Nurses’ Perceptions of Education on Invasive Mechanical Ventilation

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Mechanical ventilation is a complex supportive therapy for patients with respiratory failure or patients with partial or total airway obstruction (Fenstermacher & Hong, 2004; Tobin, 2001). Patients who are dependent on mechanical ventilation experience discomfort and anxiety, and have an increased risk of complications associated with this therapy. Therefore, optimal patient outcomes are achieved through skilled delivery of care by a multidisciplinary team (Rose, Nelson, Johnston, & Presneill, 2008).

In Australian intensive care units (ICUs), protocols for management and weaning of mechanical ventilation are uncommon. This may be due to the organizational context, which includes four main factors. First, low nurse-to-patient ratios generally indicate more individualized care where ICU nurses can closely monitor changes to a patient’s condition and react to these changes without having to follow a nonindividualized protocol (Rose, Blackwood, Burns, Frazier, & Egerod, 2011; Rose, Nelson, Johnston, & Presneill, 2007). Second, a high proportion of nurses have postgraduate ICU qualifications; Australia and New Zealand standards require that a minimum of

Background: Intensive care units (ICUs) encompass advanced clinical management and technology, mandating continuing education for nurses to maintain competency. This study examined nurses’ perceptions of current education on invasive mechanical ventilation in an Australian ICU.

Methods: Qualitative data were obtained from five optional open-ended questions as part of a larger 30-item cross-sectional survey of 160 ICU nurses. Content analysis was used to code the data, developing concepts and themes.

Results: Fifty nurses (31%) completed at least one open-ended question. Content analysis identified five major themes: advanced knowledge, in-service education, practical structured education, interactive bedside teaching, and practicing safe care. Respondents’ perceived continuing education on invasive mechanical ventilation to be more focused on novice than experienced ICU nurses and recommended practical, structured bedside teaching as the preferred method of education.

Conclusion: Respondents recognized the need for interactive, practical, bedside education sessions to transfer learning into the everyday work environment.


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50% of the ICU nursing staff hold a postgraduate qualification (Rose et al., 2008). Experienced ICU nurses and nurses with postgraduate qualifications are more likely to be autonomous and make key decisions regarding patient care (Rose et al., 2008). Third, ICUs are closed and intensivist-led, staffed by senior specialist training medical staff who continuously support patients and work side-by-side with nurses (Rose et al., 2011). Finally, Australian ICUs have an interdisciplinary focus in which dietitians, physiotherapists, social workers, nurses, and medical staff work together to deliver better patient care (Rose et al., 2007; Rose et al., 2011).

Some authors have argued that because mechanical ventilation protocols are formal and rigid, they increase the ventilation time compared to more individualized and autonomous nursing care and close medical staff support (Blackwood, Wilson-Barnett, & Trinder, 2004; Rose et al., 2007). Australian ICU nurses play a key role in providing the essential components of care, including management and prevention of complications of mechanical ventilation and weaning, physical care, emotional support, and pain and anxiety control (Rose et al., 2008). In some countries, however, the management of mechanical ventilation is performed by the respiratory therapist (Rose et al., 2007).

MECHANICAL VENTILATION EDUCATION IN AUSTRALIA

In Australia, ICU nurses learn management of mechanical ventilation either on the job through continuing education (CE) or at the graduate level, as this topic is not taught in detail as part of the undergraduate nursing curriculum. In the ICU, there is a high complexity of care, which together with rapid changes in the health care system and technology means that CE is essential for nurses to keep their knowledge and skills up to date, and to ensure they do not work beyond the limits of their competency (Offord, 2010).

In Australia, similar to the United States, United Kingdom, and Canada, CE in nursing is delivered primarily through structured and planned programs as an effective intervention that focuses on the transfer of evidence-based knowledge into the workplace to improve clinical practice, critical thinking skills, and patient care, ultimately optimizing patient outcomes (Griscti & Jacono, 2006; White-Williams et al., 2013). It involves various methods including passive didactic approaches (i.e., rounds, lectures, workshops, and conferences) and interactive approaches (i.e., simulations and hands-on in-service training) (Davis et al., 1999; Griscti & Jacono, 2006). Ideally, CE continues throughout a nurse’s career, contributing to lifelong learning and research with a broader focus beyond the immediate and short-term educational needs of nurses (Griscti & Jacono, 2006; Kvas & Seljak, 2013). In addition, reliance on CE requires that specific preferences for teaching and learning methods must be considered when planning successful methods for teaching (O’Shea, 2003).

