAB: younger age, male sex, treatment with an immunosuppressant, urinary tract procedure, nonenterococcal CAB, longer hospital stay before onset of CAB, and having a catheter in place after CAB developed. These findings (41.8% vs 26.6%; P < .001). Urinary tract procedures were more common among cases than among controls (10.8% vs 3.8%; P = .001). Cases had a longer hospital stay (10 days vs 7 days; P < .001) and had catheters in place for longer periods before CAB than did controls (8 vs 4 days; P < .001).

More case patients had catheters in place at the time of bacteremia than did control patients at an equivalent time period (79.1% vs 56.1%; P < .001). To illustrate this point further, the Figure shows the percentage of cases and controls with a catheter left in place after CAB developed. The number of case patients in whom bacteremia developed and their matched controls were removed from the denominator for subsequent days. On the day of a positive urine culture (day 0), 84% of cases and 68% of controls had a catheter in place. On subsequent days,
Figure  Percentage of cases and controls with a catheter in place after catheter-associated bacteriuria (CAB). Cases and their matched controls were removed from the denominator for days subsequent to the onset of bacteremia in the case patient. CAB developed within 72 hours after catheter removal in 16% of cases and 32% of controls.

Table 2  Drug-sensitive and drug-resistant causative organisms for catheter-associated bacteriuria (CAB) and secondary bacteremia among 632 hospitalized adults

<table>
<thead>
<tr>
<th>Organism</th>
<th>Urine (n = 658)</th>
<th>Blood (n = 158)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sensitive</td>
<td>Resistantd</td>
</tr>
<tr>
<td>Escherichia coli</td>
<td>213 (32.4)</td>
<td>12 (1.8)</td>
</tr>
<tr>
<td>Klebsiella pneumoniae</td>
<td>109 (16.6)</td>
<td>3 (0.5)</td>
</tr>
<tr>
<td>Enterococcus faecalis</td>
<td>85 (12.9)</td>
<td>7 (1.1)</td>
</tr>
<tr>
<td>Pseudomonas aeruginosa</td>
<td>43 (6.5)</td>
<td>0</td>
</tr>
<tr>
<td>Enterococcus faecium</td>
<td>4 (0.6)</td>
<td>32 (4.9)</td>
</tr>
<tr>
<td>Proteus mirabilis</td>
<td>35 (5.3)</td>
<td>0</td>
</tr>
<tr>
<td>Enterobacter cloacae</td>
<td>18 (2.7)</td>
<td>0</td>
</tr>
<tr>
<td>Morganella morganii</td>
<td>12 (1.8)</td>
<td>0</td>
</tr>
<tr>
<td>Citrobacter koseri</td>
<td>11 (1.7)</td>
<td>0</td>
</tr>
<tr>
<td>Staphylococcus aureus</td>
<td>6 (0.9)</td>
<td>4 (0.6)</td>
</tr>
<tr>
<td>Enterobacter aerogenes</td>
<td>9 (1.4)</td>
<td>0</td>
</tr>
<tr>
<td>Serratia marcescens</td>
<td>9 (1.4)</td>
<td>0</td>
</tr>
<tr>
<td>Citrobacter freundii</td>
<td>8 (1.2)</td>
<td>0</td>
</tr>
<tr>
<td>Klebsiella oxytoca</td>
<td>8 (1.2)</td>
<td>0</td>
</tr>
<tr>
<td>Other</td>
<td>30 (4.6)</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>600 (91.2)</td>
<td>58 (8.8)</td>
</tr>
</tbody>
</table>

a Organisms accounting for less than 1% of the sample are listed as other.
b Twenty-six patients had 2 causative organisms in urine.
c Resistant organisms included extended-spectrum β-lactamase Enterobacteriaceae, methicillin-resistant Staphylococcus aureus, and vancomycin-resistant enterococci. No carbapenem-resistant organisms were isolated.
Table 3  
Risk factors for bacteremia after catheter-associated bacteriuria (CAB)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Odds ratio</th>
<th>95% CI</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>0.99</td>
<td>0.97-0.99</td>
<td>.049</td>
</tr>
<tr>
<td>Male sex</td>
<td>2.76</td>
<td>1.80-4.21</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Charlson Comorbidity Index</td>
<td>1.04</td>
<td>0.94-1.16</td>
<td>.42</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>0.70</td>
<td>0.42-1.18</td>
<td>.18</td>
</tr>
<tr>
<td>Malignant neoplasm</td>
<td>1.59</td>
<td>0.88-2.88</td>
<td>.12</td>
</tr>
<tr>
<td>Urinary tract disease</td>
<td>0.86</td>
<td>0.54-1.35</td>
<td>.50</td>
</tr>
<tr>
<td>Immunosuppressant within 14 days before CAB</td>
<td>1.68</td>
<td>1.06-2.66</td>
<td>.03</td>
</tr>
<tr>
<td>Urinary tract procedure</td>
<td>2.70</td>
<td>1.09-6.74</td>
<td>.03</td>
</tr>
<tr>
<td>Enterococcus in urine</td>
<td>0.46</td>
<td>0.25-0.83</td>
<td>.01</td>
</tr>
<tr>
<td>Klebsiella in urine</td>
<td>1.35</td>
<td>0.78-2.35</td>
<td>.28</td>
</tr>
<tr>
<td>Length of stay before CAB</td>
<td>1.02</td>
<td>1.01-1.04</td>
<td>.003</td>
</tr>
<tr>
<td>Catheter in place after CAB</td>
<td>2.75</td>
<td>1.65-4.56</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

* A conditional logistic regression model with the 12 variables listed.

Although women are at increased risk for CAB,19 men are at increased risk for bacteremia associated with CAB.28,29 In our study, the odds of bacteremia were 2.8 times higher for men, supporting the earlier results. In a related study,21 men were also at increased risk for surgical site infection and primary bloodstream infection (ie, bacteremia without cultures positive for the same organism from another body site). The increased risk for bacteremia associated with CAB in men compared with women may be due to hormonal differences, differences in genitourinary anatomy, the indication for catheterization (eg, obstruction), or differences in the urinary microflora between the sexes.24 These potential underlying mechanisms deserve further investigation.

Not surprisingly, we found that patients treated with immunosuppressants were at increased risk for bacteremia compared with patients who were not given such medications, confirming earlier evidence.27,29 Also as expected, we found that patients with CAB who underwent urological procedures were at increased risk for bacteremia. Previous studies29,23,26 have indicated that procedures, such as transurethral prostate resection, that injure the mucosal barrier promote translocation of pathogens to the bloodstream, increasing the chance of bacteremia and sepsis.

The prevalence of urinary pathogens and the proportion of resistant organisms in our study were similar to the prevalence reported in 2009 through 2010 to the National Healthcare Safety Network for symptomatic and bacteremic urinary tract infection.27 The 4 most common pathogens identified in our study were among the top 5 most common urinary pathogens reported to the network.27 Drug resistance was not a predictor of bacteremia in our study. This finding confirms the results of a previous prospective study28 in which bacteremia outcomes did not differ between patients with bacteriuria caused by vancomycin-resistant enterococci and patients with bacteriuria due to vancomycin-sensitive enterococci.

We did find that the odds of bacteremia were 54% lower in patients with CAB caused by enterococci compared with other pathogens. This finding is in contrast to the results of earlier case-control studies7,29 in which the urinary pathogen was not predictive of bacteremia after adjustments were made for other factors. Similarly, in a large prevalence study29 of nosocomial CAB in hospitalized urology patients across Europe and Asia, enterococcal infections were no less likely to be manifested as urosepsis than were infections caused by other pathogens. One explanation for our finding might be that enterobacteria are more likely than other microorganisms to
elicit a febrile response and prompt physicians to obtain blood cultures. Thus, enterococcal bacteremias may have been less frequently detected.

Our results suggest that longer hospital length of stay before development of CAB increases risk for bacteremia, reinforcing previous research. Length of stay before CAB may be indicative of a patient’s severity of illness; if so, intuitively, bacteremia may be more likely to develop in patients who have been in the hospital longer.

To our knowledge, our study is the first on the influence of the continued presence of a urinary catheter on the risk for bacteremia in patients with CAB. Compared with patients whose catheters were removed, patients with a catheter left in place after the onset of CAB had higher odds of bacteremia. An association is plausible, because urinary catheters acquire biofilms that insulate pathogens physically and slow microbial replication, minimizing the effects of antimicrobial drugs. Also, latex and silicone can cause inflammation and disruption of the cell membranes of urothelial cells in the presence or absence of bacteria in vitro. The physical and chemical irritation of the bladder epithelium by catheters may promote translocation of pathogens from the urine into the bloodstream. However, our sample of patients with catheters remaining in place might have been more acutely ill than those whose catheters were removed. Although we controlled for comorbid conditions by using the Charlson Comorbidity Index, we could not control for severity of illness at the time of CAB; thus, the presence of a catheter may be an indication of a patient’s severity of illness. In addition, patients with chronic indwelling urethral catheters might have been overrepresented in the group of patients with a catheter remaining in place after CAB. Because we did not identify which patients had catheters present at the time of admission, we cannot rule out possible mediating effects of chronic catheterization on the risk for bacteremia.

Our results did not support findings that the following comorbid conditions increased the odds for bacteremia in patients with CAB: malignant neoplasm, urinary tract disease, diabetes, and higher Charlson Comorbidity Index. Our results suggest that longer hospital length of stay before development of CAB increases risk for bacteremia.

Limitations

Our study had several limitations. First, because the data were retrospective, the quality of the measures may be imperfect (eg, coding of comorbid conditions may have been incomplete, or clinical specimens may have been collected incorrectly). The quality of catheter data is especially important to our results. Patients were only included in the study if they had catheter placement and removal dates recorded. We are confident that catheter placement was accurately recorded, because the use of catheters at our study hospitals (34% of admissions, data not shown) is similar to the 31% catheter utilization rate recorded in published reports. However, if catheter removal dates were systematically missed, the subpopulation of patients who had the devices removed would be underrepresented in our study. Second, a misclassification bias is possible. Patients classified as having had a urological procedure may have undergone the procedure after the onset of CAB and the 7-day follow-up period. This misclassification of exposure would have been nondifferential, thus biasing results toward the null. Also, we drew our control patients from among all patients without a blood culture positive for microorganisms. Hence, our pool of controls may have included patients who had clinical signs of sepsis but did not have blood samples obtained for culturing or had blood cultures negative for microorganisms because of collection or culturing techniques, timing, or administration of antibiotics. In effect, we may have compared cases of bacteremia with cases of sepsis. In post hoc analysis with ICD-9-CM codes for sepsis, severe sepsis, and septic shock, we found that 41% of cases and only 7% of controls had sepsis during their hospitalization (data not shown), reassuring us that misclassification, if it occurred, was minimal. Third, unmeasured factors such as smoking, genetic predisposition to infection, or blood transfusion history may have confounded our results. Transfusion of red blood cells has a strong, dose-dependent effect on risk for urinary tract–related bacteremia, and restricting transfusions lowers the risk for health care–associated infections. Finally, the sample consisted of data on patients from 2 hospitals in a metropolitan academic medical system, so results may not be generalizable to patients in small or rural hospitals.

Implications

Despite the limitations, our findings are useful for informing clinical practice. Men with urinary catheters remaining in place after the onset of CAB, who are receiving immunosuppressants, who have had a urinary tract procedure, or who have been in the hospital for a prolonged period should be
considered at high risk for bacteremia. These patients should be targeted for early catheter removal or use of an alternative such as intermittent catheterization.\textsuperscript{11} Suprapubic catheterization could be considered for short-term bladder drainage in adults with multiple risk factors for bacteremia related to CAB.\textsuperscript{11} An external device (condom drainage) may be a useful alternative for cooperative male patients without outlet obstruction. Although episodes of bacteriuria may not be reduced with the use of an external device,\textsuperscript{36} switching from an indwelling to an external catheter will remove one of the risk factors for associated bacteremia.

Our findings also may help reduce inappropriate use of antimicrobial agents by distinguishing patients with CAB who are at low risk for bacteremia. Urinary tract infection is the second most common indication for use of antimicrobial agents in hospitalized patients.\textsuperscript{37} Despite expert recommendations against treatment for most asymptomatic urinary tract infection, 32% of patients with asymptomatic CAB are inappropriately treated.\textsuperscript{12,38} Distinguishing risk factors for bacteremia, as we have done, may encourage clinicians to refrain from treating asymptomatic CAB in patients without risk factors for associated bacteremia.

Conclusions

Our findings provide new information about the increased risk for bacteremia among patients with catheters remaining in place after the onset of CAB and add important confirmatory evidence for previously identified risk factors for bacteremia, including male sex, treatment with immunosuppressants, urinary tract procedures, and prolonged hospital stay. Patients with CAB caused by enterococci appear to be at lower risk for bacteremia than are patients with CAB caused by other urinary pathogens. Research is needed to clarify the independent effects of age on risk for bacteremia after CAB.

Appendix 1: Urinary Catheter Care and Specimen Collection

The policies for nursing care of patients with indwelling urinary catheters at the participating hospitals during the study period were as follows: Urinary catheters were inserted only when necessary and were removed as soon as possible. Intermittent catheterization was promoted as preferable to use of an indwelling catheter. Appropriate indications for use of indwelling catheters included treating urinary retention that could not be treated by other methods, such as an intermittent catheterization or medication; measurement of urine volume in critically ill patients, such as those with renal failure; patients with stage 3 or stage 4 pressure ulcers of the trunk; and palliative care patients at the end of life. After 2008, nurses began evaluating patients' ongoing need for a catheter every shift. Indwelling catheterization was avoided during treatment of urinary tract infection if possible.

Hand hygiene was performed before and after catheter insertion, manipulation, irrigation, emptying of drainage bag, and collection of specimens. A closed, sterile system was maintained, and the tamper-evident seal on connected systems was monitored. Catheters were secured to the patient’s thigh in a manner that avoided tension or tugging, and patients were instructed not to pull or tug on the catheter. Leg bags were used when possible to allow the patients greater mobility. Drainage bags were kept to gravity but off the floor. Ambulatory patients were instructed to avoid raising the drainage bag above the bladder level to prevent the reflux of urine. After 2008, the policy was to empty urine collection bags before patient transport to avoid reflux of urine back into the patient’s bladder during transfers. Drainage bags were emptied every 8 hours and as needed in a manner that avoided contact between the drainage spigot and the nonsterile collecting container. A separate collecting container was used for each patient (and after 2008, a separate container was used for each drainage device in a patient with more than 1 such device). The patient’s perineum was cleansed daily, after each bowel movement, and as needed with soap and water. Patients were instructed in self-care if applicable. Patients with unrestricted fluid intake were encouraged to increase their fluid intake to at least 3 L/d.

Indwelling catheters were not changed at arbitrary fixed intervals. Instead, catheters were changed at the first indications of infection, mechanical obstruction, or leakage. Strict aseptic technique was used, and the entire system was changed at the same time. Patients were assessed daily for signs and symptoms of infection such as cloudy malodorous urine; complaints of suprapubic, back, or flank pain; and elevations in temperature or white blood cell count. Culturing of urine specimens was performed as ordered. An order from a physician, nurse practitioner, or physician assistant was required to collect urine for culture. Specimens were collected by registered nurses or by nursing attendants or patient care technicians as instructed by a licensed professional. Hand hygiene was performed before and after specimen collection, and gloves were used during the procedure. The catheter drainage tube was clamped with a padded hemostat until the urine was visible under the catheter sample port puncture site. The surface of the puncture site was cleansed with an alcohol wipe. A 22-gauge needle was inserted at an angle through the center of the insertion site for transport to the laboratory. Indwelling catheters were not changed at arbitrary fixed intervals. Instead, catheters were changed at the first indications of infection, mechanical obstruction, or leakage. Strict aseptic technique was used, and the entire system was changed at the same time. Patients were assessed daily for signs and symptoms of infection such as cloudy malodorous urine; complaints of suprapubic, back, or flank pain; and elevations in temperature or white blood cell count. Culturing of urine specimens was performed as ordered.

An order from a physician, nurse practitioner, or physician assistant was required to collect urine for culture. Specimens were collected by registered nurses or by nursing attendants or patient care technicians as instructed by a licensed professional. Hand hygiene was performed before and after specimen collection, and gloves were used during the procedure. The catheter drainage tube was clamped with a padded hemostat until the urine was visible under the catheter sample port puncture site. The surface of the puncture site was cleansed with an alcohol wipe. A 22-gauge needle was inserted at an angle through the center of the insertion site for transport to the laboratory. Indwelling catheters were not changed at arbitrary fixed intervals. Instead, catheters were changed at the first indications of infection, mechanical obstruction, or leakage. Strict aseptic technique was used, and the entire system was changed at the same time. Patients were assessed daily for signs and symptoms of infection such as cloudy malodorous urine; complaints of suprapubic, back, or flank pain; and elevations in temperature or white blood cell count. Culturing of urine specimens was performed as ordered.

