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## Development and Implementation of an Innovative Burn Nursing Handbook for Quality Improvement

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### Abstract

**Objective**—Evidence-based burn nursing literature is extremely limited and often non-existent. As a result, there is a lack of standardization in burn nursing care. Our objective is to evaluate burn nursing knowledge at an academic medical center and implement innovative educational tools to enhance staff competency and improve the quality of care.

**Methods**—A collaboration of practicing clinical nurses developed a 24-question knowledge assessment survey (“pre-survey”) to evaluate fundamental burn nursing knowledge (fluid management, burn pathophysiology, burn-related procedures, wound care, infection control). Pre-education knowledge surveys were administered to 59 burn nurses electronically. A writing team of new and experienced nurses was established and developed a 51-page handbook focusing on areas of need identified in the survey. This book was disseminated to staff as required reading. Post-educational surveys were sent to the same nurses who completed the initial survey.

**Results**—Forty-six nurses (46/59, 78.0%) completed the survey with a mean (SD) of 55.9 (11.0)% of questions being answered correctly. Post-surveys sent to the same 46 nurses who completed the pre-survey had a response rate of 78.3% (36/46). We observed a significant increase in correctly answered questions (mean [SD]: 69.6 (8.7)%,  $P < 0.001$ ) in the post-survey intervention.

**Conclusion**—The handbook improved education and significantly improved overall fundamental burn knowledge of practicing nursing staff. Use of electronic surveys to drive development of targeted educational interventions provides evidence-based tools for establishing burn nursing standards and developing quality improvement metrics.

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## Keywords

burn nursing; innovative; quality improvement; standardized burn care; nursing handbook

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## INTRODUCTION

Evidence-based burn nursing literature and research is limited. In contrast, leading healthcare groups usually consisting of physicians have identified a need for practice guidelines in burn medical care.<sup>1</sup> Burn Practice Guidelines for medical care were published as recently as 2000.<sup>2</sup> These guidelines were later updated and added to in 2006 by the Committee on the Organization and Delivery of Burn Care. In this review, the committee acknowledged that lack of evidence-based and approved standards in burn care has resulted in a mentorship-style of teaching based on individual practices at those institutions. There is a critical need not only for evidence-based literature, but nursing-led evidence based education with the use of literature reviews and reflection on current practices.<sup>3</sup> Existing educational programs, such as Advanced Burn Life Support, focus on the initial 24-hour resuscitative phase of a burn.<sup>4</sup> Educational programs for the post-resuscitative and intensive care unit phase of a burn patient, however, are limited.

In addition to a lack of research and educational programs, each verified burn center operates independently with few or no documented burn nursing standards of care. A research study from Christian Medical Center (CMC) in Vellore, India identified a need for standards of burn care when creating a pediatric burn unit in 2005.<sup>5</sup> By utilizing a needs-assessment tool, creating their own burn protocol treatment handbook, and collaborating with other burn centers, the study results showed improved patient outcomes and helped to create a standard of nursing and physician care at CMC Vellore. To this end, there is a critical need to assess and standardize the burn nurse core curriculum.

The objective of our study was to develop and implement a burn-nursing handbook to improve nursing knowledge in core topics including fluid resuscitation, critical care, and wound management in burns.

## METHODS

A core group of practicing burn nurses at our institution conducted four focus group sessions to discuss existing burn nursing care needs. Focus groups compared current burn nursing and resident physician educational resources. Burn nursing staff volunteers were solicited to participate in the handbook planning process. The *Burn Nurse's Handbook* was then developed in three phases as described below:

### Phase 1: Establishment of the Writing Team and Pre-Education Assessment

We established a core multidisciplinary team (comprised of experienced and novice burn nurses, researchers, respiratory therapists, and a nutritionist) to write an outline of key topics in fundamental burn nursing care. Next, we produced a knowledge assessment survey based on this outline to evaluate current burn nursing staff competency. The survey, administered via e-mail using SurveyMonkey, consisted of 24 multiple-choice, select all that apply, and

short answer questions. The burn nursing staff was invited to participate in this pre-handbook survey. Members of the core team proctored each SurveyMonkey session to prevent the use of external resources during the assessment. Survey data was de-identified to encourage participation; however, a roster of participants was retained for follow-up during Phase 3.