There is limited nursing research on CE in the area of mechanical ventilation, which is a key patient care responsibility for ICU nurses. Therefore, this study focused on whether CE on invasive mechanical ventilation delivered to novice and experienced ICU nurses in a large regional tertiary referral hospital in Australia was perceived as satisfactory. The ICU nurses’ perceptions of the education provided on invasive mechanical ventilation are described, and recommendations for further education are offered.

METHOD

Design

This article reports the qualitative findings from a semistructured, cross-sectional, self-administered 30-item survey completed by ICU nurses. Details of the quantitative findings from this research are detailed elsewhere (Guilhermino, Inder, Sundin, & Kuzmiuk, 2013). The survey was developed following a review of the literature to identify existing surveys regarding education for ICU nurses on the subject of invasive mechanical ventilation. As an existing survey was not identified, a survey tool was developed by the authors, all of whom have critical care nursing experience.

Setting

The setting for this study was a 22-bed level three ICU that specializes in trauma cases within a 550-bed teaching hospital in Australia. The ICU provides adult, pediatric, and cardiothoracic intensive care and high dependency services (Hunter New England Local Health District, 2008). Level three ICUs are referral centers for intensive care patients, providing high-level, multisystem life support under the management of an attending intensive care specialist. These ICUs provide supporting services such as backup laboratory and clinical service facilities with a commitment to academic education and research (College of Intensive Care Medicine of Australia and New Zealand, 2011).

At the time of the survey, the education provided for the ICU nurses on invasive mechanical ventilation consisted of the following five main components (Table 1):

- An educator-assisted intensive care-based orientation program (Kuzmiuk, 2011).
- An assisted bedside orientation (Kuzmiuk, 2011).

A competency program titled “Recognition in Prior Professional Learning, Experiences, and Skills” (RIPPLES) (McMullen, 2005).

In-service education sessions.

This survey did not aim to obtain ICU nurses’ perceptions on the two orientation programs that were designed to introduce ICU nurses to hospital policy and guidelines and to train nurses when they first start working on the ICU. Instead, the study aimed to obtain perceptions about the SDLP, RIPPLES, and the in-service education sessions that were available to all nursing staff, both new and experienced.

**Sample**

As ICU nurses are responsible for managing, assessing, and making decisions for patients receiving invasive mechanical ventilation, either autonomously or in collaboration with medical staff, the survey was targeted toward this group. Therefore, the inclusion criterion was any RN employed in the hospital ICU. Enrolled nurses, who have less than a 3-year degree and who work alongside RNs providing basic care, were excluded. All 160 RNs employed in the ICU at the time of the survey, including casual staff and those on leave, were eligible to participate.

**Survey Tool**

This qualitative component of the survey consisted of responses to the optional open-ended components of two closed-ended questions and three open-ended questions (Table 2). The two optional open-ended questions asked participants their reasons for not completing a learning package and to specify other current educational opportunities on invasive mechanical ventilation in the ICU, if provided. These two questions were only required to be answered by a sub-sample of participants.

The first of the three open-ended questions was immediately preceded by a question asking participants to rate the importance of five forms of education: case scenarios presented during grand rounds, high-fidelity simulation, in-service education, hands-on practice, and workshops or courses. Participants then were asked to suggest additional forms of education that they thought might be useful.

Similarly, the second open-ended question was preceded by a question asking participants to rate the
importance of eight topics on invasive mechanical ventilation: understanding and setting appropriate ventilator settings, ventilation waveform interpretation, understanding maneuvers of alveolar recruitment, chest radiograph interpretation, selection of the most appropriate mode of ventilation, interpreting arterial blood gas, indications for collecting arterial blood gases, and decision making around changes to ventilator settings. The participants were asked for any recommendations or suggestions for additional topics on invasive mechanical ventilation.

The remaining open-ended question asked for general comments or suggestions about education for nurses on invasive mechanical ventilation. All of the participants were directed to answer these three open-ended questions.