An order from a physician, nurse practitioner, or physician assistant was required to collect urine for culture. Specimens were collected by registered nurses or by nursing attendants or patient care technicians as instructed by a licensed professional. Hand hygiene was performed before and after specimen collection, and gloves were used during the procedure. The catheter drainage tube was clamped with a padded hemostat until the urine was visible under the catheter sample port puncture site. The surface of the puncture site was cleansed with an alcohol wipe. A 22-gauge needle was inserted at an angle through the center of the insertion site for transport to the laboratory. Indwelling catheters were not changed at arbitrary fixed intervals. Instead, catheters were changed at the first indications of infection, mechanical obstruction, or leakage. Strict aseptic technique was used, and the entire system was changed at the same time. Patients were assessed daily for signs and symptoms of infection such as cloudy malodorous urine; complaints of suprapubic, back, or flank pain; and elevations in temperature or white blood cell count. Culturing of urine specimens was performed as ordered.
The following gram-negative rods were identified in accordance with the Abbreviated Identification of Bacteria and Yeast; Approved Guideline—Second Edition of the Clinical and Laboratory Standards Institute**: Escherichia coli, Proteus species, and Pseudomonas aeruginosa. All other gram-negative rods were identified by using the VITEK 2 microbial identification system (bioMérieux).

For all gram-negative rods, antimicrobial susceptibility testing was performed by using the VITEK 2 microbial identification system (bioMérieux). Identification and susceptibility testing for all gram-positive organisms were performed by using the MicroScan WalkAway system (Beckman Coulter, Inc).

Blood Cultures

Blood culture bottles (Bactec Plus Aerobic, Plus Anaerobic Lytic, and Peds Plus) were loaded onto the BD Bactec FX blood culture system (Becton, Dickinson, and Co) within 30 minutes of arriving in the laboratory. Bottles were incubated at 35°C for up to 5 days before results were finalized as negative for microorganisms. A sensor identifies bottles positive for microorganisms by detecting fluorescent carbon dioxide captured by a filter on the bottom of the bottle.

Contents of positive blood culture bottles were inoculated onto 5% sheep blood agar, chocolate agar, and MacConkey agar plates (Becton, Dickinson, and Co) via a venting needle. If the anaerobic bottle was positive, a battery of anaerobic media was included. If yeast was observed on the Gram stain, CHROMagar candida and Sabouraud dextrose agar plates were added. Plates were incubated at 35°C in ambient air for 18 to 24 hours before being examined by a medical technologist. Anaerobic media were inoculated under anaerobic conditions, and plates were examined at 48 hours.

The following gram-negative rods were identified in accordance with the Abbreviated Identification of Bacteria and Yeast; Approved Guideline—Second Edition**: Escherichia coli, Proteus species, and Pseudomonas aeruginosa. All other gram-negative rods, as well as yeast, were identified by using the VITEK 2 microbial identification system (bioMérieux).

For all gram-negative rods, antimicrobial susceptibility testing was performed by using the VITEK 2 microbial identification system. Identification and susceptibility testing for all gram-positive organisms were performed by using the MicroScan WalkAway system (Beckman Coulter, Inc).

FINANCIAL DISCLOSURES

Laurie J. Conway was supported by Ruth L. Kirschstein National Research Service Award F31 NR014063, National Institute of Nursing Research.

REFERENCES


To purchase electronic or print reprints, contact American Association of Critical-Care Nurses, 101 Columbia, Aliso Viejo, CA 92656. Phone, (800) 899-1712 or (949) 362-2050 (ext 532); fax, (949) 362-2049; e-mail, reprints@aacn.org.

Notice to CE enrollees:
This article has been designated for CE contact hour(s). The evaluation tests your knowledge of the following objectives:

1. List factors that may increase the risk for bacteremia in acute care patients with catheter–associated bacteriuria.
2. Describe limitations common to case-control studies.
3. Discuss the implications of the study results for nursing practice regarding urinary catheter use in acute care patients with bacteriuria.

To complete evaluation for CE contact hour(s) for test #A1726013, visit www.ajcconline.org and click the “CE Articles” button. No CE test fee for AACN members. This test expires on January 1, 2019.

The American Association of Critical-Care Nurses is an accredited provider of continuing nursing education by the American Nurses Credentialing Center’s Commission on Accreditation. AACN has been approved as a provider of continuing education in nursing by the State Boards of Registered Nursing of California (#01036) and Louisiana (#LSBN12).
Background  Despite years of reducing tobacco use, few studies describe to what extent evidence-based tobacco-cessation interventions are a standard of acute and critical care nursing practice using the US Public Health Service 5 A’s framework: ask, advise, assess, assist, and arrange.

Objectives  To identify relationships between the 5 A’s framework, attributes of individual and organizational excellence, and intention to integrate tobacco-cessation interventions as a standard of daily practice among nurses.

Methods  Nurses attending the American Association of Critical-Care Nurses National Teaching Institute were invited to complete a 21-item survey. Data were gathered in Boston, Orlando, and Chicago in a 3-year period. Descriptive statistics and logistic regression were used for data analysis.

Results  Among 1773 completed surveys, nurses from organizations with standing orders for tobacco dependence were 5 times more likely to have high confidence in their 5 A’s skills (odds ratio, 5.037; 95% CI, 3.429-7.400; \( P < .001 \)) and 3.4 times more likely to have high intentions to integrate tobacco cessation into their daily practice (odds ratio, 3.421; 95% CI, 1.765-6.628; \( P < .001 \)). Nurses with certifications were more likely to want to learn how to integrate tobacco-cessation interventions (odds ratio, 1.676; 95% CI, 0.990-2.836; \( P = .05 \)).

Conclusions  Opportunities abound to create strategies leveraging attributes of nursing and organizational excellence to promote evidence-based approaches to improve health outcomes in acutely and critically ill tobacco-dependent populations. (American Journal of Critical Care. 2017;26:53-61)
Major advances in tobacco control resulted in the 50th anniversary celebration of the 1964 Surgeon General’s report on smoking and health; smoking prevalence in the United States was 42% in 1964, compared with 18% today. Despite this progress, approximately 45 million adults continue to smoke, contributing to poor health outcomes and escalating health care costs. Recent reports suggest that the projected 443,000 deaths attributable to cigarette smoking each year may be significantly underestimated.

Meeting the Healthy People 2020 goal of reducing cigarette use to less than 14% will continue to require substantial tobacco control efforts. More aggressive strategies in acute and critical care environments are needed to improve health outcomes related to tobacco dependence. Although evidence-based tobacco-cessation interventions exist in acute care settings and nurses are effective interventionists, interventions have not been widely adopted in practice.

Nurses in particular, as direct health care providers (HCPs), recognize the window of opportunity to intervene with critically ill patients whose health vulnerability creates a heightened awareness of the consequences of tobacco use. Almost half of all smokers (45%) attempt to quit for at least 1 day a year, signifying the important role that HCPs in acute care settings have to intervene effectively with evidence-based tobacco-cessation interventions. However, such interventions are effective only if adequate infrastructures are in place to ensure inpatient treatment and postdischarge follow-up.

The US Public Health Service (USPHS) recommends that all HCPs identify and treat tobacco users by integrating the evidence-based 5 A’s framework (ask [about tobacco use], advise [to quit], assess [readiness to quit], assist [plan to quit], arrange [follow-up to quit]). The USPHS guideline has a strong evidence base of more than 8,700 studies that led to recommendations that include system-level support for education, resources, and organizational policies, such as standing orders and feedback mechanisms, to promote tobacco cessation. Although most evidence related to the effectiveness of the 5 A’s framework has been in primary care settings, a few studies have been done in fast-paced acute care health environments. Best practices and systematic support to facilitate the delivery of tobacco-cessation interventions in acute and critical care populations are needed.

Studies of attributes of HCPs that are associated with the ability to affect tobacco-dependent populations have focused on barriers to effective and consistent interventions, including lack of education, role perceptions, perceived resources, and HCPs’ own tobacco dependence. Evidence of the value of training programs for acute care HCPs that include integration of the USPHS guideline (5 A’s) exist and not only improve self-perceived knowledge and confidence with tobacco-cessation interventions but increase intentions to integrate those interventions as a standard of nursing practice. The more we understand individual beliefs and values, the more we can design interventions, such as tobacco cessation, to effectively influence health outcomes at the individual level, organizational level, or both.

Definitions of attributes of excellence at an individual level can be wide and varied. At the American Association of Critical-Care Nurses (AACN), certification is the hallmark to validate nursing competency and promote continuing excellence in the nursing profession. Although the body of research related to the positive value of certified nursing practice among acute and critical care nurses is growing, no evidence to date supports the effect of critical care specialty certification on tobacco-cessation interventions. In addition, recognizing that more than...
87,000 nurses are certified through the AACN Certification Corporation in 9 different specialty areas, we are not aware of questions on board examinations that specifically address tobacco-cessation interventions. Definitions of attributes of excellence at an organizational level can be wide and varied as well. Organizational benchmarks of nursing excellence, such as the American Nurses Credentialing Center’s Magnet recognition or the AACN’s Beacon Award for Critical Care Nursing Excellence, may have a positive effect on tobacco-cessation interventions. Currently, 409 hospitals have earned Magnet recognition and 323 critical care units have been recognized with the Beacon Award. Although health care organizations may be pursuing different recognition paths for demonstrating excellence in nursing, there is a need to correlate system-level evidence-based strategies, such as policies and implementation of standing orders, for tobacco control.

Integration of evidence-based guidelines, such as the 5 A’s, is within the scope of practice of all nurses. Organizations that commit resources and integrate policies to support tobacco-cessation interventions in acute and critical care environments systemically should be rewarded for their efforts to address the leading preventable cause of death. Exploring relationships between tobacco-cessation interventions and attributes of individual and organizational excellence may help to identify best practices to adequately address tobacco-dependent populations in acute and critical care settings.

Objectives

The purpose of this study was to identify relationships between the 5 A’s framework, individual and organizational attributes of excellence, and intentions for integrating tobacco-cessation interventions as a standard of daily practice among nurses.

Methods

Design and Consent

This descriptive, correlational study design was approved by the University of Virginia’s institutional review board. From 2011 to 2013, nurses attending the AACN National Teaching Institute held in Boston, Orlando, and Chicago were invited to participate. Each National Teaching Institute consisted of a 3-day period of exhibits, where an average of 6000 nurses had the opportunity to visit the Nursing Leadership for Tobacco Control exhibit booth and be recruited for the study. A drawing was conducted each day for a $100 gift certificate to the AACN bookstore for those participants who completed the survey. Consent was implied when participants agreed to complete the survey. The study did not control for nurses responding from the same hospital/nursing unit or for nurses who had completed the survey in the past.

Survey

The 21-item, investigator-developed survey instrument for this study was based on the Theory of Reasoned Action and modified from previous studies. Most of the questions addressed individual nurse attributes and included 3 demographics: age, sex, and highest nursing degree. Four questions addressed professional attributes: position classification (staff, manager, educator, advanced practice registered nurse, researcher, other), type of unit (medical intensive care unit, intensive care unit, surgical intensive care, step-down unit, other), years of experience, and certification (yes/no) and type (CCRN, PCCN, ACNP, other). Six questions addressed self-perceived confidence in providing tobacco-cessation interventions: overall skills and each of the 5 A’s (ask, advise, assess, assist, and arrange). One question addressed the value of learning how to integrate effective tobacco-cessation interventions into practice, and 1 question addressed the intention to start integrating tobacco-cessation interventions into daily practice. The remaining 6 questions addressed organizational attributes: geographic location, hospital size, Magnet status, Beacon status, prescribed pharmacotherapy, and standing orders for tobacco cessation/nicotine withdrawal. The survey was found to be reliable (Cronbach’s α = 0.71) and took approximately 10 minutes to complete.

Data Analysis

Statistical analyses were performed using SPSS version 22 (IBM SPSS Inc). Data were examined for missing values, multicollinearity, and multivariate outliers. All assumptions were met. Descriptive statistics were used to report demographics; logistic regression models were used to examine relationships.

Separate multinomial logistic regression models were constructed for the nurses’ self-perceived (1) level of confidence in the ability to help patients quit tobacco, (2) value of learning to integrate effective tobacco-cessation interventions into practice, and (3) level of intention to begin incorporating tobacco-cessation interventions into practice. Variables for nursing certification and organizational attributes (Magnet status, Beacon status, standing orders for...
of the 1773 participants, not all responded to each demographic item. Values in
Abbreviations: APRN, advanced practice nurse; CNS, clinical nurse specialist; ICU, Other
PCCN
CCRN
Type of certification
In progress
No
Yes
Certificate nursing practice
Range
Sex
Female
Male
Highest nursing education
Associate degree
Bachelor's degree
Master's degree
Doctoral degree
Other
Nursing practice
Staff
Manager
Educator
APRN (NP or CNS)
Researcher
Other
Type of nursing unit
MICU/ICU
Cardiac ICU
Step-down
Telemetry
SICU
Other
Years of experience
Mean (SD)
Range
Certified nursing practice
Yes
No
In progress
Type of certification
CCRN
PCCN
Other
Abbreviations: APRN, advanced practice nurse; CNS, clinical nurse specialist; ICU, intensive care unit; MICU, medical ICU; NP, nurse practitioner; SICU, surgical ICU.
* Of the 1773 participants, not all responded to each demographic item. Values in the last 4 columns are number (percentage) of respondents unless otherwise indicated in first column.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>All years</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>46 (11.0)</td>
<td>47 (9.9)</td>
<td>45 (10.9)</td>
<td>46 (10.6)</td>
</tr>
<tr>
<td>Range</td>
<td>24-72</td>
<td>22-77</td>
<td>24-70</td>
<td>22-77</td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>666 (92.1)</td>
<td>401 (92.4)</td>
<td>543 (91.7)</td>
<td>1610 (90.8)</td>
</tr>
<tr>
<td>Male</td>
<td>57 (7.9)</td>
<td>33 (7.6)</td>
<td>49 (8.3)</td>
<td>139 (7.9)</td>
</tr>
<tr>
<td><strong>Highest nursing education</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Associate degree</td>
<td>135 (18.5)</td>
<td>104 (23.9)</td>
<td>73 (12.4)</td>
<td>312 (17.8)</td>
</tr>
<tr>
<td>Bachelor's degree</td>
<td>345 (47.3)</td>
<td>235 (54.0)</td>
<td>308 (52.3)</td>
<td>888 (50.7)</td>
</tr>
<tr>
<td>Master's degree</td>
<td>179 (24.6)</td>
<td>89 (20.5)</td>
<td>162 (27.5)</td>
<td>430 (24.5)</td>
</tr>
<tr>
<td>Doctoral degree</td>
<td>3 (0.4)</td>
<td>4 (0.9)</td>
<td>15 (2.5)</td>
<td>22 (1.3)</td>
</tr>
<tr>
<td>Other</td>
<td>67 (9.2)</td>
<td>3 (0.7)</td>
<td>31 (5.3)</td>
<td>101 (5.8)</td>
</tr>
<tr>
<td><strong>Nursing practice</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Staff</td>
<td>482 (66.9)</td>
<td>309 (71.9)</td>
<td>392 (67.1)</td>
<td>1198 (68.2)</td>
</tr>
<tr>
<td>Manager</td>
<td>138 (19.2)</td>
<td>44 (10.2)</td>
<td>111 (19.0)</td>
<td>293 (16.9)</td>
</tr>
<tr>
<td>Educator</td>
<td>56 (7.8)</td>
<td>48 (11.2)</td>
<td>47 (8.0)</td>
<td>151 (8.5)</td>
</tr>
<tr>
<td>APRN (NP or CNS)</td>
<td>33 (4.6)</td>
<td>21 (4.9)</td>
<td>22 (3.8)</td>
<td>76 (4.4)</td>
</tr>
<tr>
<td>Researcher</td>
<td>0 (0)</td>
<td>1 (0.2)</td>
<td>1 (0.2)</td>
<td>2 (0.1)</td>
</tr>
<tr>
<td>Other</td>
<td>11 (1.5)</td>
<td>7 (1.6)</td>
<td>11 (1.9)</td>
<td>29 (1.7)</td>
</tr>
<tr>
<td><strong>Type of nursing unit</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MICU/ICU</td>
<td>364 (51.1)</td>
<td>194 (45.4)</td>
<td>287 (50.1)</td>
<td>845 (49.4)</td>
</tr>
<tr>
<td>Cardiac ICU</td>
<td>47 (6.6)</td>
<td>62 (14.5)</td>
<td>47 (8.2)</td>
<td>156 (9.1)</td>
</tr>
<tr>
<td>Step-down</td>
<td>37 (5.2)</td>
<td>34 (8.0)</td>
<td>17 (3.0)</td>
<td>88 (5.1)</td>
</tr>
<tr>
<td>Telemetry</td>
<td>57 (8.0)</td>
<td>39 (9.1)</td>
<td>39 (6.8)</td>
<td>135 (7.9)</td>
</tr>
<tr>
<td>SICU</td>
<td>34 (4.8)</td>
<td>22 (5.2)</td>
<td>29 (5.1)</td>
<td>85 (5.0)</td>
</tr>
<tr>
<td>Other</td>
<td>173 (2.5)</td>
<td>76 (17.8)</td>
<td>154 (26.9)</td>
<td>403 (23.5)</td>
</tr>
<tr>
<td><strong>Years of experience</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>15.9 (10.3)</td>
<td>17.82 (11.3)</td>
<td>17.23 (11.0)</td>
<td>16.81 (10.8)</td>
</tr>
<tr>
<td>Range</td>
<td>1-70</td>
<td>1-60</td>
<td>1-49</td>
<td>1-70</td>
</tr>
<tr>
<td><strong>Certified nursing practice</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>417 (59.5)</td>
<td>281 (65.5)</td>
<td>394 (68.6)</td>
<td>1092 (64.1)</td>
</tr>
<tr>
<td>No</td>
<td>207 (29.5)</td>
<td>96 (22.4)</td>
<td>144 (25.1)</td>
<td>447 (26.2)</td>
</tr>
<tr>
<td>In progress</td>
<td>77 (11.0)</td>
<td>52 (12.1)</td>
<td>36 (6.3)</td>
<td>165 (9.7)</td>
</tr>
<tr>
<td><strong>Type of certification</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CCRN</td>
<td>352 (74.3)</td>
<td>273 (85.3)</td>
<td>339 (81.3)</td>
<td>964 (79.6)</td>
</tr>
<tr>
<td>PCCN</td>
<td>42 (8.9)</td>
<td>31 (9.7)</td>
<td>36 (8.6)</td>
<td>109 (9.0)</td>
</tr>
<tr>
<td>Other</td>
<td>80 (16.9)</td>
<td>16 (5.0)</td>
<td>42 (10.1)</td>
<td>138 (11.4)</td>
</tr>
</tbody>
</table>

tobacco cessation) were dichotomized (no versus yes/in process), with no as the referent group. Age category was dichotomized into Generation X (30-45 years) and Generation Y (20-30 years) compared with the Silent Generation (>65 years) and Baby Boomers (45-65 years). Levels of confidence were categorized as no/low levels, average, and above average/high levels.