### **Phase 2: Burn Nursing Handbook Writing**

The handbook was produced over a nine month time frame following Phase 1 and was divided into seven chapters (Table 1). The introduction included an overview of burn management including initial evaluation and treatment, with an emphasis on fluid resuscitation and maintenance. Airway and breathing sections included intubation/tracheostomies, chest tubes, assessment of arterial blood gas (ABG) values, ventilator modes, prevention of ventilator associated pneumonia (VAP), and acute respiratory distress syndrome (ARDS). The circulation chapter gave an overview of basic hemodynamics, vasopressor drug therapy, electrolyte imbalances, and dialysis. Wound care sections emphasized wound types, topical medication management, pain control, and mobility. The specialized nutritional need of the patient with burns was discussed in the nutrition portion. A chapter regarding infection control included antimicrobial drugs, cultures, and maintaining a clean environment. The last chapter included discharge considerations, outpatient and follow-up care, in-patient transfers, and the deceased patient. Following completion of the handbook, burn nursing staff outside of the core team, attending burn surgeons, nurse educators, and burn researchers were recruited to provide feedback and to encourage collaboration by the burn center as a whole.

### **Phase 3: Burn Nursing Handbook Implementation and Post-Education Assessment**

The third and final phase involved implementation of the handbook to burn nursing staff, then reassessment of staff competency using the same assessment survey. Burn nursing staff that participated in Phase 1 were provided the handbook via e-mail and given two months to read through the document. These nurses were given the same knowledge assessment, or post-handbook survey, after verbal confirmation that they read the handbook. Participants were not proctored for the post-survey but were asked to independently complete without references. Results, again, were de-identified. Length of time between pre- and post-surveys was approximately one year.

### **Statistical Analysis**

Data analysis was performed using R-statistical software ([www.r-project.org](http://www.r-project.org)). Descriptive statistics were determined for each question, and overall for pre- and post-education surveys. The binomial test was used to compare the proportion of correct answers for each question between pre- and post-education surveys.

## **RESULTS**

The pre-education survey was sent to all 59 burn nurses. Forty-six nurses completed the survey—yielding a 78% response rate. The pre-survey had a mean (SD) of 55.9 (11)% of questions answered correctly. Post-education surveys were sent to the same 46 nurses who

completed the initial survey. Thirty-six burn nurses responded resulting in a 78.3% response rate. The proportion of new versus experienced nurses did not significantly differ between the pre- and post-education periods (Table 2). However, there was a statistically significant overall increase in correctly answered questions with a mean (SD) 55.9 (11.0)% vs. 69.6 (8.7)% ( $P < 0.001$ ) of the questions answered correctly.

The survey tested overall knowledge of selected themes in burn nursing care, which was randomized within the survey. Themes included fluid resuscitation and total body surface area (TBSA) burn calculation, wound care and symptoms, ventilation, procedures, and disinfecting equipment. Questions were written as multiple choice, short answer, or select all that apply.

The first four questions of the survey tested fluid rate calculation knowledge during immediate resuscitation and TBSA burn calculation. The first question required the nurse to calculate the total fluid requirement for a burn scenario using the Parkland formula and had the highest percentage of correct answers of the three, with 78.3% correct for the pre-survey and 91.7% for the post-survey. The other two questions regarding hourly resuscitation fluid rate and then maintenance rate, respectively, had fewer correct answers. The fluid maintenance rate calculation question decreased to 23.9% correct answers for the pre-survey but improved to 63.9% for the post-survey. Staff performed well overall on questions about the Parkland formula, answering correctly in the 90<sup>th</sup> percentile for pre- and post-surveys (93.5% vs. 94.4% respectively). Answers about the correct use of albumin during burn resuscitation actually decreased from 84.8% on the pre-survey to 80.6% on the post-survey ( $P = 0.067$ ). Finally, correct answers related to calculating TBSA burn significantly increased from 39.1% on the pre-survey to 66.7% on the post-survey ( $P < 0.001$ ).

Questions about knowledge of wound care and symptoms included signs and symptoms of wound infection, expected pain for a burn of specified depths and severity, topical wound treatment for a person with a sulfonamide allergy, and peak onset effect of pain medication used during wound care. Knowledge of topical treatment for a person with sulfonamide allergy significantly improved from 80% correct answers pre-survey to 100% ( $P < 0.001$ ) correct answers after implementation of the handbook. Conversely, correct answers related to signs of wound infection decreased, although not significantly ( $P = 0.072$ ), from 67.4% prior to reading the handbook to 61.1% after implementation of the handbook.