**Data Collection and Informed Consent**

An information sheet about the study was distributed via a group e-mail from the ICU’s nurse manager supported by a written note in the ICU nursing communication book. In the interest of informed, voluntary consent, all nurses were provided with an envelope via internal mail with their name on it; the envelope contained a research information sheet, a copy of the survey (without any identifying information), and a postage-paid return envelope. The survey was distributed to all of the ICU nurses employed in the hospital in May, 2011. The survey was estimated to take 10 to 20 minutes to complete, and the nurses were given 12 weeks to complete and return it.

The human research ethics committees of the University of Newcastle and the local health district approved the survey to be administered. All of the participants were assured that no identifying information would be collected, guaranteeing participant anonymity.

**Data Analysis**

Qualitative data were transcribed into an Excel® worksheet and then analyzed by the authors using content analysis. The data were coded and concurrently grouped, thus developing a set of concepts. Concepts then were examined for relationships, a pattern was defined, and evolving themes were named (Graneheim & Lundman, 2004).
RESULTS

A total of 83 nurses (52%) returned the survey, and 50 nurses (31%) responded to at least one open-ended question. The number of nurses who completed each open-ended question is shown in Table 2. The demographic characteristics of the nurses employed at the time of the survey compared to the respondents of the qualitative arm of the survey are shown in Table 3. The following five major themes were identified:

- Advanced knowledge.
- In-service education.
- Practical structured education.
- Interactive bedside teaching.
- Practicing safe care.

Advanced Knowledge

Many respondents had prior ICU nursing experience or graduate certificate qualifications, and many had previously completed learning packages similar to the SDLP. When asked why they decided not to complete the SDLP, respondents indicated their previous experience or current knowledge meant that they thought the SDLP was unnecessary. Clearly, the education packages extant at the time of this study were perceived as not offering these nurses any further knowledge but rather providing only introductory information on the topic of invasive mechanical ventilation. One participant commented, “I had 20 years ICU experience when I started at this ICU. I have advanced mechanical ventilation knowledge.” Other participants’ comments included, “I didn’t feel it would benefit me after reading it,” and “I didn’t start ICU at this hospital; I have learned mechanical ventilation before.”

In-Service Education

Respondents were asked to identify other available forms of education on invasive mechanical ventilation offered apart from the SDLP and RIPPLES program. The majority of respondents indicated in-service education and the intensive care-based orientation that were offered by the ICU; there was no mention of any other form of CE. This theme highlighted that in-service education was targeted mainly at day-shift nurses who were on duty at the time the in-service was conducted or that in-service education was conducted primarily when a new ventilator machine or mode of ventilation was being introduced. In addition, ICU nurses mentioned receiving unstructured, ad hoc, informal education at the bedside on invasive mechanical ventilation. Participants’ comments included “various in-services usually relating to the different ventilators,” and “bedside education with colleagues.”

Practical Structured Education

ICU nurses did not believe there were enough practical sessions to help them develop the skills and knowledge to manage, make decisions, and troubleshoot problems occurring with different ventilators. Respondents emphasized the importance of understanding the weaning process and indicated that this learning and practice needed to happen in a safe environment, minimizing patient risk. In addition, respondents wanted continuous education (not only when a new ventilator or different mode of ventilation or guideline was introduced), arguing, for example, that some modes of ventilation were not regularly used and that information could be forgotten. The following participant comments illustrate this theme:

- As an in-service: a) practical session for identifying deteriorating patients that may potentially require intubation [and] b) practical session practicing equipment collection [where the equipment is stored in the event of elective and nonelective intubation and which equipment to use] and pretend [simulate an] intubation. Look at each [person’s] role and/or role swap necessary to be performed during intubation.
- Case scenarios and problem management. Regular in-services about ventilation. Refreshers—for example, NAVA (neutrally adjusted ventilatory assisted mode) was introduced approximately 2 years ago, and we very rarely have patients on it. Every time I look after a patient on it, it’s like it’s the first time.

Interactive Bedside Teaching

The recommendations for additional forms of education revealed that the nurses’ learning preference was for interactive teacher-centered approaches. They elucidated the need for more frequent structured bedside teaching on a daily basis, as well as peer education and discussions on mechanical ventilation. ICU nurses preferred this form of education to be initiated by clinical nurse specialists or clinical nurse educators and involve multidisciplinary team members. They also recommended hands-on practical sessions, more regular in-service education, and case scenarios for problem solving. For example, participants’ comments included, “Bedside teaching, multidisciplinary learning (nurses, physios, doctors together),” “Education throughout the work days/shifts talking about ventilation and talking about patient’s current ventilation, etc.,” and “More hands-on in-services, especially when first starting in the ICU, [and] troubleshooting in-services.”