Predictors in the first set of models included individual attributes (age category of the nurse, highest nursing degree, and position [staff, manager, educator, nurse practitioner/advanced practice nurse]) and organizational attributes (hospital size [≤ 200 beds, 201-500 beds, > 500 beds], Magnet status, Beacon status, standing orders for tobacco cessation or nicotine withdrawal). Predictors in the second set of models included the 5 A’s (ask, advise, assess, assist, arrange) and standing orders for tobacco cessation or nicotine withdrawal. Alpha was set at .05 for significance; Akaike’s information criterion was used to assess model fit.

**Results**

**Participants’ Demographics**

During the recruitment period (2011-2013), 1773 surveys were completed by nurses who met the inclusion criteria (Table 1). Recruitment efforts ranged from 436 in Orlando (2012) to 744 in Boston (2011). Overall, the majority were female (91%) working as staff nurses in medical intensive care units (49%) and from hospitals with 201 to 500 beds (47%). The sample ranged in age from 22 to 77 years with a mean of 17 years of nursing experience. Seventy-seven percent had a baccalaureate degree or higher in nursing; 64% were certified in a specialty area. Thirty-three percent worked in Magnet-designated hospitals, 25% worked in Beacon units, and 66% worked in organizations with standing orders to treat tobacco-dependent populations.

**Confidence with the 5 A’s**

Frequency data were examined for overall level of the nurse’s self-perceived confidence in providing tobacco-cessation interventions (the 5 A’s) on a Likert scale of 1 to 5 (with 1 = no confidence and 5 = high confidence). Collapsing data into 3 broad categories for descriptive analysis revealed 24% (n = 420) had no confidence or a low level of confidence, 50% (n = 872) had an average level of confidence, and 26% (n = 452) had an above average or high level of confidence.

Overall individual nurse characteristics and the 5 A’s revealed no significant differences in terms of educational preparation and confidence in tobacco-cessation skills (Table 2). Staff nurses had lower levels of overall confidence in helping patients quit compared with managers, educators, researchers, and advanced practice nurses (odds ratio, 0.557; 95% CI, 0.319-0.973; P = .04). Generations X (age, 30-45 years) and Y (age, 20-30 years) were more likely to have above average or high levels of confidence in helping patients to quit compared with the Baby Boomers (age, 45-65 years) and Silent Generation (age > 65 years) (odds ratio, 1.67; 95%
Nurses having higher levels of confidence with the ask, assist, and arrange skills of the 5 A’s were more likely to have confidence in their overall abilities to help patients to quit (Table 2).

Nurses from organizations with established standing orders for tobacco cessation or nicotine withdrawal or in progress of implementing such orders were almost 5 times more likely to have above average or high levels of confidence (odds ratio, 5.037; 95% CI, 3.429-7.400; P<.001) in their skills to help patients to quit tobacco use compared with nurses at hospitals without standing orders (Table 2). Although not statistically significant (P = .09), nurses from organizations with Beacon units or in the process of earning Beacon recognition were more likely to have above average or high levels of confidence in helping patients to quit tobacco use.

**Value of Learning Effective Interventions**

Frequency data were examined for the value of learning how to integrate effective tobacco-cessation interventions into daily practice (on a Likert scale of 1 to 5 with 1 = no value and 5 = high value). Collapsing data into 3 broad categories for descriptive analysis revealed that 6% of respondents (n = 105) perceived no value or a low level of value of learning, 27% (n = 475) perceived an average level of value of learning, and 67% (n = 1161) perceived an above average or a high level of value of learning.

When asked about the value of learning how to integrate the 5 A’s into daily practice effectively (Table 3), nurses with a certified practice were more likely to highly value learning effective interventions compared with nurses without certification (odds ratio, 1.676; 95% CI, 0.990-2.836; P = .05). Nurses with master’s or doctoral degrees (Table 3) were more likely to highly value learning effective interventions than were nurses with associate and bachelor’s degrees (odds ratio, 1.969; 95% CI, 1.088-3.561; P = .008).

**Intentions to Integrate the 5 A’s**

Frequency data were examined for overall level of intentions to start integrating tobacco-cessation interventions in daily practice (on a Likert scale of 1 to 5 with 1 = no intention and 5 = high intention). Collapsing data into 3 broad categories for descriptive analysis revealed that 7% (n = 67) had no intention or a low level of intention to integrate tobacco-cessation interventions in daily practice, 32% (n = 331) had an average level of intention, and 61% (n = 620) had above average to high levels of intention. Nurses with above average or high levels of confidence with the “assess” skill of the 5 A’s were approximately 4 times more likely to integrate effective tobacco-cessation interventions (odds ratio, 4.280; 95% CI, 1.380-13.270; P = .01) into their practice (Table 4).

Nurses at hospitals with standing orders for tobacco cessation or nicotine withdrawal in place or in the process of implementation (Table 4) were 3.5 times more likely to have above average or high levels of intention to start integrating tobacco-cessation interventions into their daily practice compared with nurses at hospitals without standing orders (odds ratio, 3.421; 95% CI, 1.765-6.628, P<.001). No significant differences in the intentions of nurses to integrate tobacco-cessation interventions into daily practice were found for organizations with Magnet or Beacon status.

---

### Table 2

**Attributes associated with confidence in skills to help patients quit tobacco use**

<table>
<thead>
<tr>
<th>Variable</th>
<th>B</th>
<th>SE</th>
<th>P</th>
<th>Odds ratio</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital size, beds</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ 200</td>
<td>-0.183</td>
<td>0.251</td>
<td>.46</td>
<td>0.833</td>
<td>0.510-1.361</td>
</tr>
<tr>
<td>201-500</td>
<td>-0.079</td>
<td>0.201</td>
<td>.89</td>
<td>0.924</td>
<td>0.623-1.369</td>
</tr>
<tr>
<td>&gt; 500</td>
<td>Ref</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Magnet status</td>
<td>0.165</td>
<td>0.185</td>
<td>.37</td>
<td>1.179</td>
<td>0.821-1.693</td>
</tr>
<tr>
<td>Beacon status</td>
<td>0.329</td>
<td>0.193</td>
<td>.09</td>
<td>1.389</td>
<td>0.952-2.027</td>
</tr>
<tr>
<td>Tobacco treatment orders</td>
<td>1.617</td>
<td>0.196</td>
<td>&lt;.001</td>
<td>5.037</td>
<td>3.429-7.400</td>
</tr>
<tr>
<td>Age category</td>
<td>0.468</td>
<td>0.175</td>
<td>.008</td>
<td>1.670</td>
<td>1.133-2.249</td>
</tr>
<tr>
<td>Degree category</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Associate</td>
<td>-0.444</td>
<td>0.270</td>
<td>.10</td>
<td>0.642</td>
<td>0.378-1.090</td>
</tr>
<tr>
<td>Bachelor’s</td>
<td>-0.308</td>
<td>0.214</td>
<td>.15</td>
<td>0.735</td>
<td>0.483-1.118</td>
</tr>
<tr>
<td>Master’s/doctorate</td>
<td>Ref</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Position</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Staff</td>
<td>-0.585</td>
<td>0.284</td>
<td>.04</td>
<td>0.557</td>
<td>0.319-0.973</td>
</tr>
<tr>
<td>Manager</td>
<td>-0.594</td>
<td>0.319</td>
<td>.06</td>
<td>0.552</td>
<td>0.295-1.031</td>
</tr>
<tr>
<td>Educator/NP/APRN</td>
<td>Ref</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Certification</td>
<td>0.051</td>
<td>0.193</td>
<td>.79</td>
<td>1.053</td>
<td>0.721-1.536</td>
</tr>
<tr>
<td>Ask about tobacco use</td>
<td>1.582</td>
<td>0.327</td>
<td>&lt;.001</td>
<td>4.864</td>
<td>2.562-9.236</td>
</tr>
<tr>
<td>Advise not to use tobacco</td>
<td>-0.436</td>
<td>0.415</td>
<td>.29</td>
<td>0.647</td>
<td>0.286-1.460</td>
</tr>
<tr>
<td>Assess if ready to quit</td>
<td>0.685</td>
<td>0.359</td>
<td>.06</td>
<td>1.984</td>
<td>0.982-4.011</td>
</tr>
<tr>
<td>Assist with quitting</td>
<td>1.510</td>
<td>0.351</td>
<td>&lt;.001</td>
<td>4.526</td>
<td>2.275-9.007</td>
</tr>
<tr>
<td>Arrange follow-up about tobacco use</td>
<td>1.334</td>
<td>0.298</td>
<td>&lt;.001</td>
<td>3.797</td>
<td>2.118-6.805</td>
</tr>
</tbody>
</table>

Abbreviations: APRN, advanced practice nurse; NP, nurse practitioner; Ref, referent.

a Akaike information criterion (AIC) = 1408.35; Nagelkerke $R^2$ = 0.099; overall classification = 50.2%; referent group: no or low level of confidence.

b Referent group for Magnet status, Beacon status, and tobacco treatment orders is no versus yes or in process.

c Referent group for age category is Generations X and Y versus Silent Generation and Baby Boomers.

d Referent group for certification is no versus yes or in process.
attributes of individual and organizational excellence, and intentions for integrating tobacco-cessation intervention in acute and critical care nursing practice. Our findings support the need for continued efforts in educating nurses, creating organizational infrastructure support, and setting the expectation that tobacco-cessation interventions are just as critical in providing high-quality care as interventions to manage pain or diabetes. The journey to create a culture where nurses have the confidence, preparation, and support to intervene effectively with tobacco-dependent populations as a standard of daily practice must be embraced with reinforced recognition that inpatient hospitalization provides a “teachable moment” for patients who use tobacco.11

### Confidence to Integrate the 5 A’s

Findings related to confidence associated with tobacco-cessation interventions were notable with respect to several individual and organizational attributes. From an individual perspective, higher confidence to help patients quit was associated with younger age, whereas staff nurses were less likely to have high levels of confidence in helping patients quit. Although evidence from more than a decade ago indicates that nursing curricula are lacking in educational content related to tobacco-cessation interventions,12–14 younger nurses may have had more exposure to curricula that address tobacco prevention and treatment. In addition, younger nurses may live and/or work in regions with stronger advocacy and regulation for tobacco control compared with older nurses. Additionally, there is a cultural shift toward the banning of smoking in public spaces, which has been the norm for younger nurses during their lifetimes, unlike their older peers.

Staff nurses had lower levels of confidence to help patients quit smoking compared with managers and educators. A potential explanation is that staff nurses may feel that they lack the knowledge base to deliver such interventions effectively. Nurses having above average or high levels of confidence with the “ask,” “assist,” and “arrange” skills of the 5 A’s were 4 times more likely to have confidence in their abilities to help patients to quit. More research is needed with the 5 A’s, especially recognizing that nurses had higher levels of intention to integrate tobacco-cessation interventions in daily practice when they felt more confident with the “assess readiness to quit” skill.

Confidence, from an organizational perspective, was significantly associated with established standing orders for tobacco cessation or nicotine withdrawal.

#### Table 3

<table>
<thead>
<tr>
<th>Variable</th>
<th>B</th>
<th>SE</th>
<th>P</th>
<th>Odds ratio</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Above average/high level of value</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hospital size, beds ≤ 200</td>
<td>-0.537</td>
<td>0.354</td>
<td>.13</td>
<td>0.584</td>
<td>0.292-1.169</td>
</tr>
<tr>
<td>201-500</td>
<td>-0.105</td>
<td>0.312</td>
<td>.74</td>
<td>0.900</td>
<td>0.488-1.659</td>
</tr>
<tr>
<td>&gt; 500</td>
<td>Ref</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Magnet status</td>
<td>0.099</td>
<td>0.277</td>
<td>.72</td>
<td>1.104</td>
<td>0.641-1.899</td>
</tr>
<tr>
<td>Beacon status</td>
<td>-0.064</td>
<td>0.289</td>
<td>.83</td>
<td>0.938</td>
<td>0.532-1.654</td>
</tr>
<tr>
<td>Orders</td>
<td>0.640</td>
<td>0.256</td>
<td>.01</td>
<td>1.897</td>
<td>1.150-3.130</td>
</tr>
<tr>
<td>Age category</td>
<td>0.114</td>
<td>0.260</td>
<td>.66</td>
<td>1.121</td>
<td>0.673-1.867</td>
</tr>
<tr>
<td>Degree category</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Associate</td>
<td>0.793</td>
<td>0.389</td>
<td>.04</td>
<td>2.211</td>
<td>1.032-4.737</td>
</tr>
<tr>
<td>Bachelor’s</td>
<td>0.677</td>
<td>0.302</td>
<td>.02</td>
<td>1.969</td>
<td>1.088-3.561</td>
</tr>
<tr>
<td>Master’s/doctorate</td>
<td>Ref</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Position</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Staff</td>
<td>-0.085</td>
<td>0.382</td>
<td>.82</td>
<td>0.918</td>
<td>0.434-1.943</td>
</tr>
<tr>
<td>Manager</td>
<td>0.145</td>
<td>0.446</td>
<td>.74</td>
<td>1.157</td>
<td>0.482-2.774</td>
</tr>
<tr>
<td>Educator/NP/APRN</td>
<td>Ref</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Certification</td>
<td>0.516</td>
<td>0.268</td>
<td>.05</td>
<td>1.676</td>
<td>0.990-2.836</td>
</tr>
<tr>
<td>Average level of value</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hospital size, beds ≤ 200</td>
<td>-0.180</td>
<td>0.374</td>
<td>.63</td>
<td>0.835</td>
<td>0.401-1.739</td>
</tr>
<tr>
<td>201-500</td>
<td>0.117</td>
<td>0.329</td>
<td>.72</td>
<td>1.125</td>
<td>0.590-2.143</td>
</tr>
<tr>
<td>&gt; 500</td>
<td>Ref</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Magnet status</td>
<td>0.060</td>
<td>0.291</td>
<td>.84</td>
<td>1.062</td>
<td>0.600-1.881</td>
</tr>
<tr>
<td>Beacon status</td>
<td>0.001</td>
<td>0.304</td>
<td>&gt; .99</td>
<td>1.001</td>
<td>0.551-1.817</td>
</tr>
<tr>
<td>Orders</td>
<td>0.377</td>
<td>0.270</td>
<td>.16</td>
<td>1.457</td>
<td>0.859-2.473</td>
</tr>
<tr>
<td>Age category</td>
<td>0.006</td>
<td>0.274</td>
<td>.98</td>
<td>1.006</td>
<td>0.588-1.722</td>
</tr>
<tr>
<td>Degree category</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Associate</td>
<td>0.352</td>
<td>0.420</td>
<td>.40</td>
<td>1.421</td>
<td>0.624-3.236</td>
</tr>
<tr>
<td>Bachelor’s</td>
<td>0.881</td>
<td>0.321</td>
<td>.006</td>
<td>2.414</td>
<td>1.287-4.528</td>
</tr>
<tr>
<td>Master’s/doctorate</td>
<td>Ref</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Position</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Staff</td>
<td>0.058</td>
<td>0.406</td>
<td>.89</td>
<td>1.059</td>
<td>0.478-2.350</td>
</tr>
<tr>
<td>Manager</td>
<td>-0.242</td>
<td>0.482</td>
<td>.62</td>
<td>0.785</td>
<td>0.305-2.019</td>
</tr>
<tr>
<td>Educator/NP/APRN</td>
<td>Ref</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Certification</td>
<td>0.389</td>
<td>0.283</td>
<td>.17</td>
<td>1.475</td>
<td>0.847-2.570</td>
</tr>
</tbody>
</table>

Abbreviations: APRN, advanced practice nurse; NP, nurse practitioner; Ref, referent.
A Akaike information criterion (AIC) = 1145.1; Nagelkerke $R^2$ = 0.048; overall classification = 66.9%; referent group: no or low level of value.
B Referent group for Magnet status, Beacon status and orders is no versus yes or in process.
C Referent group for age category is Generations X and Y versus Silent Generation and Baby Boomers.
D Referent group for certification is no versus yes or in process.
Although practice guideline recommendations such as standing orders continue to be variably adopted, they have been used successfully for immunizations and pain control. Standing orders provide infrastructure for effective delivery of tobacco-cessation interventions; adding education and prompting related to pharmacological interventions further enhances the support provided by standing orders.