The question with 0% correct answers for pre- and post-surveys came from knowledge of the VAP bundle compliance with a check all that apply question. Three other questions related to ventilation included an example criterion for ARDS ( $\text{PaO}_2/\text{FiO}_2$  ratio), change in ventilator mode to improve  $\text{PaO}_2$ , and change in ventilator mode to improve  $\text{PaCO}_2$ . The latter two questions had a statistically significant increase ( $P < 0.001$ ) in correct answers (pre-survey with 21.7% and 13% respectively, post-survey with 66.7% and 41.7% respectively).

Five questions on policy and procedure related specifically to this institution; for example, a multiple choice question tested knowledge of the policy for changing intravenous site dressings. One procedural question that was written as a check all that apply showed need

for education on measurement of abdominal compartment syndrome. This procedural assessment resulted in a 28.3% correct answer in the pre-survey, which decreased to 13.9% in the post-survey ( $P = 0.053$ ). Also, assessment of the perfusion of an extremity distal to an arterial line resulted in 6.5% correct answers on the pre-survey and 11.1% ( $P = 0.082$ ) correct on the post-survey. The policy for performing arterial punctures by physicians vs. nurses resulted in 95.7% correct answers in the pre-survey to 100% correct answers in the post-survey.

Finally, the disinfectant category asked about “dry time” for the cleaning wipes and spray used on the unit at the time of writing, as well as the appropriate use of disinfectant wipes on select equipment. Two questions about a disinfectant wipe and disinfectant spray dry time resulted in 30.43% and 60.87% correct answers, respectively, during pre-survey assessment. Post-survey assessment of the same two questions resulted in correct answer percentage of 75% and 91.67%, respectively. Lastly, the question asking about which items are appropriate for cleaning with disinfectant resulted in 52.17% correct answers in pre-survey and 50% correct answers in post-survey.

## DISCUSSION

The handbook improved education as evidenced by an increase in overall post-survey score. In addition, having a standardized educational resource improved staff knowledge related to burn nursing care at our institution. The use of electronic surveys to drive development of targeted educational interventions provides evidence-based tools for quality improvement. This quality improvement project helps to create burn nursing standards and benchmarks within our burn center. Years experience did not appear to influence burn nursing knowledge. Development of the handbook also fostered a culture of nursing research in our burn center and inspired additional nurses to participate in future studies.

The rather low post-survey mean of 69.6% could be related to poor question writing as well as outdated information between the times of pre- to post-surveys. Knowledge was strongest in resuscitation fluid calculation, with an improved knowledge in maintenance fluid rate calculation after reading the burn handbook. Knowledge appeared to decline in post-surveys for areas such as abdominal pressure measurement, use of 25% albumin vs. 5% albumin for resuscitating low fluid volume, and signs of wound infection. At least two questions were written with outdated information by the time the handbook was released. For example, the question regarding disinfectant wipe dry time and its use on certain equipment was obsolete by the time of the post-survey period since the product had been changed during that year of writing.

During revision of our survey it would be beneficial to exclude “check all that apply” questions since there are several possible groups of answers that test-takers may make arguments for and are usually less clearly written. Our free text responses did not appear to make a difference in outcomes, as a significant percentage of staff answered correctly. Although we had an improvement from pre- to post-survey, a 69.6% average is not a satisfactory benchmark. We strive to set our nursing benchmark at 80% on our unit by 2015.

The handbook will be reviewed and updated annually and disseminated within our burn center as a hard copy and available on our institution's secure intranet. In addition, we are collaborating with two similar burn centers within the state. Both institutions have requested to use the *Burn Nurse's Handbook* and implement our survey as an educational tool at their facilities. Prior to survey implementation outside of our unit, adjustments to questions need to be made as evidenced by our survey data. Future surveys will be more clearly written now that our educational model is available.

We hope to use this model to support the creation of a national burn nursing benchmark, followed by creation of a burn nursing certification, which currently does not exist. This will further standardize the quality of burn nursing care by improving and maintaining a baseline competency.

## CONCLUSION

This quality improvement project highlights the necessity and benefit of having a standardized educational and assessment tool for burn nursing knowledge during the post-resuscitative, intensive care unit phase. Use of a handbook for education, such as the one we created, will standardize a top model of care. By creating a national benchmark of burn nursing care, with the use of a survey module or required assessment, patient outcomes will improve. These innovative tools create measurable results by which to evaluate the level of nursing care at burn centers.

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**Table 1**

<b>Table of Contents</b>	
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**Table 2**

	Nurse Experience		
	< 2 Years (%)	2 Years (%)	Not Reported (%)
Pre-Survey (n = 46)	5 (11.1)	39 (86.7)	2 (4.3)
Post-Survey (n = 36)	2 (5.6)	33 (91.7)	1 (2.8)

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