A diverse range of methods were recommended to meet individual learning styles; participants stated that CE also should have online activities and simulations instead of being mainly education tutorials or workshops. Some
ICU nurses reported that although they were confident about their knowledge and understanding of invasive mechanical ventilation, frequent updates such as structured refresher courses and workshops were fundamental for them. The following participant comments reflect this:

- Structured education in clinical environment/at the bedside, low-fidelity simulation in the clinical environment, workshops x three each year—we should be experts on mechanical ventilation; this is our specialty. More in-services are needed, and redesign the learning package.
- An online package presenting a scenario and requiring decision making by the participant may be useful or an online program with virtual ventilators that can be used to change settings, etc., and see the potential effects of those ventilator changes on a patient.

**Practicing Safe Care**

The respondents were asked to provide recommendations for content that would supplement their understanding of invasive mechanical ventilation. They identified a need to review lung physiology and pathophysiology; principles of mechanical ventilation including indications for mechanical ventilation and setting the ventilator, as well as modes of mechanical ventilation; and sedation and technological troubleshooting. Finally, they indicated a need to better understand the ventilation weaning process. Some examples of topics recommended by participants included:

- Care of patients on mechanical ventilation.
- Indications and complications associated with mechanical ventilation.
- Safety measures.
- Interpretation of reaction, response, and outcomes of mechanical ventilation.
- Weaning techniques from ventilation settings.
- What to do when a patient fails the weaning process.
- Escalation strategies of types of ventilation, from nasal prongs oxygen to high-frequency oscillatory ventilation.
- What propels patients to each step (e.g., nasal prongs, Venturi mask, non-rebreather mask, and ventilation).

**DISCUSSION**

The findings of this study indicate that most of the respondents perceived that apart from the SDLP, the RIPPLES program, and a few ad-hoc in-service education sessions, other forms of education delivered were designed for newly hired nurses or for novice ICU nurses. The study suggested that the CE provided at this time was not meeting the ongoing needs of more experienced nurses and that they would support CE on invasive mechanical ventilation delivered within the clinical area. It is important to understand that CE is key not only for keeping up to date or acquiring new knowledge but also as a way of improving quality of care, questioning, reflecting, and rethinking current practice (Al-Majid, Al-Majed, Rakovski, & Otten, 2012; Levett-Jones, 2005).

ICU nurses who reported not completing the SDLP indicated they perceived the package to have mostly introductory content and was not relevant for their level of development. The ICU nurses’ reasoning about the application of education and the relevance of its content is crucial to engaging nurses’ learning and increasing their levels of satisfaction with the education (O’Shea, 2003). Course content that is relevant to nurses is easily implemented into practice (Meyer, Lees, Humphris, & Connell, 2007). Also, it was not evident from the responses given by the respondents whether they were instructed by the education team or nurse managers that the SDLP was not designed only for novice ICU nurses.

ICU nurses have varying levels of clinical experience, skills, and knowledge. This poses challenges in selecting relevant content for CE to meet individual goals. Relevant content leads to successful learning transfer and a high level of satisfaction for participants (Meyer et al., 2007). Therefore, it may be beneficial for the educational content to meet the professional needs and different stages of nurses’ development including introductory, intermediate, and advanced components.

Respondents suggested bedside teaching and peer education as the preferred teaching method. These methods represent a nonpolarized way of learning whereby instead of being passive recipients of knowledge (e.g., as part of the audience of a seminar), the education would be more participative, with the challenges of the work itself, and the nurses would be able to exchange knowledge and experiences. These responses are supported by the literature, which suggests that interactive learning methods involving direct participation are the most appropriate teaching style and are most likely to lead to future changes in professional practice (Grisci & Jacono, 2006). In addition, nurses prefer direct teacher-structured experience; however, the knowledge obtained from external workshops, conferences, or seminars, for example, are more expensive and time consuming, and sometimes do not address nurses’ context-specific needs (Berings, Poell, & Gelissen, 2008; O’Shea, 2003).