Preparation to Integrate the 5 A’s

Findings related to preparation to intervene effectively with tobacco-dependent populations were predominately notable at the individual level. Certified nurses are twice as likely to value learning how to integrate effective tobacco interventions in daily practice at above average or high levels. Because intense preparation is required to earn and maintain board certification, the notion of life-long learning may be reinforced with certified nurses to promote excellent care delivery. This study is the first to evaluate the impact of critical care specialty certification on tobacco-cessation interventions. This association may also be related to our finding that nurses on Beacon-designated units have higher levels of confidence with the “assess readiness to quit” skill. Nurses with no/low levels of tobacco-cessation interventions into daily practice

Support to Integrate the 5 A’s

Findings most notably related to the overall support associated with tobacco-cessation interventions included 1 individual attribute and 2 organizational attributes. Sixty-one percent of nurses had above average/high levels of intention to integrate the 5 A’s into daily practice; 7% had no/low levels of intent. Intention was higher with presence of standing orders and with confidence with the “assess readiness to quit” skill. Nurses with no/low levels of intention to integrate the 5 A’s into daily practice put hospitals at risk for not meeting national quality standards and measures for tobacco-dependent populations. Recognizing that nurse clinicians receive limited tobacco-cessation education and that nurses who do are more likely to intervene with tobacco-dependent populations emphasizes the value of education and organizational resources.

The 2 organizational attributes evaluated in this study for nursing excellence, Magnet and/or Beacon designation, did not yield statistically significant results. However, it is of clinical significance

### Table 4

<table>
<thead>
<tr>
<th>Attribute</th>
<th>B</th>
<th>SE</th>
<th>p</th>
<th>Odds ratio</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital size, beds</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ 200</td>
<td>0.018</td>
<td>0.464</td>
<td>.97</td>
<td>1.018</td>
<td>0.410-2.527</td>
</tr>
<tr>
<td>&gt; 200</td>
<td>0.286</td>
<td>0.386</td>
<td>.46</td>
<td>1.330</td>
<td>0.624-2.835</td>
</tr>
<tr>
<td>Magnet status</td>
<td>-0.116</td>
<td>0.366</td>
<td>.75</td>
<td>0.891</td>
<td>0.434-1.826</td>
</tr>
<tr>
<td>Beacon status</td>
<td>0.266</td>
<td>0.383</td>
<td>.49</td>
<td>1.430</td>
<td>0.615-2.765</td>
</tr>
<tr>
<td>Tobacco treatment orders</td>
<td>1.230</td>
<td>0.337</td>
<td>&lt;.001</td>
<td>3.421</td>
<td>1.765-6.628</td>
</tr>
<tr>
<td>Age category</td>
<td>0.273</td>
<td>0.335</td>
<td>.42</td>
<td>1.314</td>
<td>0.681-2.535</td>
</tr>
<tr>
<td>Degree category</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Associate</td>
<td>0.424</td>
<td>0.576</td>
<td>.46</td>
<td>1.529</td>
<td>0.494-4.729</td>
</tr>
<tr>
<td>Bachelor’s</td>
<td>-0.019</td>
<td>0.430</td>
<td>.96</td>
<td>0.981</td>
<td>0.423-2.276</td>
</tr>
<tr>
<td>Master’s/doctorate</td>
<td>Ref</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Position</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Staff</td>
<td>-0.179</td>
<td>0.510</td>
<td>.73</td>
<td>0.836</td>
<td>0.308-2.273</td>
</tr>
<tr>
<td>Manager</td>
<td>0.460</td>
<td>0.676</td>
<td>.50</td>
<td>1.584</td>
<td>0.421-5.958</td>
</tr>
<tr>
<td>Educator/NP/APRN</td>
<td>Ref</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Certification</td>
<td>-0.054</td>
<td>0.402</td>
<td>.89</td>
<td>0.947</td>
<td>0.431-2.084</td>
</tr>
<tr>
<td>Ask about tobacco use</td>
<td>0.966</td>
<td>0.463</td>
<td>.04</td>
<td>2.627</td>
<td>1.061-6.505</td>
</tr>
<tr>
<td>Advise not to use tobacco</td>
<td>0.232</td>
<td>0.526</td>
<td>.66</td>
<td>1.261</td>
<td>0.450-3.537</td>
</tr>
<tr>
<td>Assess if ready to quit</td>
<td>1.454</td>
<td>0.577</td>
<td>.01</td>
<td>4.280</td>
<td>1.380-13.270</td>
</tr>
<tr>
<td>Assist with quitting</td>
<td>0.306</td>
<td>0.670</td>
<td>.65</td>
<td>1.358</td>
<td>0.365-5.045</td>
</tr>
<tr>
<td>Arrange follow-up about tobacco use</td>
<td>1.106</td>
<td>0.688</td>
<td>.11</td>
<td>3.024</td>
<td>0.786-11.637</td>
</tr>
</tbody>
</table>

Abbreviations: APRN, advanced practice nurse; NP, nurse practitioner; Ref, referent. A Referent group for Magnet status, Beacon status, and orders is no versus yes or in process. B Referent group for age category is Generations X and Y versus Silent Generation. C Referent group for certification is no versus yes or in process. D Referent group for certification is no versus yes or in process. AIC: 730.15; Nagelkerke R² = 0.092; overall classification = 62.5%; referent group: no or low level of intention. B Referent group for Magnet status, Beacon status, and orders is no versus yes or in process. C Referent group for age category is Generations X and Y versus Silent Generation and Baby Boomers. D Referent group for certification is no versus yes or in process. E AIC: 608.2; Nagelkerke R² = 0.026; overall classification = 64.5%; referent group: no or low level of intention.
Nurses in Beacon units were 1.5 times more confident in their overall skills to help patients quit using tobacco.

that nurses were 1.5 times more confident in their overall skills to help patients quit tobacco if they were in environments with Beacon status. Working in a unit with such standards may help to explain nurses’ increased confidence in using the 5 A’s. Although Beacon status was not a statistically significant predictor \(P = .09\), creating a path for recognition of nursing excellence may be instrumental in changing the standard of practice for interventions with tobacco-dependent populations.

Regardless of the organization’s vision for exceptional nursing care, improved outcomes, patient satisfaction, education emphasis, evidence-based practice, research, and establishing healing environments; health care organizations must provide infrastructure for effective tobacco cessation to occur. Although not a part of this study, evidence indicates that HCPs who use tobacco are less likely to intervene and that broader organizational support is needed to help with provider cessation efforts.\(^{11,40}\)

Limitations

Limitations include the inability to generalize results to the general nursing population. The study did not control for nurses responding from the same hospital/nursing unit or those who had completed the survey in the past. The survey did not ask about nurses’ prior awareness of the 5 A’s framework, whether there was a tobacco-dependence treatment program/specialist in their system, or if they were tobacco-dependence treatment specialists themselves. Participants who visited the booth and completed the survey could have had more interest in tobacco cessation than did visitors who did not participate in the survey.

Conclusion

Gaps exist in implementation of evidence-based strategies to treat tobacco dependence in acute and chronically ill patients. Health care systems with standing orders for tobacco-dependence treatment were significantly associated with increased levels of confidence for nurses to intervene effectively. Opportunities exist to reduce and/or eliminate the barriers for nurses to provide tobacco-cessation interventions. Educational and organizational strategies can create a culture in which attributes of excellence are leveraged to improve health outcomes in acute and critically ill tobacco-dependent populations.

ACKNOWLEDGMENTS

The authors thank the exceptional nurses who attend the AACN National Teaching Institute and Critical Care Exposition and visit the Nursing Leadership for Tobacco Control booth to enhance their knowledge and commitment for optimizing the care for acute and critically ill populations. We thank research team members, Larry Lassiter, DNP; Jessica Denomme, BSN; and Della Marsh, BS, for their assistance with this study.

REFERENCES


To purchase electronic or print reprints, contact American Association of Critical-Care Nurses, 101 Columbia, Aliso Viejo, CA 92656. Phone, (800) 899-1712 or (949) 362-2050 (ext 532); fax, (949) 362-2049; e-mail, reprints@aacn.org.
PREHOSPITAL DELAY, PRECIPITANTS OF ADMISSION, AND LENGTH OF STAY IN PATIENTS WITH EXACERBATION OF HEART FAILURE

By Jia-Rong Wu, RN, PhD, Kyoung Suk Lee, RN, PhD, Rebecca D. Dekker, RN, PhD, J. Darlene Welsh, RN, PhD, Eun Kyeung Song, RN, PhD, Demetrius A. Abshire, RN, PhD, Terry A. Lennie, RN, PhD, and Debra K. Moser, RN, PhD

**Background**  Factors that precipitate hospitalization for exacerbation of heart failure provide targets for intervention to prevent hospitalizations.

**Objectives**  To describe demographic, clinical, behavioral, and psychosocial factors that precipitate admission for exacerbation of heart failure and assess the relationships between precipitating factors and delay before hospitalization, and between delay time and length of hospital stay.

**Methods**  All admissions in 12 full months to a tertiary medical center were reviewed if the patient had a discharge code related to heart failure. Data on confirmed admissions for exacerbation of heart failure were included in the study. Electronic and paper medical records were reviewed to identify how long it took patients to seek care after they became aware of signs and symptoms, factors that precipitated exacerbation, and discharge details.

**Results**  Exacerbation of heart failure was confirmed in 482 patients. Dyspnea was the most common symptom (92.5% of patients), and 20.3% of patients waited until they were severely dyspneic before seeking treatment. The most common precipitating factor was poor medication adherence. Delay times from symptom awareness to seeking treatment were shorter in patients who had a recent change in medicine for heart failure, renal failure, or poor medication adherence and longer in patients with depressive symptoms and hypertension.

**Conclusions**  Depressive symptoms, recent change in heart failure medicine, renal failure, poor medication adherence, and hypertension are risk factors for hospitalizations for exacerbation of heart failure. (American Journal of Critical Care. 2017;26:62-69)
The clinical course of heart failure is characterized by frequent exacerbations that lead to visits to an emergency department, hospitalizations, or even death. Because of the high cost and public health impact of this complication, identification of factors that precipitate hospitalization for exacerbation of heart failure could provide targets for interventions to decrease high hospitalization rates. Demographic (eg, old age), clinical (eg, previous hospitalizations, comorbid conditions), psychosocial (eg, poor social support), and behavioral (eg, poor adherence to medication or to a low-sodium diet) factors have been identified as precipitating factors of readmission for exacerbation of heart failure. In none of these studies, however, have demographic, clinical, behavioral, and psychosocial factors been analyzed together, thus limiting the ability to define independent predictors of readmission.

Many patients with worsening heart failure and escalating signs and symptoms delay seeking medical advice or treatment that could prevent rehospitalization or a prolonged stay in the emergency department. Shorter delay in seeking early medical advice or treatment is associated with fewer or less intense signs and symptoms, shorter treatment time in the emergency department, shorter stays in intensive care units, shorter hospital stays, lower mortality, and better quality of life. Few studies have been done on factors associated with delay in seeking care for escalating signs and symptoms in patients with heart failure. Similarly, few investigators have examined the relationship between prehospital delay and length of hospital stay. Accordingly, the purposes of our study were to describe demographic, clinical, behavioral, and psychosocial factors that precipitate admission for exacerbation of heart failure among patients who delay seeking care; determine the relationship between the precipitating factors and delay time from symptom awareness to seeking medical care; and determine the relationship between prehospital delay time and length of hospital stay.

Methods

Design and Sample
The study was a retrospective chart review of data on patients admitted during 1 year (January 1 through December 31, 2009) to a tertiary referral medical center consisting of 2 separate hospitals. Data were screened for inclusion if they had a International Classification of Diseases, Ninth Revision discharge code related to heart failure (428.0-428.4, 428.9, 429.3, 425.0-425.9). The appropriate institutional review board approved an exemption from obtaining informed consent from patients whose data were reviewed. In addition to data with the appropriate ICD-9 codes, admission data were included in the study if an exacerbation of heart failure was the primary or secondary cause of admission that either met the Framingham criteria for exacerbation of heart failure or resulted in the patient receiving treatment for exacerbation of heart failure. Adjudication by heart failure experts was done when necessary. Only data on patients with a history of heart failure were included.

Measurement
Electronic and paper medical records were reviewed to identify signs and symptoms experienced before the patients sought treatment, responses to worsening signs and symptoms by patients and caregivers, factors that precipitated hospital admission for exacerbation of heart failure, medication regimen before admission, and discharge details. The

Shorter delay in seeking early medical advice or treatment for worsening heart failure is associated with better outcomes.
Table 1
Characteristics of 482 patients in the sample

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Valuea</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, mean (SD), y</td>
<td>62 (15)</td>
</tr>
<tr>
<td>Age ≥ 65 years</td>
<td>203 (42)</td>
</tr>
<tr>
<td>Male</td>
<td>272 (56)</td>
</tr>
<tr>
<td>Living at home alone</td>
<td>87 (18)</td>
</tr>
<tr>
<td>Unmarried</td>
<td>250 (52)</td>
</tr>
<tr>
<td>White</td>
<td>375 (78)</td>
</tr>
<tr>
<td>Body mass index,b mean (SD)</td>
<td>31.5 (9.2)</td>
</tr>
<tr>
<td>Charlson Comorbidity Index, mean (SD)</td>
<td>6.0 (7.9)</td>
</tr>
<tr>
<td>Left ventricular ejection fraction, mean (SD), %</td>
<td>43.7 (27.0)</td>
</tr>
<tr>
<td>Left ventricular ejection fraction ≥ 40%</td>
<td>221 (46)</td>
</tr>
<tr>
<td>Use of angiotensin-converting enzyme inhibitor (before admission)</td>
<td>223 (46)</td>
</tr>
<tr>
<td>β-Blocker use (before admission)</td>
<td>306 (63)</td>
</tr>
<tr>
<td>Delay time, mean (SD), days</td>
<td>15.7 (51.6)</td>
</tr>
<tr>
<td>Length of hospital stay, mean (SD), days</td>
<td>7.2 (13.0)</td>
</tr>
<tr>
<td>Number of signs or symptoms before seeking treatment, mean (SD)</td>
<td>5.1 (2.2)</td>
</tr>
<tr>
<td>Number of precipitating factors, mean (SD)</td>
<td>2.1 (1.3)</td>
</tr>
</tbody>
</table>

a Values are number (percentage) of patients unless otherwise specified in the first column.
b Calculated as weight in kilograms divided by height in meters squared.

disagreements to ensure 100% agreement. Data collectors met weekly throughout the chart review period to discuss records that were difficult to interpret or had conflicting data.

Delay time was defined as the time from first awareness of a sign or symptom of heart failure (eg, shortness of breath) to seeking treatment (patients reached hospital for seeking medical care) and was calculated from symptom awareness to emergency department arrival time as documented in the history and physical examination. Length of stay during the index hospitalization was calculated as the time from emergency department arrival to hospital discharge.

Data Analysis
SPSS, version 23.0, software (IBM) was used for data analysis; *P* less than .05 was considered significant. Patient characteristics, time from symptom awareness to emergency department arrival, length of stay during the index hospitalization, signs and symptoms of exacerbation of heart failure before the index hospitalization, and factors that precipitated exacerbation of heart failure were summarized by using means and standard deviations or frequencies with percentages. We used *χ*² analysis, *t* tests, and Spearman correlations to examine the bivariate relationships among signs and symptoms of exacerbation of heart failure before the index hospitalization, precipitating factors of hospitalization for exacerbation of heart failure, time from symptom awareness to hospital admission, and length of stay during the index hospitalization. All potential precipitating factors were entered in a stepwise or forward linear regression to determine which precipitating factors contributed to longer times that patients had signs or symptoms before being admitted. Because delay time and length of stay were skewed, a logarithmic transformation was used to obtain a normal distribution for these variables. A normal distribution was confirmed by using histograms, skewness, and kurtosis (-1 < skewness and kurtosis < 1). All correlation or regression analyses were done with the transformed value. We assessed variance inflation factors to test for multicollinearity in the multiple regression models.

Results
Sample Characteristics
A total of 482 patients were admitted for a confirmed exacerbation of chronic heart failure and had complete information on precipitating factors of exacerbation and length of hospital stay; 346 patients had data on delay time. The mean age of patients in the sample was 62 years (SD, 15 years), and about half were male (Table 1). More than half of the patients precipitating factors were demographic (eg, age, sex), clinical (eg, infection, myocardial infarction, comorbid conditions), psychosocial (eg, documented history of depressive symptoms, anxiety), and behavioral (eg, adherence to prescribed medications or a low-sodium diet). A form to collect all information was developed for the study. Precipitating factors were based on previous publications, clinical insight, and patients’ perspectives. All data on precipitating factors were based on whether or not the factor was documented in the electronic or paper medical records. For example, whether or not patients had medication nonadherence was based on whether or not any documented data from the medical record (eg, no insurance, no money, no transportation, no support) indicated that the patients did not refill their prescriptions, skipped taking medications, or did not take medications regularly as prescribed.

Patients could have more than one factor precipitating admission. All data were abstracted from medical records by registered nurses who were cardiac care specialists and extensively trained in data collection. Before data collection, all team members independently collected data from the same 3 charts. We compared the data collected on the same forms during this reliability testing process and resolved
had systolic dysfunction with a left ventricular ejection fraction of 40% or less. A total of 26 patients (5.4%) died before discharge. The majority of the patients were white. About one-fifth of the patients lived alone at home.

**Signs and Symptoms Experienced and Management Before Seeking Care**

Patients experienced about 5 signs or symptoms before admission. Dyspnea was the most common (93%). Next, in order, were edema (64%), exertional dyspnea (42%), orthopnea (36%), angina (34%), cough (33%), paroxysmal nocturnal dyspnea (23%), nausea (22%), weight gain (18%), and excessive tiredness (17%). More than one-third of the patients (36.3%) did not do anything (ie, no action taken was documented in the medical record) when they had signs or symptoms. A few patients called their physicians or nurses (4%) or took a diuretic (3%) before seeking care. Approximately one-fifth of the patients (20.3%) waited until they were severely dyspneic before seeking treatment. Less than half of the patients came to the hospital by ambulance (45%); others were transported by family (12%), other mode of transport (4%), and even by self (2%).

**Precipitating Factors of Hospital Admission**

The most common precipitating factor was poor medication adherence; slightly more than one-fifth of patients had documentation in their chart that they did not adhere to their prescribed medication before admission. The other top precipitating factors included infection (19%), renal insufficiency (17%), renal failure (15%), hypertension (14%), and dysrhythmias (13%; Table 2).

**Delay Time and Other Data**

The mean delay time from symptom awareness to seeking treatment was 16 days (SD, 52 days; median, 3 days). Mean length of stay during the index hospitalization was 7 days (median, 4 days). We detected a significant correlation between delay time and number of signs and symptoms before admission (ρ = 0.203; P < .001). No significant relationship was detected between delay time and length of stay during the index hospitalization (ρ = 0.09; P = .12) or between delay time and number of precipitants of hospital admission for exacerbation of heart failure (ρ = -0.073; P = .18).

Depressive symptoms, recent change in heart failure medicine, renal failure, poor medication adherence, and hypertension were significantly associated with delay in time from symptom awareness to seeking treatment. Patients who had recent changes in their heart failure medications, renal failure, and poor medication adherence had shorter delay times from symptom awareness to seeking treatment. Those who had depressive symptoms and hypertension experienced longer delay times from symptom awareness to seeking treatment (Table 3). In each regression model, all variance inflation factors were 1.1 or less, suggesting no parameter distortion due to multicollinearity.

**Discussion**

The Centers for Medicare and Medicaid Services recently initiated the Readmissions Reduction Program based on the Affordable Care Act. Hospitals are financially penalized for heart failure readmissions within 30 days. Therefore, identifying factors that precipitate acute decompensated heart failure is timely and important in order to intervene and decrease the likelihood of rehospitalization.3–6 We

---

**Table 2**

<table>
<thead>
<tr>
<th>Rank</th>
<th>Precipitating factor</th>
<th>No. (%) of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Poor medication adherence</td>
<td>99 (21)</td>
</tr>
<tr>
<td>2</td>
<td>Infection</td>
<td>93 (19)</td>
</tr>
<tr>
<td>3</td>
<td>Renal insufficiency</td>
<td>84 (17)</td>
</tr>
<tr>
<td>4</td>
<td>Renal failure</td>
<td>73 (15)</td>
</tr>
<tr>
<td>5</td>
<td>Hypertension</td>
<td>68 (14)</td>
</tr>
<tr>
<td>6</td>
<td>Dysrhythmias</td>
<td>64 (13)</td>
</tr>
<tr>
<td>7</td>
<td>Excessive fluid intake</td>
<td>53 (11)</td>
</tr>
<tr>
<td>8</td>
<td>Myocardial infarction</td>
<td>50 (10)</td>
</tr>
<tr>
<td>9</td>
<td>Excessive sodium</td>
<td>41 (9)</td>
</tr>
<tr>
<td>9</td>
<td>Exacerbation of chronic obstructive pulmonary disease</td>
<td>45 (9)</td>
</tr>
</tbody>
</table>

---

**Table 3**

<table>
<thead>
<tr>
<th>Precipitating factor</th>
<th>t</th>
<th>β</th>
<th>95% CI</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depression or depressive symptoms</td>
<td>3.114</td>
<td>0.176</td>
<td>0.29 to 1.28</td>
<td>.002</td>
</tr>
<tr>
<td>Recent change in heart failure medicine</td>
<td>-2.873</td>
<td>-0.163</td>
<td>-0.63 to -0.12</td>
<td>.004</td>
</tr>
<tr>
<td>Renal failure</td>
<td>-3.046</td>
<td>-0.173</td>
<td>-0.50 to -0.11</td>
<td>.003</td>
</tr>
<tr>
<td>Poor medication adherence</td>
<td>-2.771</td>
<td>-0.161</td>
<td>-0.39 to -0.07</td>
<td>.006</td>
</tr>
<tr>
<td>Hypertension</td>
<td>2.154</td>
<td>0.126</td>
<td>0.02 to 0.39</td>
<td>.03</td>
</tr>
</tbody>
</table>

a F = 6.65, P < .001.
found several important clinical (infection, renal insufficiency, renal failure, hypertension, dysrhythmias), behavioral (poor adherence to medications), and psychosocial (depressive symptoms) factors that precipitated exacerbations of heart failure. The majority of patients with heart failure have multiple comorbid conditions.23,24 Our findings suggest that increased attention to these comorbid conditions (including psychological conditions such as depressive symptoms) is warranted.

We found that more than one-fifth of cases of acute decompensated heart failure were due to poor adherence to the recommended regimen; poor medication adherence was independently associated with delay in seeking treatment. Our finding of poor medication adherence as a precipitating factor to signs and symptoms and treatment is consistent with the results of previous studies.3,4,6,9,23,25,31 In our study, poor medication adherence was the leading precipitant of acute decompensated heart failure among all demographic, clinical, behavioral, and psychosocial factors. Thus, development of effective interventions to address medication nonadherence before discharge is needed. Because of the lack of effectiveness of usual discharge instructions, most likely emphasis on discharge should be directed toward this common problem associated with rehospitalization.

Using multiple regression, we found 5 factors either positively or negatively associated with delays to seeking treatment: depression or depressive symptoms, recent change in heart failure medicine, renal failure, poor medication adherence, and hypertension. As is well-known, heart failure patients with poorer medication adherence have worse health outcomes than do patients with better adherence.32 We hypothesized that patients with poor medication adherence would have a longer delay time in seeking medical attention. However, contrary to our hypothesis, patients with poor medication adherence had shorter delay times. Information on relationships between medication adherence and delay in time between symptom onset and accessing treatment has not been reported. In 2 studies33,34 on chronic obstructive pulmonary disease, patients with higher adherence to a written action plan (initiate standing prescriptions for both antibiotics and prednisone within 3 days of onset of exacerbation) had a greater reduction in exacerbation recovery time than did patients with poor adherence.31 A longer delay time in treatment of exacerbation significantly extended recovery time, with 0.42 days per additional day of delay.34 However, patients with poor medication adherence might delay less because they realize their nonadherence might place them at risk, although the potential mechanism needs further study.

We found that a recent change in heart failure medications, as documented by health care providers in a patient’s history and physical examination, was associated with shorter time to seek care. To our knowledge, no studies have indicated the relationship between recent changes in heart failure medications and delay in seeking care. Patients who had a recent change in medications may have had a recent encounter with their health care provider and so might be more alert to signs and symptoms of heart failure and thus shorten their delay time. Our findings emphasize the need to teach patients about the effects and side effects they may experience with changes in medication or dosage. Patients with heart failure should pay careful attention to changes in signs and symptoms during this period, a step that might result in shorter delay in seeking treatment.

In our study, patients with a history of renal failure had shorter delays in seeking treatment. The experiences of this cohort of signs and symptoms and treatment of comorbid conditions may have influenced the patients’ decision to seek care. Multiple factors such as older age, living alone, and low socioeconomic status have been linked to greater delays in seeking treatment among patients experiencing acute coronary syndromes.35 However, more acute symptoms and knowledge about the source of symptoms were associated with shorter treatment delays in this population of patients.35 An increase in body weight due to fluid retention, pulmonary edema, and anasarca are comparable consequences of fluid volume overload in patients with renal disease or heart failure. Additional mutual symptoms for these comorbid conditions include severe fatigue and cognitive changes.36,37 Plausibly, patients with combined renal and heart failure have exaggerated symptom experiences because of common symptoms associated with the dual pathological changes and, consequently, seek treatment earlier than do patients without this pattern of comorbid conditions. Furthermore, patients with renal failure often require recurring medical procedures to remove excess fluids and waste,37 a situation that may increase their proficiency with accessing the health care system for management of signs and symptoms or disease. Last, patients with renal failure may have received instructions on symptom management for the renal disease that also applies to heart failure and acted on that
knowledge by accessing professional medical treatment more expeditiously.

Psychological states play an important role when patients make decisions to seek care. In our study, patients with heart failure who had a history of depression or any depressive symptoms had longer delays in time from symptom awareness to seeking treatment. This finding is similar to the results of a study by Johansson et al.\(^4\) in which patients with depressive symptoms had an almost 1.5 times higher risk than did patients without depressive symptoms for a treatment delay greater than 3 days after adjustments were made for clinical variables. Patients with heart failure with depressive symptoms postpone seeking treatment, a decision that may lead to more severe complications and in-hospital procedures.\(^5,6\) Therefore, for patients with heart failure and depressive symptoms, depression screening and treatment may be important strategies for improving delays in seeking care.

In our study, patients with a history of hypertension also had longer delays in seeking treatment. The finding is in line with the results of previous research.\(^7,8,9\) Most patients with hypertension do not have obvious signs and symptoms that prompt them to seek medical treatment. However, uncontrolled hypertension may complicate the acute episode of exacerbation of heart failure and lead to a worse prognosis for hypertension.\(^10\) Therefore, good control of blood pressure is essential in the management of patients who have both heart failure and hypertension.

In addition, we found no association between delay time from symptom awareness to seeking treatment and length of stay during the index hospitalization. This result differs from that of Johansson et al.,\(^11\) who found that patients who delayed less than 1 day had a shorter length of stay than did patients who delayed more than 1 day. The lack of association between delay time and length of stay in our study has several potential explanations. Because of the positive correlation between delay time and number of prehospital signs or symptoms in our study, possibly the patients who delayed the longest were the most severely ill and thus received medical treatment more quickly. Previous research has suggested that patients who have a longer delay time are more severely ill than patients with a shorter delay time,\(^12\) have more signs and symptoms,\(^13\) and are more likely to be classified as New York Heart Association functional class IV.\(^14\) Possibly those patients who experienced symptom relief shortly after receiving treatment had a shorter hospital length of stay.\(^15\) Although we did not assess dyspnea relief in this study, Mebazzaa et al.\(^16\) reported that approximately 75% of patients with acute heart failure experienced less dyspnea 6 hours after receiving standard treatment. Data\(^17\) also suggest that patients with acute decompensated heart failure receive intravenous therapy about 5 hours after being admitted to the emergency department and that delayed treatment is associated with a longer stay. Other factors not included in our study might have influenced the relationship between treatment time delays and length of stay. For example, a longer stay has been associated with the presence of respiratory comorbid conditions and in-hospital complications.\(^18\) Patients’ living arrangements might also have influenced length of stay among our sample. Living alone at home has also been associated with a longer stay;\(^19\) only 18% of our patients reported living alone at home.

**Limitations**

Our study has some limitations. First, the study was retrospective, and we had to depend on information documented in the chart by clinicians and retrieved from medical records. Thus, precipitating factors might not have been recorded in some instances. Most likely, more hospital admissions than we detected were associated with poor medication adherence or other psychosocial or behavioral factors. Second, the study sample was limited to a single southeastern state, and the experiences in this state may not be generalizable to other locations. Third, this study took place after the Joint Commission instituted the Heart Failure Core Measures (to which our hospitals had nearly 100% compliance in our chart review) but before the Centers for Medicare and Medicaid Services stopped reimbursing for heart failure readmissions within 30 days of discharge. Therefore, our findings need to be verified in the current climate of nonreimbursement for early readmissions of patients with heart failure.

Among a wide variety of demographic, clinical, behavioral, and psychosocial factors that precipitate admission for exacerbation of heart failure, poor adherence to the recommended medication was the most common factor. Patients with depressive symptoms, recent changes in heart failure medicine, renal failure, poor medication adherence, and hypertension require more diligence with care.
delivery and disease management by clinicians to decrease high rehospitalization rates for exacerbation of heart failure.

FINANCIAL DISCLOSURES

This study was supported by funding from the National Institute of Nursing Research awards K23NR014489 (Jia-Rong Wu, principal investigator) and K23NR013480 (Rebecca L. Dekker, coinvestigator) and by a National Institute of Nursing Research center grant 1P20NR010679 (Debra Moser, principal investigator) to the University of Kentucky, College of Nursing.

REFERENCES


To purchase electronic or print reprints, contact American Association of Critical-Care Nurses, 101 Columbia, Aliso Viejo, CA 92656. Phone, (800) 899-1712 or (949) 362-2050 (ext 532); fax, (949) 362-2049; e-mail, reprints@aacn.org.
Background
Society demands competent and safe health care, which obligates professionals to deliver quality patient care using current knowledge and skills. Participation in continuous professional development programs is a way to ensure quality nursing care. Despite the importance of continuous professional development, however, critical care nurse practitioners’ attendance rates at these programs is low.

Objective
To explore critical care nurses’ reasons for their unsatisfactory attendance at a continuous professional development program.

Methods
A nominal group technique was used as a consensus method to involve the critical care nurses and provide them the opportunity to reflect on their experiences and challenges related to the current continuous professional development program for the critical care units. Participants were 14 critical care nurses from 3 critical care units in 1 private hospital.

Results
The consensus was that the central theme relating to the unsatisfactory attendance at the continuous professional development program was attitude. In order of importance, the 4 contributing priorities influencing attitude were communication, continuous professional development, time constraints, and financial implications.

Conclusion
Attitude relating to attending a continuous professional development program can be changed if critical care nurses are aware of the program’s importance and are involved in the planning and implementation of a program that focuses on the nurses’ individual learning needs. (American Journal of Critical Care. 2017; 26:70-76)
Continuous professional development (CPD) is necessary for nurses to maintain and build on current knowledge and skills in the rapidly changing health care environment. The importance of CPD is highlighted by Joyce and Cowman, who claim that greater accountability is being placed on health care professionals by society as well as the health care profession. The public’s demand for competence and safe practice “obliges the profession to meet the challenges of quality care” with updated knowledge and skills. Participation in CPD activities is recognized by various organizations, such as governing bodies, accreditation organizations, certification boards, employers, and the general public, “as one of the most important competencies” that professionals must possess. Competence depends on updated knowledge and skills in one’s field of specialty. The ultimate goal of CPD should be to enhance health care delivery to critical ill patients.

In South Africa, CPD programs are viewed as systematic efforts to support professionals in remaining updated and competent. In 1997, the South African National Department of Health put into effect the White Paper for Transformation of the Health System, published in Government Gazette no. 17910. One of the focus areas was a CPD program for nurses. As yet, no formalized CPD programs or requirements have been legislated for nurses in South Africa. Although CPD programs are in the development phase, the South African Nurses Council currently regards CPD programs as the focus area.

Public and private hospital groups initiated internal CPD programs to acquire, maintain, and improve the competencies of nurses. One of the main principles behind CPD was to take control of the learning opportunities to enrich nursing practice through professional development. A private hospital group in South Africa implemented a policy stating that every nurse should attend a minimum of 22 hours of CPD training per year. This requirement was set as part of the CPD initiative in an effort to enhance the quality of patient care. The CPD program was developed by the unit managers and the critical care unit’s clinical facilitator. The content was theory and practice based and included topics such as hemodynamic monitoring of critical ill patients, mechanical ventilation, renal dialysis, electrocardiographic interpretation, as well as a respiratory workshop. The CPD program consisted of sessions facilitated and presented by medical doctors, critical care nurses (CCNs), a dietitian, and a clinical facilitator. The program was presented during an 8-month period, and every topic was presented 3 times to ensure that all the CCNs were given an opportunity to attend. The planned outcome was to enhance CCNs’ competence, using current knowledge and skills in existing and new areas of practice to enhance quality of care.

The strategy to implement a compulsory CPD program using a top-down approach did not have the desired outcome. From an organizational point of view, all requirements was met to ensure successful implementation of the CPD program. The CPD program was well planned and organized by the management team. Official on-duty time was provided for nurses to attend the CPD sessions, various facilitators were arranged, and the program was communicated to the staff members. Nevertheless, the average attendance was less than 30%. Only 32% of the CCNs (10 of 31) were able to provide a portfolio of evidence of participation in the CPD program, despite an extended deadline. Unsatisfactory attendance at a CPD program led to the realization that the current CPD program is not achieving its goal.