In contrast, it has been suggested that health care professionals should be more self-directed rather than teacher-centered learners, as they have more experience and subsequently are more confident to control their learning. This would depend on the nurse’s motivation and learning orientation, resulting in the nurse educator’s role shift-
ing from teaching to facilitating nurses to develop a set of skills for effective self-directed learning (O’Shea, 2003).

At the time of the survey, this ICU did not provide a well-designed and structured CE program for all levels of nursing experience on invasive mechanical ventilation. Such a program would include multiple educational approaches aligned with the nurses’ learning preferences and styles. Smith and Dalton (2005) stated that learning preferences can be represented in two dimensions: dependent or independent/self-directed, and verbal or nonverbal. It is reasonable to suggest that within this ICU, nurses were more nonverbal than verbal and more dependent than self-directed, therefore demonstration and hands-on practice sessions probably would be the most appropriate educational approaches.

Kolb’s study (1983) proposed a learning style model in which individuals learn through a four-stage cycle process that progresses from learning through experimenting/doing or observing and using intuition/feeling-based judgment or using logical thinking. The open-ended questions gave an overview of the individual’s learning style to help construct new or improved learning opportunities (Massey, Kim, & Mitchell, 2011; Neri, 2007). The literature also suggests that senior experienced nurses are more likely to use abstract conceptualization and active experimentation as their preferred learning style, indicating they learn from thinking and analyzing problems in a systematic way and by actually doing what they are learning (Salehi, 2007).

Study Strengths

The main strength of this study is that the respondents were representative of those currently working in a level three ICU in Australia, providing feedback on their experience in terms of education regarding invasive mechanical ventilation. Analysis followed a pragmatic approach, where it described the phenomenon and reflected the respondents’ point of view (Neergaard, Olesen, Andersen, & Sondergaard, 2009). The data collection tool for this study was guided by contemporary literature and developed by four critical care nurses with clinical and research experience.

This study was conducted at a large regional tertiary referral center ICU, which is likely to be similar to other large ICUs elsewhere, and the respondents’ perceptions could be shared by other ICU nurses. Thus, the findings of this study could add to the existing literature used to improve CE on invasive mechanical ventilation in this specific ICU, within Australia, and in other countries.

Study Limitations

Since this survey was conducted, education on invasive mechanical ventilation at this ICU has undergone modification and therefore some of the findings may be less relevant. In addition, the survey focused on the education on invasive mechanical ventilation only. It would be valuable to extend understanding of the respondents’ perceptions of the education on noninvasive ventilation.

The findings from the survey regarding the two specific tools (SDLP and RIPPLES) cannot be generalized to all ICUs because they are not standardized. In addition, the qualitative findings reported here came from a limited number of open-ended questions, thereby limiting the depth of exploration on the topic. Not all nurses were required to answer all questions, and not all nurses responded to all questions; incomplete surveys were included in this qualitative component for this reason. The response rate (approximately 40% for the three open-ended questions that all participants were directed to answer) provided sufficient qualitative data. In the qualitative context, responses were holistic, appropriate, and transferable to this population of nurses, enabling the authors to explore and answer the research question (Marshall, 1996).

The themes created by using qualitative content analysis were developed by the authors’ interpretation of the text with possible multiple meanings from the survey (Graneheim & Lundman, 2004). In addition, no respondents could be identified after the surveys had been returned to the researchers. Therefore, the authors were unable to return the emerging analysis to respondents and validate themes as they developed. This is a limitation of the trustworthiness of this project.

CONCLUSION

In highly dynamic and challenging environments, such as ICUs, where change in evidence-based clinical
practice and the advancement in technology occurs at a rapid pace, CE on mechanical ventilation should use a structured approach and be delivered frequently. ICU nurses perceived a gap in the CE delivered on invasive mechanical ventilation. At the time of this survey, the focus was more toward novice ICU nurses entering the critical care area or updating skills on the arrival of new technology. The ICU nurses’ main recommendations were related to the design and implementation of interactive learning tools and courses focusing on experienced nurses. These findings will guide future investigation on delivery of mechanical ventilation education to nurses to help determine whether ICUs are meeting nurses’ educational needs in this area; to make improvements to CE; and possibly to help standardize the learning objectives for invasive mechanical ventilation throughout Australia. Future research should explore whether the findings from this study are shared by other large ICUs.

REFERENCES