To improve participation in the CPD program, it is crucial to first identify the challenges associated with engagement in the CPD program from the CCNs’ perspective. The purpose of this research was to explore reasons for CCNs’ unsatisfactory attendance at a CPD program.

About the Authors
Myra Viljoen is a clinical training specialist, University of Pretoria, Pretoria, South Africa. Isabel Coetzee is a senior lecturer, University of Pretoria. Tanya Heyns is a senior lecturer, University of Pretoria.

Corresponding author: Myra Viljoen, RN, MCur, P O Box 49287, Hercules, Pretoria, Gauteng 0030, South Africa (e-mail: myraviljoen@gmail.com).
Methods

Procedure
A nominal group technique was used to reach consensus on the reasons for unsatisfactory attendance at a CPD program. The nominal group technique is a consensus-seeking method based on reaching accord within a group, thereby increasing the participants’ sense of ownership. The nominal group technique has more advantages than other group techniques. A nominal group is less prone to bias arising from vocal individuals influencing group members’ views, which tends to occur in open discussions. The possibility of domination by other group members is minimized, and this results in significantly higher levels of group satisfaction because the procedure ensures that all participants have an equal opportunity to produce new ideas.

Setting
This study’s setting was within a private hospital group consisting of hospitals and health care services. The focus of the study was on CPD in the critical care units (CCUs), and the immediate setting for this study was a CCU in one of the hospital group’s private hospitals situated in Gauteng. The specific CCUs made use of nurses with different levels of training. The nurse practitioners in the CCUs were CCNs (CCNs had had 4 years of training programs plus specialization; n = 22), registered nurses (RNs; had completed 4 years of training programs; n = 9), and enrolled nurses (had completed 2 years of training programs; n = 8). The number of permanently employed staff included day and night nurse practitioners working in these units. The focus was on the CCNs and RNs working in the CCU, collectively referred to here as CCNPs.

Sampling
This study’s target population was CCNPs working in the CCUs of the specific hospital group in Gauteng. The sample comprised CCNPs working in the CCUs of the private hospital. Information sessions were facilitated by one of the authors with the aim of informing the CCNPs that the current CPD program is not working and their input would aid understanding why the current CPD program is not well attended, to improve future CPD programs. The CCNPs were assured that, if they were willing to participate, none of the information shared during the data collection would be used against them. Purposive sampling was used to include CCNPs who did attend and those who did not attend the CPD program; 20 invitations to attend the nominal group were distributed.

Of the 14 participants who voluntarily attended the nominal group technique for data collection, 10 were critical care experienced registered nurses and the remaining 4 were trained critical care registered nurses.

Data Collection and Analysis
Nominal group technique was used to collect and analyze data. At the onset of the nominal group technique, an overview was presented on the aim and objectives of the study.

An independent expert facilitated the nominal group with 14 CCNs. The facilitator posed a central question to the participants: “Why don’t critical care nurses attend the continuous professional development program?” Five steps adopted from Potter et al were followed to collect and analyze data:

1. Silently generate ideas. The participants were requested to silently and in writing generate their ideas relating to the question.
2. Round-robin recording of ideas. Ideas of the participants (anonymously and in no specific order) were recorded on a flip chart visible to the entire group. Participants were allowed to “pass” if they had no new ideas and were allowed to reenter later if they wished to do so.
3. Serial discussion. Permission was obtained to record the discussions. Every idea listed on the flip chart was briefly discussed by the facilitator to ensure that the facilitator had understood the participants correctly. The participants then joined the discussion to share their views or ideas about the listed data. The facilitator and the participants analyzed the listed ideas and grouped data with similar meanings.
4. Voting and ranking. From the flip chart, all participants were requested to identify a list of 4 themes they considered the most important. Then they arranged their lists from most important to least important. The worksheets were collected and shuffled. The facilitator counted the votes and recorded each vote on the flip chart next to the relevant theme.
5. Brief discussion. After the participants viewed the ratings of their votes, a brief discussion followed that focused on the ideas rated the highest during the preliminary voting process. During this short discussion, participants concentrated on clarification of these ideas and reaching consensus on the order of priority. Once the facilitator was satisfied that the
Four themes emerged: communication, continuous professional development, time constraints, financial implications, and attitude.

**Theme 1: Communication**
Participants concurred that ineffective communication was the main reason for unsatisfactory attendance at the CPD program. Participants indicated that they require certain information early in the year to plan their activities for the rest of the year, including the topics and/or content of the CPD program planned for the coming year and the dates, times, duration, venues, and contents for these courses.

**Collaborative Decision-Making.** One of the main concerns highlighted was the lack of collaborative decision-making among the CCNs, the clinical facilitator, and unit managers. The participants regarded the process as a top-down approach and wished for involvement in decision-making processes about planning, content, and implementation of the CPD program. One participant said, “it [the CPD process] is a one-way thing.” Another said, “everything is just pushed down upon the staff.” The participants indicated that if there was collaboration and if they had participated in the process, they probably would have attended more enthusiastically.

**Theme 2: Continuous Professional Development**
CPD was identified as the second theme. The participants indicated that some CCNs were not aware of the importance of CPD and, therefore, did not attend the planned activities. The following quotes from participants support the findings that awareness impacts the attendance of the CPD program: “they [CCNs] do not think it is necessary to attend CPD” and “personnel don’t see the importance of it [CPD].”

**Learning Needs.** The participants strongly agreed that a thorough learning-needs assessment before the planning and implementation of a CPD program is important. Their viewpoint was that no learning-needs assessment was done and, therefore, they were not motivated to attend the sessions because the topics presented did not address their individual learning needs.

One participant said, “[an] individual’s learning needs differs from person to person.” Another said, “employees [CCNs] do not have a say in what their learning needs are.”

The participants claimed that if they were given an opportunity to identify their individual learning needs, it could increase their sense of ownership because the topics would be regarded as valuable and, therefore, their negative attitude towards CPD could change.

One participant said, “if you [the CCN] make the decision to go for a specific topic, then you will attend.”

**Theme 3: Time Constraints**
The participants strongly agreed that 1 of the factors impacting attendance at the CPD program was time constraints. Scheduled time played an important role in the nonattendance at CPD programs. Their argument was that because the CCU must have sufficient CCNP on-duty per shift, additional hours would be added for CPD program attendance; therefore, they would work more than the normal required hours per month.

One participant said, “[CPD] should be included into the week’s shift days.” Another said, “even though you [CCNP] get the hours from the hospital, it is seen as ‘I am giving up my time because I still have to work my shifts.’”

**Trustworthiness**
Member checking was used as a strategy to enhance credibility in this study, as follows: Feedback was given to the participants to confirm that the data collected were correctly interpreted by the facilitator; the participants were encouraged to provide critical feedback about factual errors or interpretive deficiencies, and member checking was done through a face-to-face discussion with the participants directly after the themes and categories had been identified. Other strategies used to enhance trustworthiness of the study included prolonged engagement, comprehensive and intense recording of data, data saturation, and independent coder checks.

Results
Four themes and 1 central theme emerged during the nominal group technique: communication, continuous professional development, time constraints, and financial implications and attitude.

**Trustworthiness**
The Faculty of Health Sciences Research Ethics Committee, University of Pretoria, approved the study protocol (reference number S62/2012).
Most participants indicated that there was a negative attitude toward attending the activities.

Theme 4: Financial Constraints

From the participants’ perspective, attending the CPD program had an impact on the CCNPs’ financial status. They agreed that attending CPD programs in the form of symposiums, congresses, and conferences was very expensive. Furthermore, the participants indicated that attending the CPD program affects the available time to work overtime (ie, overtime is reduced), and the participants considered working overtime financially more attractive than attending a CPD program.

Participants’ statements included “working overtime and being paid versus coming for CPD [as part of normal duty time not receiving immediate reimbursement]” and “the fact that CPD count[s] for on-duty time help[s] . . . but it reduce[s] the time for overtime, which [has] a financial implication.”

Central Theme: Attitude

The majority of participants acknowledged the importance of CPD programs but voiced that there was a negative attitude toward attending the CPD activities. One of the nurses said, “the more I know the more I have to do . . . responsibility increase[s] with knowledge.” Other comments included “already work at a fast pace, do not have time to implement new ideas or changes” and “working long hours in a critical care unit—lots of stress so you [CCN] don’t want to add another stress on top.”

Discussion

It is the opinion of Skees3 that CPD serves as “a bridge to excellence” in nursing practice. However, this idea can be appropriated only if the CCN is willing to make a commitment to learn and apply new knowledge in clinical practice. The expectations of and demands from society for the delivery of safe health care compel all health care providers to meet the challenges of delivering quality patient care with up-to-date knowledge and skills.10 Being aware and understanding the value of CPD is essential13 because a lack of understanding can be a barrier to successful implementation of and attendance at CPD activities.14 Professionals require guidance to enhance awareness and understanding of CPD because it will enable them to develop into lifelong independent learners.14 Collins4 refers to learning in the competitive global marketplace of the 21st century as “lifelong earning demands lifelong learning.” In the past, hard work and loyalty led to a secure future, whereas in modern times, a premium is placed on those who continuously acquire skills and knowledge and who have the resilience and flexibility to adjust to the growing needs of the global labor market.4 The majority of literature sources list financial implications as a barrier or challenge experienced by CCNPs to attend CPD programs.

Consistent communication is highly appreciated when the nature, timing, and dissemination of CPD opportunities, as well as the expectations following the CPD program, are pointedly communicated.15 In this case, communication will be positive and contribute to the effective provision of and attendance at CPD programs. Brekelmans et al14 state that effective communication stimulates participation in a CPD program. In addition, effective communication is classified as an important aspect of successful collaboration.16

For the implementation of a successful CPD program, the learning needs of individual nurses, society, and the organization should be incorporated.17 CCNs have specific learning needs that may not be consistent with the needs of clinical facilitators and unit managers. When the type, nature, and content of a CPD program is not in accordance with the individuals’ learning needs, the individuals are reluctant to participate in CPD activities.18 CCNs are responsible for identifying their own learning needs and these should be clarified by an in-depth needs assessment to ensure a flexible, well-executed CPD program. For a CPD program to be implemented successfully, it is imperative that the learning needs of participating professionals should be addressed to ensure engagement with and commitment to the program. Individual motivation has a significant influence on the degree of participation in a CPD program and is fundamental to its success.14

The amount of time CCNPs are expected to contribute to attending a CPD program results in conflict between home and domestic commitments; this was seen as a barrier to achieving a desirable work-life balance.3,14,15 People in organizations are “the key to success or failure.”20 To ensure the success of a CPD program, nurses must be part of the collaboration throughout the decision-making process, including the planning (learning-needs assessment) and implementation of the program. Using a top-down approach in which the clinical facilitator and unit managers decide on the content, time, and strategies to be used during the CPD program may result in unsatisfactory attendance.21 A feeling of being pressured by managers to engage in
a CPD program with the mere objective of meeting the requirements of the organization contribute to unsatisfactory attendance at CPD programs. Collaboration involves supporting sustained teamwork by developing a culture that values personal integrity, sharing power and respect, integrating individual differences, resolving competing interests, and safeguarding the essential contribution that each individual makes to achieve the desired outcomes of an organization. Through collaborative decision-making, ownership of the decisions and responsibility for the outcomes and success of the CPD program will enhance attendance.

A change of attitude toward CPD among nurses is needed because participation in CPD largely relies on the attitude of the individual. Tame adds that the degree to which CPD is undertaken depends on the individual’s previous educational experience: if previous educational experiences were negative or created the perception that learning is about passing or failing, instead of professional development, future education may be hindered. Lee confirmed that the attitude of professional peers may benefit or hinder learning in CPD participants. It is recommended that managers or clinical facilitators promote learning and support CPD participation through positive change. Moreover, determination of the attitudes of professionals and organizations about change is a challenge in itself because attitudes are neither “tangible nor visible.”

Limitations of the Study

This study was planned to improve the attendance of the CPD program in the CCU. Participants were selected from only 1 private hospital and the sample size was limited by the limited number of nurse practitioners working in the specified setting. Thus, transferability of the findings may be limited, but this was not part of the aim of the study.

Conclusion

CCNs indicated that they had a negative attitude toward the CPD program because of a lack of awareness of its value and not being involved in a collaborative decision-making process about the identification of the program’s content to ensure that individual learning needs are met. If CCNs were included in a collaborative decision-making process, they would be motivated to participate in the CPD program. Through collaboration, the CCNs would feel less coerced by the clinical facilitator and unit management (top-down approach) to participate in the CPD program. Increasing CCNs’ feeling of worthiness would subsequently lead to a sense of ownership of the CPD program. For CCNs to be active in a CPD program, it is vital that they be aware of the benefits of participating. These are benefits for their employer as well as for the patients entrusted to their care. Collaboration with CCNs to identify individual learning needs and to plan and implement a CPD program may influence CCNs’ attitudes positively, resulting in increased attendance at a CPD program and, consequently, its success.

ACKNOWLEDGMENTS

The article is based on the findings of a Magister Curationis (MCur; Clinical) dissertation conducted at the Department of Nursing Science, University of Pretoria. We thank the nurses who so willingly participated in this study and all those who supported the first author through the progression of this research.

FINANCIAL DISCLOSURES

None reported.

eLetters

Now that you’ve read the article, create or contribute to an online discussion on this topic. Visit www.ajcconline.org and click “Submit a response” in either the full-text or PDF view of the article.

REFERENCES

Research published in 2016 identified strategies to enhance acute and critical care, initiated discussions on professional roles and responsibilities, clarified complex care issues, and led to robust debate. Some of this important work addressed strategies to prevent delirium and pressure ulcers, considerations for pain management within the context of the opioid abuse crisis, strategies to guide fluid resuscitation in patients with sepsis and heart failure, and ways to enhance care for family members of intensive care patients. The new sepsis definitions highlight the importance of detecting and providing care to patients with sepsis outside of critical care areas.

Chimeric antigen receptor T-cell therapy is an example of the advancement of research in genomics and personalized medicine and of the need to understand the care implications of these therapies. Other research topics include interprofessional collaboration and shared decision-making as well as nurses’ role in family conferences. Resources such as policies related to medical futility and inappropriate care and the American Association of Critical-Care Nurses’ healthy work environment standards may inform conversations and provide strategies to address these complex issues. (American Journal of Critical Care. 2017;26:77-88)
In 2016, research was published that identified strategies to enhance acute and critical care, initiated discussions on professional roles and responsibilities, provided clarity on complex care issues, and led to a robust debate. This article summarizes some of this important work. Strategies to prevent delirium and pressure ulcers, considerations for pain management within the context of the opioid abuse crisis, strategies to guide fluid resuscitation in patients with sepsis and heart failure, and ways to enhance care for family members of patients in intensive care units (ICUs) are discussed. Although the new sepsis definitions may introduce more questions than answers, they also highlight the importance of detecting sepsis and providing care for patients with sepsis outside the ICU. Chimeric antigen receptor (CAR) T-cell therapy is presented as an example of the advancement of research in genetics and personalized medicine and of the need to understand the care implications of these therapies. Other research topics presented include interprofessional collaboration and shared decision-making and the role for nurses in family conferences.

Delirium

Since 2000, delirium has emerged as a significant determinant of adverse outcomes for patients. Research is ongoing to determine which patients are at greatest risk, how to prevent delirium from developing, how to incorporate delirium assessment as a standard of care, and how to treat delirium once it is identified. In a retrospective observational study of patients who survived cardiac arrest and were treated with therapeutic hypothermia, all patients studied had at least 1 day of delirium. Among these patients, increased age and time to resuscitation were associated with longer periods of delirium, whereas use of propofol was associated with shorter duration of delirium.

Wolters et al found that patients who experienced ICU delirium were older, had more comorbid conditions, had more mental health issues before ICU admission, stayed longer in the ICU, and were more severely ill than were patients who did not experience delirium. In that study, which explored the relationship between ICU delirium and long-term mental health problems, 52% of the 567 ICU survivors surveyed experienced delirium while in the ICU. At 1 year, 43% of survivors reported anxiety, 45% had depression, and 39% most likely had posttraumatic stress disorder. However, no association was found between delirium and these mental health conditions, as seen in studies of non-ICU patients. The researchers concluded that critical illness itself could be associated with adverse mental health outcomes.

Despite findings that routine delirium monitoring is independently associated with a reduction of hospital mortality in critically ill surgical patients, the accurate and ingrained assessment of delirium is still a challenge in many settings. Several studies published in 2016 provided examples of interventions to improve delirium monitoring. DiLibero et al presented a multifaceted effort to improve the accuracy of delirium assessments completed by critical care nurses. This initiative, which targeted barriers and enhanced education, leadership, culture, and accountability, was associated with a 25% improvement in the accuracy of delirium assessments completed by critical care nurses. This initiative, which targeted barriers and enhanced education, leadership, culture, and accountability, was associated with a 25% improvement in the accuracy of delirium assessments completed by critical care nurses. The researchers described previous attempts to improve delirium-related care, but noted they finally achieved success with structure and guidance provided through the AACN’s Clinical Scene Investigator Academy. Johnson et al described an educational intervention designed to increase knowledge and screening by multiple disciplines as part of an effort to decrease the incidence of delirium in a trauma population. The unit educator taught nurses, physicians, pharmacists, and respiratory therapists about screening,

About the Authors

Elizabeth Bridges is a professor at University of Washington School of Nursing and a clinical nurse researcher at University of Washington Medical Center, Seattle, Washington. Margaret M. McNeill is a clinical nurse specialist, peri-anesthesia, Frederick Regional Health System, Frederick, Maryland. Nancy Munro is a senior acute care nurse practitioner, National Institutes of Health, Bethesda, Maryland.

Corresponding author: Elizabeth Bridges, RN, PhD, CCNS, 1959 NE Pacific, Box 357260, University of Washington School of Nursing, Seattle, WA 98195 (e-mail: ebridges@u.washington.edu).
risk factors, and interventions to decrease delirium. Questionnaires were administered before and after the intervention to measure practice, beliefs, and knowledge about delirium. Knowledge of the 72 participants increased, but the significant finding was the 22.6% increase in response to the item reflecting a belief that delirium is preventable ($P = .04$). The impact of the intervention on patient care was not measured.

Litton et al." published a systematic review and meta-analysis to assess the efficacy of earplugs as an ICU strategy for reducing delirium. Earplug placement was associated with a relative risk of delirium of 0.59 (95% CI, 0.44-0.78), which means a 41% decrease in risk of delirium in patients who used earplugs compared with patients with no earplugs. The authors concluded that placement of earplugs in patients admitted to the ICU, either in isolation or as part of a bundle of sleep hygiene improvement, was associated with a significant reduction in risk of delirium.6

Neufeld et al." conducted a systematic review and meta-analysis of 19 studies, looking for evidence that antipsychotic medications affect delirium. In 7 studies comparing antipsychotic agents with placebo or no treatment for delirium prevention after surgery, no significant effect on delirium incidence was found (odds ratio, 0.56; 95% CI, 0.23-1.34). Overall, use of antipsychotic medications was not associated with changes in duration or severity of delirium or length of stay in the hospital or ICU. A new systematic review has been registered that will synthesize research evidence on the effect of nonpharmacological interventions on delirium in critically ill patients.8

The results are eagerly anticipated, as more interventions that can reduce or prevent delirium are needed. Delirium adds complexity to pain management, as many of the currently available pain assessment tools have been evaluated only in nondelirious critically ill patients. A study by Kanji et al." demonstrated the validity of the Critical Care Pain Observation Tool in noncomatose, delirious adult ICU patients who are unable to reliably self-report the presence or absence of pain. This study is important in light of the 2013 clinical practice guidelines for the management of pain, agitation, and delirium in adult patients in the ICU,10 which indicate that pain should be assessed routinely by using a validated pain assessment tool. Although most of the articles published on delirium were focused on adults, it is important to recognize that delirium affects patients of all ages. Groves et al." reported a case series of 3 infants in a neonatal ICU who exhibited classic symptoms of delirium, a condition not typically considered in this population. In a study of patients in a pediatric ICU, Traube et al." reported that costs increased with number of days spent delirious, peaking at $75,833 for more than 3 days with delirium. After age, sex, severity of illness, and length of stay in the pediatric ICU were controlled for, delirium was associated with an 85% increase in costs for the unit ($P < .001$).

**Pressure Injury: Risk Assessment and Prevention**

Swafford, Culpepper, and Dunn11 remind us that hospital-acquired pressure injuries are considered preventable, and because of this, the cost of treatment for stage III and IV pressure injuries is not reimbursed by Medicare. There is disagreement with the idea that all pressure injuries and skin breakdown in critically ill patients are preventable, and more investigation is needed into the concept that skin can fail as do other organs, especially in very critically ill patients and at the end of life.12,13

Bly et al." tested a model of risk factors for pressure injuries related to pressure, oxygenation, and perfusion. Risk factors that were significantly associated with development of pressure injuries included any transport off the unit, number of days to bed change, systolic blood pressure less than 90 mm Hg, and the use of more than 1 vasopressor. Other significant risk factors were a history of pulmonary disease and the presence of a feeding tube. In a 15-month retrospective chart review of patients with pressure injuries in a medical ICU, Smit et al." found that vasopressors ($P = .02$) and length of stay ($P = .02$) were the only factors associated with the development of pressure injuries. The results of these studies are important because these factors are not currently included in instruments for assessing risk of pressure injury, and they highlight that risk assessment instruments must be developed for critically ill patients. Both studies were retrospective, and the results were consistent with results of previous studies on risk factors in critically ill patients; prospective studies are needed to test these models and develop screening tools appropriate for critically ill patients.

Several articles published in 2016 described efforts to decrease pressure injuries. In an intervention study,15 treating high-risk patients with a prophylactic sacral dressing decreased the incidence of unit-acquired sacral pressure injuries by 3.4 to 7.6
The treatment of pain with opioids has now become a major health care concern.

Per 1000 patient days, Thorpe described a non-comparative performance improvement project in which incorporation of a prophylactic sacral dressing was associated with a decrease in pressure injury incidence from 19.9 to 0.84 per 1000 patients in 1 year, with 310 pressure injury–free days. Finally, in a prospective randomized controlled trial in 366 patients, Kalowes et al compared routine pressure ulcer prevention care with care supplemented with a multilayer silicone sacral dressing. The use of the prophylactic dressing resulted in a significantly lower rate of hospital-acquired pressure ulcers (0.7% vs 5.9%, \( P = .01 \)), with the experimental group having an 88% lower risk of a pressure ulcer developing while the patients were hospitalized. In another study, an interdisciplinary team designed a pilot program using Lean Six Sigma methods to test 4 interventions: standardized documentation, equipment monitoring, monitoring of patients getting out of bed to a chair, and a rounding checklist. This systematic innovation was associated with a decrease in pressure injuries from 4.4% to 2.8%, and more importantly, these results were sustained. Overall, these studies demonstrate the benefit of a prophylactic intervention and a systematic bundle of strategies to sustain this optimal care outcome.

In April 2016, the term pressure injury replaced pressure ulcer in the National Pressure Ulcer Advisory Panel’s pressure injury staging system. The definitions of pressure injury and the different stages also were revised to better assist clinicians with identification. The concept of skin failure, first introduced a decade ago, has received renewed attention and warrants further exploration. The results achieved by Donovan et al, along with the other successful interventions just described, relied on systematic, well-developed plans and execution, with the method of implementation as critical as the content.

### Pain Control in Acute and Critical Care Settings

Management of pain has become an emergent topic in health care, especially in acute and critical care settings. In 2001, The Joint Commission developed standards for pain assessment because of national concerns about the undertreatment of pain. However, the treatment of pain with opioids has now become a major health care concern. In 2014 in the United States, 20,000 deaths were related to overdoses of prescription opioids. In response to the epidemic of opioid-related drug events, the Centers for Disease Control and Prevention (CDC) published the “CDC Guideline for Prescribing Opioids for Chronic Pain—United States, 2016.” The guidelines are divided into 3 categories: (1) determining when to initiate or continue opioids for chronic pain; (2) opioid selection, dosage, duration, follow-up, and discontinuation; and (3) assessing risk and addressing harms of opioid use. These guidelines emphasize the importance of clinicians understanding the link between acute pain and the development of chronic pain. The Joint Commission also published a clarification of their pain standards, which states that “the standards do not require the use of drugs to manage patient’s pain and when a drug is appropriate, the standards do not specify which drug should be prescribed.”

One aspect of pain management that warrants attention is an increased awareness of common interventions or procedures that can cause pain above baseline levels (see Table). In the Europain Study, the most painful procedures were chest tube removal, wound drain removal, and arterial catheter insertion. Evaluation of pain must include behavioral observation using instruments such as the Behavioral Pain Scale or the Critical Care Pain Observation Tool. Preprocedural pain assessment is also recommended, as increased preprocedural pain intensity and pretreatment with opioids are associated with increased procedural pain. Reasons for the latter finding may be inappropriate opioid dosing or timing for the procedure; however, this finding was not replicated in a recent study of pain in patients receiving mechanical ventilation. Two important reasons to mitigate procedural pain are
that amplification of procedural pain may contribute to the transition of acute to chronic pain and that approximately 20% of ICU patients remember procedural pain, with a small subset holding that memory for up to 9 months after discharge.31

The management of acute pain in the ICU may contribute to the development of chronic pain. Chronic postsurgical pain is pain that is the result of some surgical procedure (eg, amputations and sternotomies) and persists for 3 to 6 months after the procedure.32 Risk factors for the development of chronic postsurgical pain include female sex, younger age, depression, anxiety, and genetic factors that are thought to increase sensitivity to pain. Other factors that may contribute to chronic postsurgical pain include preoperative pain, surgical technique and expertise, incision location, and some anesthetic factors including use of high-dose opioids for analgesia as these may have a paradoxical effect of hyperalgesia (ie, increased pain sensitivity from exposure to opioids).32

Another care challenge in critical care is the weaning of patients off of opioids. ICU patients, especially those who require mechanical ventilation, may receive prolonged opioid infusions (commonly with a benzodiazepine). Patients may be weaned off of these infusions quickly to try to facilitate extubation, which may cause withdrawal symptoms, thereby increasing pain. Patients who have had long-term treatment with intravenous opioids should not be weaned off of the opioids any faster than a 10% decrease in dose per day.33 To assist with the weaning process, α₂-agonists such as clonidine and dexmedetomidine can be initiated. If opioid tolerance is suspected, ketamine can be used because it prevents hyperalgesia.34 Multimodal analgesia techniques, such as nonopioid analgesics including acetaminophen/paracetamol, nonsteroidal anti-inflammatory drugs, and anticonvulsants may also decrease the risk of opioid-induced hyperalgesia.35 Development of ICU-specific protocols that use multimodal techniques should be pursued. An excellent resource to further understand multimodal therapies and their role in mitigating the development of chronic pain is the 2016 AACN webinar “Preventing the Acute-to-Chronic Pain Transition”35 presented by Dr Puntillo.

Sepsis and Septic Shock

In 2016 the Sepsis-3 guidelines were published, with recommendations for the revision of the definitions of sepsis and septic shock.36-38 These guidelines, some of the most downloaded in recent history,39 have engendered robust debate.40 One area of debate is whether the elimination of the systemic inflammatory response syndrome (SIRS) criteria from the guidelines will delay the early detection and treatment of sepsis.41-45

In August 2016, the CDC declared that when sepsis occurs, it should be treated as a medical emergency.46 Central to this discussion is the early identification of patients with sepsis across the continuum of care. Analysis of the Surviving Sepsis Campaign datasets from 2005 to 2012 indicates that 32% of all patients with severe sepsis had the diagnosis made while they were in medical and surgical care areas.47 The potential effect of the revised sepsis definitions on patients in general care areas can be explored by using results from a medical records review of 269,951 such patients.48 Among these patients, 50% met SIRS criteria on admission, independent of their diagnosis. Additionally, 50% of all these patients were positive for SIRS at least once during their hospitalization. These data demonstrate that the SIRS criteria alone have high sensitivity and low specificity, which may result in excessive alerts for patients not at risk for sepsis.

In contrast, the integration of the SIRS criteria and indications of organ failure into a tool (SOF-Triage) for use in general care areas to assess patients for sepsis, was associated with a significant improvement in the odds of 30-day survival (odds ratio, 2.7; 95% CI, 1.6-4.6), as well as a lower probability of severe organ failure developing (odds ratio, 0.7; 95% CI, 0.4-0.9) and a shorter length of stay (mean, 3.7 days; 95% CI, 1.5-5.9 days).49 Interestingly, the frequency of observations of respirations, temperature, and pulse improved markedly (eg, ≥5 observations per day) compared with the baseline period, when a majority of the observations were characterized as having poor frequency (0-1 observations per day) or some frequency (2-4 observations per day). It is not clear if the improved outcomes were associated with the screening tool and mandatory response times, or whether use of the tool required increased observations of the patient, thus enhancing early recognition of patients with sepsis and septic shock. An excellent review50 summarizes the state of the science on the detection of sepsis in patients in general care areas and discusses the use of SIRS criteria and the quick Sepsis-Related Organ Failure (qSOFA) score in this population.

A concern identified by Odden et al51 is that only 9290 (11%) of the 82,514 patients in the 122 studies...
included in the 2012 Surviving Sepsis Guidelines were patients in general care areas. More importantly, only 1 of the 25 guideline recommendations (duration of empiric antibiotics and antibiotics within 1 hour) was supported by research that included patients in general care areas. In the 3 recent sepsis trials, only patients admitted through the emergency department were included. Thus, we do not have specific evidence-based guidelines for management, including early fluid resuscitation, in a heterogeneous population of patients in general care areas, and generalization of the surviving sepsis guidelines to these patients must be done with caution.

Three documents may be useful in informing discussions regarding the new guidelines. A review by Vincent et al outlines the strategy for integrating the qSOFA and SOFA scores into the early recognition and management of patients with septic shock. A review by Kleinpell et al summarizes the rationale for the changes in definitions and the recommended process for identifying patients with sepsis and septic shock, and a response from the Surviving Sepsis Campaign outlines considerations for integration of these new recommendations into care.

**Fluid Resuscitation in Patients With Septic Shock and Heart Failure**

One clinical challenge is safe fluid resuscitation in patients with septic shock and depressed cardiac dysfunction (particularly diastolic failure). In one study, upon admission to the ICU for septic shock, 26% of patients had systolic dysfunction and 83% had diastolic dysfunction. Three retrospective studies (presented as abstracts) related to patients with septic shock and heart failure, and a response from the Surviving Sepsis Campaign outlines considerations for integration of these new recommendations into care.

**Chimeric Antigen Receptor (CAR) T-Cell Therapy**

In recent years, the focus of cancer treatment has shifted from chemotherapy and irradiation toward using the body’s immune system to destroy cancer cells. Cancer immunology research uses principles of immune function to develop new techniques and drugs to destroy cancer cells. The T lymphocyte or T cell of the immune system is important in this research because of its unique ability to detect and destroy abnormal cells. T cells, which excel in the adaptive process, have a surface receptor like an antibody that recognizes specific parts of an antigen (foreign substance or agent). Within the fast-developing fields of genomics and personalized medicine, the T cell can be programmed to recognize specific cells, a process referred to as adoptive cell transfer. In this process, cells are removed from a patient with...
cancer, and the genetic coding of the T cell and tumor cells are analyzed. Depending on the genetic information, cell surface proteins of the T cell can be genetically altered or “engineered” to change the surface receptor, allowing the T cell to recognize the cancer cells as antigen material and destroy them. These artificial T-cell receptors are referred to as chimeric antigen receptors (CARs). This destructive process, which is like an antigen/antibody reaction on a large scale, is very complex and involves other cells of the immune system. Once the engineered T cell engages the designated cancer cell, an inflammatory response is initiated, leading to the release of cytokines to help destroy the cancer cells. This inflammatory response, referred to as cytokine release syndrome, can be massive depending on the magnitude of the immune cell activation.

This cell immunotherapy is a front-line therapy in the treatment of refractory acute lymphoblastic leukemia in children and has had promising results in several small studies. As expected with an inflammatory response, symptoms include fever, nausea, myalgia, and malaise. The presentation can progress to increased oxygen requirements, hypotension requiring volume resuscitation, and vasoactive drugs. Ultimately the patient may require multisystem support (eg, mechanical ventilation, renal replacement therapy). The clinical features of cytokine release syndrome are similar to those for sepsis; however, the mechanism is different. In cytokine release syndrome, fevers are higher (>40°C), and vasodilatation can be more profound and last longer than in septic shock. It is important to understand that when developing new therapies, similar concepts cannot be generalized to different populations of patients. With further research, a connection may be discovered between cytokine release syndrome and sepsis, but for now they remain similar yet distinct.

Psychological Impact of Critical Illness on Families: Nursing Interventions

Harvey and Davidson report on the growing concern about the long-term consequences for ICU survivors and their families. In a synopsis of past research, they discuss the prevalence of elements of post-intensive care syndrome in family members, which includes anxiety (10%-75%) and posttraumatic stress (8%-42%). Prolonged or complicated grief, exacerbation of chronic health conditions, and financial insecurity are also seen in families with post-intensive care syndrome. Konstanti et al investigated levels of cardiac anxiety (ie, the fear of cardiac-related stimuli and sensations because of their perceived negative consequences) in family members of ICU patients in Greece. The Cardiac Anxiety Questionnaire was completed by 223 family members of 147 ICU patients. The mean score for overall cardiac anxiety was 1.11 out of 4 (SD, 0.64), which was significantly higher ($P<.001$) than for the general population (0.90 out of 4; SD, 0.60). The mean score for patients’ siblings (2.0 out of 4; SD, 0.01) was significantly higher than the mean for other family member groups ($P=.02$). This finding was intriguing because many studies are focused on spousal anxiety. These results add to the body of knowledge about anxiety in families of ICU patients and highlight the risk for symptoms of cardiac anxiety.

Cameron et al studied caregiver and patient characteristics to determine which factors were associated with caregivers’ health outcomes during the first year after patient discharge from an ICU. In that study, they prospectively enrolled 280 caregivers of patients who had received 7 or more days of ICU mechanical ventilation. A large percentage of caregivers (67% initially and 43% at 1 year) reported high levels of depressive symptoms. Although depressive symptoms decreased with time in 84% of the caregivers, the symptoms persisted in 16% of these individuals. Variables significantly associated with worse mental health outcomes in caregivers were younger age, greater effect of patient care on other activities, less social support, less sense of control over life, and less personal growth. No patient variables were consistently associated with caregiver outcomes over time.

To help with stress, providing bereavement support to family members who lose a loved one in the ICU is recommended. McAdam and Erikson conducted a cross-sectional prospective survey study to describe current bereavement services in adult ICUs in the United States. A total of 237 ICU nurse leaders from diverse hospital and ICU types reported that their ICUs (n = 148, 62.4%) did not offer bereavement follow-up services, and they identified many barriers. When offered, bereavement care was largely informal and minimal in nature. Multiple logistic regression indicated that ICUs in hospitals with palliative care were almost 8 times (odds ratio, 7.66; 95% CI, 2.15-27.32) more likely to provide bereavement support than ICUs in hospitals without palliative care. The study findings provide insight into an opportunity to help families after an ICU loss.

Chimeric antigen receptor T-cell therapy shows promise for providing new cancer treatments.
In a study on patients’ family participation in ICU rounds, both family members and health care providers described inconsistent practices surrounding family participation in ICU rounds. Family members identified 3 primary logistical challenges to participation in ICU rounds: distance to hospitals, work/family obligations, and the rounding schedule. Both family members and providers reported virtual participation as a potential solution to facilitate participation when a long distance or competing demands are faced.

In a neuroscience ICU with a private suite for patients’ family members and an open visitation policy, family members rated their needs as being met at a high level. The rank order of the importance of these needs was similar to the order described in prior family studies in a variety of critical care units. The most important needs in order were as follows: information about the patient, visiting the patient, being given hope, talking with a doctor each day, and being assured that the best care is being provided for the patient. In another study, elimination of even minimal restrictions on visitation hours improved family satisfaction and improved nurses’ perceptions of family satisfaction with the visitation policy.

A qualitative study was done to explore how nurses perceive the experiences of long-stay surgical ICU patients and their families, and the results provided insight into how nurses could cultivate resilience among patients’ families. Nurses noted that unrealistic expectations regarding the patient’s recovery, from both the hospital team and family members, can foster false hope. Nurses recognized families as “cheerers” who provide support by being involved in patient care. They also observed how extensive family involvement can be beneficial to patients, but overwhelming for the families. With many clinicians involved in a patient’s care, inconsistencies in information can occur, resulting in confused and disturbed families. Nurses identified ways to enhance family resilience through routine and consistent communication. More research is needed to identify interventions that mitigate the stress encountered by families of ICU patients.

**Shared Decision-Making**

Shared decision-making is most often defined as interactions between patient/family and physicians related to medical care issues. A recent policy statement from the American College of Critical Care Medicine and American Thoracic Society defined shared decision-making as a “collaborative process that allows patients, or their surrogates, and clinicians to make healthcare decisions together, taking into account the best scientific evidence available, as well as the patient’s values, goals, and preferences.” This policy document is useful as it provides examples of situations where shared decision-making may be appropriate and suggests evidence-based strategies and language to facilitate this process. What this policy statement does not address is interprofessional shared decision-making.

Research on nurse-physician collaboration and shared decision-making in the ICU is not new, with several studies demonstrating differences in perceptions between ICU nurses and physicians. A study by Dekeyser Ganz et al provides insight into the concept of shared decision-making between ICU physicians and nurses and may inform interventions to enhance true teamwork (ie, coordination, collaboration, and respect) as defined by Parker. Based on observations and interviews of ICU nurses and physicians, a model of interprofessional shared decision-making was developed (see Figure).
This study demonstrated the importance of using quantitative and qualitative methods to explore this complex concept. Perceptions of collaboration were quantified by using the Jefferson Scale of Attitudes toward Physician-Nurse Collaboration. Overall, there was a moderate perception of collaboration, with no significant difference between nurses and physicians. In contrast, the qualitative responses demonstrated distinctly different perceptions of shared decision-making and identified a possible area for interprofessional discussion on shared decision-making expectations, as outlined in the decision model. Researchers in that study also acknowledged the scope and responsibilities of nurses and physicians and outlined different levels of decision-making appropriate for different components of care. Further work to enhance appropriate shared decision-making and true collaboration and teamwork is essential to decrease burnout syndrome and potentially improve patients’ outcomes.

**Nurse Participation in Family Conferences**

On the Patient Care Page in AJCC earlier this year, Bell described several nursing actions to support families of ICU patients. Communication with families has long been a foundation of the nurse-patient-family relationship in critical care. Active participation by nurses in family conferences is an opportunity for interprofessional shared decision-making and may be a component of mitigating post-intensive care syndrome in patients’ family members.

Three recent studies explored the role and effect of nurse participation in family conferences. In a study of nurses’ involvement in family meetings, 3 major themes were identified: nurses can play multiple roles in supporting conduct in family meetings, nurses face critical barriers to fully realizing these roles, and nurses end up as intermediaries in family meetings. The latter role was necessitated in part by the poor communication between the physicians and the patients’ families and among care providers. Nurses perceived themselves to be well positioned to act as the patient’s advocate, yet felt undervalued and underempowered to contribute important information in family meetings, with physicians not actively engaging with the nurses during the conference. The researchers concluded that involvement of nurses in family meetings could improve with communication training, empowerment of the nurses, and improved nurse-physician relations related to family meetings.

In a study conducted in France, researchers evaluated whether any long-term psychological benefits for family members were associated with nurses’ participation in planned family conferences led by physicians. Family members were also asked their perceptions of the conference, including the presence of the nurse. No significant difference was found in the prevalence of post-intensive care syndrome in family members with signs or symptoms of posttraumatic stress disorder, but the family members in the experimental group had lower anxiety and depression scores. Interpretation of these results is limited as other factors associated with psychological outcomes after an ICU stay were not controlled for.

An interesting finding was that although the family members valued the conference, no difference was found in their perceptions of conferences with or without the nurse. The presence of the nurse in the conference had only limited effects on the family members’ trust that ICU teamwork was effective (56.8%), care was patient-centered (37.5%), information was disseminated effectively, and every effort was made to relieve their anxiety (13.6%). One potential explanation for these findings relates to the script used to guide the conference, which indicates that nurses’ primary role in the conference was to explain direct care issues (eg, what tubes and machines are for, the appearance of the patient, and how to communicate with the patient) and to assess family members’ comprehension. In contrast, the physician was responsible for the overall conference, delivering information to the family, including information about management and prognosis. Analysis of the qualitative responses from the family members highlighted potential benefits provided by the nurses in enhancing communication overall, but also mixed responses on whether there was actual benefit in having the nurse at the conference.

Similar results were noted in a study conducted in a pediatric ICU in the United States. In this study, 47 nurses were surveyed and 40 audio-recorded family conferences were analyzed. The nurses reported that their attendance at the conferences was primarily to gain knowledge of the discussion, to offer unique insights into the care of the patient, and to provide emotional support and advocacy. Audio

**Nurse participation in family conferences could be enhanced with communication training and empowerment.**
recordings indicate that nurses contributed only 4.6% of overall conversation. Overall, these studies suggest limited active participation of nurses in family conferences.

Although recent recommendations\textsuperscript{68,88} emphasize the need for integration of strategies such as frequent and understandable communication about the patients’ care and condition and shared decision-making, there are no guidelines specific to the role of nurses in these activities. Several recent publications may be useful in addressing this limitation. DeKeyser-Ganz’s\textsuperscript{64} decision model may inform interprofessional conversations related to roles and responsibilities during a family conference, suggest how nurses can be more actively engaged, and address concerns raised by nurses about contributing to discussions of prognosis and complex care decisions.\textsuperscript{39,92,93} The AANC healthy work environments standard\textsuperscript{41} also provides a framework and tools to enhance nurses’ ability to participate more actively in family conferences. Key constructs of the healthy work environment standard include collaboration, effective decision-making, and skilled communication, which are all essential to advancing appropriate shared decision-making. Finally, 2 recent policy statements on medical futility and inappropriate care\textsuperscript{85,96} and an excellent article\textsuperscript{97} including a series of cases specific to medical futility in neurocritical care may also provide common language for discussions related to these complex care issues.

FINANCIAL DISCLOSURES
The contents of this manuscript do not necessarily represent the views of the US Department of Health and Human Services.

eLetters
Now that you’ve read the article, create or contribute to an online discussion on this topic. Visit www.ajconline.org and click “Submit a response” in either the full-text or PDF view of the article.

REFERENCES

To purchase electronic or print reprints, contact American Association of Critical-Care Nurses, 101 Columbia, Aliso Viejo, CA 92656. Phone, (800) 899-1712 or (949) 362-2050 (ext 532); fax, (949) 362-2049; e-mail, reprints@aacn.org.
ECG Puzzler

A RARE DISEASE WITH CARDIAC INVOLVEMENT

By Salah S. Al-Zaiti, RN, PhD, CRNP, Michele M. Pelter, RN, PhD, Teri M. Kozik, RN, PhD, CNS, CCRN, and Mary G. Carey, RN, CNS, PhD

Scenario: This 12-lead electrocardiogram (ECG) was obtained from a 36-year-old African American man who was evaluated at an emergency department for dizziness and chest pressure. The patient had no significant medical history and denied using any prescription or illicit drugs. He had been evaluated for similar complaints at the same setting several weeks earlier, and his ECG and bloodwork were unremarkable at that time. The current cardiac workup showed mild cardiomegaly on the chest x-ray, with slight anemia and leucopenia that were not seen previously. Other tests, including cardiac enzymes and urine toxicology, were negative.

Interpretation Questions:

1. Is the ECG properly calibrated (10 mm) and are leads properly placed? [ ] Yes [ ] No [ ] NA
   If no, interpret cautiously.

2. Is this a sinus rhythm (one P wave preceding every QRS complex)? [ ] Yes [ ] No [ ] NA
   If no, check for number of P waves in relation to QRS complexes.

3. Is the heart rate (R-R interval) normal (60-100/min)? [ ] Yes [ ] No [ ] NA
   If no, check for supra-ventricular or ventricular arrhythmias.

4. Is the QRS complex narrow (duration < 110 milliseconds [ms] in V1)? [ ] Yes [ ] No [ ] NA
   If no, check for bundle branch blocks (BBBs), pacing, or ventricular arrhythmia.

5. Is the ST segment deviated (> 2 mm in V2-V3, or > 1 mm in other leads)? [ ] Yes [ ] No [ ] NA
   If yes, check for similar deviations in contiguous cardiac territories.

6. Is the T wave inverted in relation to the QRS (> 0.5 mV)? [ ] Yes [ ] No [ ] NA
   If yes, check for ST deviation or conduction abnormalities.

7. Is the QT interval lengthened (> 450 ms [men] or > 470 ms [women])? [ ] Yes [ ] No [ ] NA
   If yes, check for ventricular arrhythmias or left ventricular hypertrophy.

8. Is R- or S-wave amplitude enlarged (S wave V1 + R wave V5 > 35 mm)? [ ] Yes [ ] No [ ] NA
   If yes, check for axis deviation or other chamber hypertrophy criteria.

©2017 American Association of Critical-Care Nurses doi: https://doi.org/10.4037/ajcc2017189
Interpretation

This ECG shows sinus bradycardia with a morphological QRS pattern of right bundle branch block (RBBB). There is also a left axis deviation (negative R in lead aVF and positive R in lead I). This is called a bifascicular block (RBBB plus left anterior fascicle block of the left bundle branch). The small R wave amplitude in aVF (furthest ECG lead from the heart) along with the observed conduction defects can indicate increased impedance in the thoracic cavity due to underlying cardiopulmonary disease. These very subtle clues are important given that the patient also shows signs of increased pulmonary vascular resistance, manifested by S1Q3T3 pattern (deep S in lead I, isolated Q with T inversion in lead III).

Rationale

The patient is an apparently healthy young adult, so more thorough diagnostics were needed to define the etiology of his symptoms. A follow-up echocardiogram revealed impaired systolic function with an ejection fraction of 45%. A contrast-enhanced CT scan of the chest showed bilateral enlargement and peripheral calcification of the mediastinal and hilar lymph nodes. Subsequently, a cardiac MRI showed myocardial and pulmonary granulomas supporting the diagnosis of sarcoidosis with both pulmonary and cardiac involvement.

Management

Sarcoidosis is a rare condition characterized by idiopathic inflammation and granuloma formation in multiple body organs. This condition primarily affects younger African Americans. Patients frequently have systemic manifestations of the disease, but it may occur in single organs. For example, when the heart is involved, electrical conduction defects can occur either at the AV node or bundle branches. Because this patient reported dizziness, careful arrhythmia monitoring should be done. Patients can have varied cardiac symptoms ranging from asymptomatic left ventricular dysfunction to symptomatic congestive heart failure.

Cardiac-involvement is typically self-limiting and early management includes immune-suppressive therapy and other clinically indicated supportive therapies (eg, treatment of heart failure). In severe cases, the disease might be progressive and unresponsive to treatment, eventually warranting heart transplantation. This patient was given a loading dose of intravenous hydrocortisone, then an oral maintenance dose of prednisone. Systemic sarcoidosis cannot be cured, but often can be controlled with lifelong corticosteroids. During hospitalization, nurses should prioritize continuous cardiac monitoring for serious arrhythmias and assess for signs of heart failure. Serious arrhythmias require early administration of anti-arrhythmic medications and, if indicated, pacemakers and/or implantable defibrillators to prevent sudden death.
Save Time. Learn More.

We know you’re busy — busy at work, busy at home, busy all around.

That’s why we want to help you find the most important articles in each issue of the American Journal of Critical Care.

Now you can get an early look at what’s coming in each issue of the American Journal of Critical Care — before the journal arrives in your mailbox — with eTOCs (electronic tables of contents).

eTOCS are designed to help you identify the articles most important to you in each issue — as quickly as possible. eTOCs also provide quick links to the online version of the American Journal of Critical Care.

So why wait?

Go to ajcc.aacnjournals.org/cgi/alerts and sign up today.
**FLORIDA**

Plantation
42nd Annual Spring Seminar

*Date:* April 1, 2017.  
*Place:* Renaissance Hotel.  
*Address:* 1230 S Pine Island Rd, Plantation, FL 33324.  
*Sponsor:* Broward County Chapter of AACN.  
*Contact:* Patty Kelly.  
*Phone:* (954) 722-8020.  
*E-mail:* pattykelly7@att.net.  
*Fee:* Before March 14: member, $75 and nonmembers, $100. After March 14: member, $100 and nonmember, $125. At the door: member, $125 and nonmember, $150.  
*Credits:* 6.5 CEUs.

**NEVADA**

Las Vegas
Certification in Legal Nurse Consulting (5-day seminar and online)

*Date:* March 20-24, 2017.  
*Place:* Rio All-Suite Hotel and Casino.  
*Address:* 3700 W Flamingo Rd, Las Vegas, NV 89103.  
*Keynote Speaker:* Vickie L. Milazzo.  
*Sponsor:* Vickie Milazzo Institute.  
*Contact:* Vickie L. Milazzo.  
*Phone:* (800) 880-0944.  
*Fax:* (713) 942-8075.  
*E-mail:* mail@LegalNurse.com.  
*Fee:* Varies.  
*Credits:* 25.3 CEUs (5-day seminar); 40 CEUs (online).

**NATIONWIDE**

State: Ongoing
One Day CCRN Review Cram

*Date:* 2017.  
*Place:* Orlando (January), Atlanta (February), Dallas (February), San Francisco (March), Los Angeles (March), New York (March, October) Columbus (April), Chicago (April), Charlotte (May), Boston (May), Richmond (May), Atlantic City (October).  
*Keynote Speakers:* Laura Gasparis Vonfrolio, RN, PhD, Lee Taylor Vaughan, EJD, MSN, RN, CCRN-CSC.  
*Sponsor:* Education Enterprises.  
*Address:* 31 Yeomalt Ave, Staten Island, NY 10312.  
*Contact:* Laura Gasparis Vonfrolio, RN, PhD.  
*Phone:* (800) 331-6534.  
*Fax:* (718) 317-0858.  
*E-mail:* afeduprn@aol.com.  
*Fee:* As low as $99.  
*Credits:* 8 CEUs.

For AJCC Education Directory submission information phone (800) 809-2273, ext 532; or e-mail, ajcc@aacn.org.
The ultimate, case-based guide for learning and teaching the art of diagnostic reasoning

“The cases, and the process used in the book to teach diagnostic reasoning, are perfect to use in virtual simulations for my students across the state!”

—Tonja Hartjes, DNP, ACNP-BC, CCRN, CSC / University of Florida College of Nursing

AMERICAN ASSOCIATION of CRITICAL-CARE NURSES

McGRaw Hill Education
Come Explore

Enhanced navigation to save you time and effort

More of the great clinical resources you’ve come to expect

New dashboard (My AACN) delivers the personalization you asked for

Nurse stories that will delight and inspire you

We’ve redesigned the AACN website for you and other members of our community. Come see what we’ve done to the place. Wherever you are in your critical care nursing journey, you can count on AACN for the inspiration and information you need.

See for yourself at: www.aacn.org/exploreaacn