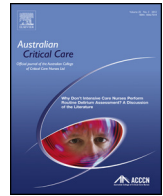




Contents lists available at ScienceDirect

Australian Critical Care

journal homepage: [www.elsevier.com/locate/aucc](http://www.elsevier.com/locate/aucc)



## Education of ICU nurses regarding invasive mechanical ventilation: Findings from a cross-sectional survey



Michelle Copede Guilhermino (Grad Cert Crit Care, Grad Cert Surg Nurs, BN, RN)<sup>a,\*</sup>,  
 Kerry J. Inder (PhD Grad Dip Clin Epid, BN, RN)<sup>b,1</sup>,  
 Deborah Sundin (PhD, BN (Hons))<sup>c</sup>,  
 Leila Kuzmiuk (MN, Dip Adv Clin Nurs (ICU), BN, RN)<sup>d</sup>

<sup>a</sup> School of Nursing & Midwifery, Faculty of Health and Medicine, University of Newcastle, NSW, Australia

<sup>b</sup> School of Medicine and Public Health, Faculty of Health and Medicine, University of Newcastle, Callaghan, NSW, Australia

<sup>c</sup> School of Nursing, Midwifery and Post Graduate Medicine, Edith Cowan University, Perth, WA, Australia

<sup>d</sup> Intensive Care Services, John Hunter Hospital, Hunter New England Local Health District, Newcastle, NSW, Australia

### ARTICLE INFORMATION

#### Article history:

Received 8 January 2013

Received in revised form 21 October 2013

Accepted 31 October 2013

#### Keywords:

Mechanical ventilation

Intensive care

Education

Nursing

### ABSTRACT

**Background:** Continuing education for intensive care unit nurses on invasive mechanical ventilation is fundamental to the acquisition and maintenance of knowledge and skills to optimise patient outcomes.

**Purpose:** We aimed to determine how intensive care unit nurses perceived current education provided on mechanical ventilation, including a self-directed learning package and a competency programme; identify other important topics and forms of education; and determine factors associated with the completion of educational programmes on invasive mechanical ventilation.

**Methods:** A cross-sectional, 30-item, self-administered and semi-structured survey on invasive mechanical ventilation education was distributed to 160 intensive care nurses. Analysis included descriptive statistics and logistic regression was used to determine factors associated with current education completion, reported as adjusted odds ratios (AOR) and 95% confidence intervals (CIs).

**Findings:** Eighty three intensive care unit nurses responded and the majority (63%) reported not receiving education about mechanical ventilation prior to working in intensive care. Using a Likert rating scale the self-directed learning package and competency programme were perceived as valuable and beneficial. Hands-on-practice was perceived as the most important form of education and ventilator settings as the most important topic. Multivariate analysis determined that older age was independently associated with not completing the self-directed learning package (AOR 0.20, 95% CI 0.04, 0.93). For the competency programme, 4–6 years intensive care experience was independently associated with completion (AOR 17, 95% CI 1.7, 165) and part-time employment was associated with non-completion (AOR 0.23, 95% CI 0.08, 0.68).

**Conclusion:** Registered nurses are commencing their ICU experience with limited knowledge of invasive MV therefore the education provided within the ICU workplace becomes fundamental to safe and effective practice. The perception of continuing education by ICU nurses from this research is positive regardless of level of ICU experience and may influence the type of continuing education on invasive MV provided to ICU nurses in the future, not only in the ICU involved in this study, but other units throughout Australia.

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### Introduction

Mechanical ventilation (MV) is the main intervention performed in the treatment of critically ill patients in intensive care units (ICUs). Invasive MV is indicated to support patients with acute respiratory failure in situations where the patient has a partial or total airway obstruction, for example following a drug overdose, slow recovery from anaesthetic drugs or neuromuscular disorders.<sup>1,2</sup> Intensive care unit (ICU) nurses require

\* Corresponding author. Tel.: +61 249292308.

E-mail addresses: [Michelle.Guilhermino@hnehealth.nsw.gov.au](mailto:Michelle.Guilhermino@hnehealth.nsw.gov.au) (M.C. Guilhermino), [Kerry.Inder@newcastle.edu.au](mailto:Kerry.Inder@newcastle.edu.au) (K.J. Inder), [d.sundin@ecu.edu.au](mailto:d.sundin@ecu.edu.au) (D. Sundin), [Leila.Kuzmiuk@hnehealth.nsw.gov.au](mailto:Leila.Kuzmiuk@hnehealth.nsw.gov.au) (L. Kuzmiuk).

<sup>1</sup> Tel.: +61 02 4042 0522

scientific knowledge to provide constant surveillance; make complex decisions to reduce patient discomfort, anxiety and risk of complications; execute ventilator trouble shooting effectively and efficiently; and optimise the patient's ventilation parameters and outcome.<sup>3</sup> Scientific literature on invasive MV and weaning comes predominantly from North America and highlights the development and utilisation of weaning protocols to guide decision-making in clinical practice, rather than the role of ICU nurses in the weaning process<sup>4</sup>; with some results suggesting that protocols reduce the length of intubation.<sup>5–7</sup>

The role that ICU nurses perform in the care of ventilated patients differs considerably between countries. In North America, respiratory therapists are responsible for managing ventilator changes and weaning under medical supervision.<sup>8</sup> Therefore, clinical bedside decision making on the management of ventilated patients by ICU nurses is limited and the ICU nurses role in decision making becomes less clear.<sup>8,9</sup> In Australia, New Zealand and some European countries, the weaning process is collaborative between ICU nurses and physicians, where ICU nurses fill the respiratory therapist's role,<sup>8</sup> having an autonomous role in the management of MV and weaning, with an associated high level of responsibility.<sup>10</sup>

The undergraduate curriculum for nursing in Australia incorporates basic care of the patient with breathing difficulties however, the principles of invasive MV are not taught in detail, and registered nurses (RNs) new to ICU may not be sufficiently prepared to independently care for patients receiving invasive MV. In Australia and New Zealand there are a variety of non-mandatory post-graduate programmes that comprise certificates, diplomas and masters, which incorporate skills and knowledge on invasive and non-invasive ventilation and the weaning process.<sup>8</sup> The majority of RNs commence employment in the ICU before enrolling in a post-graduate course; therefore it is fundamental that the workplace offers high quality education to bridge the gap between new knowledge acquired and competent practice. It is equally important that, continuing education targeting all levels of nursing experience is employed to maintain patient safety, improve patient outcomes and assure ICU nurses' welfare.<sup>11,12</sup>

## Context

This research was undertaken in a 22-bed, level three ICU within a 550-bed regional tertiary referral hospital in New South Wales. This ICU incorporates adult, paediatric and cardiothoracic intensive care, as well as high dependency services; all under the management of an intensive care specialist. Level three ICUs are referral centres for critical care patients, providing complex multi-system life support and 24-h on-site access to pathology, pharmacy, operating theatres and tertiary imaging services.<sup>13</sup> This ICU has neither a formalised protocol on ventilation or weaning, or respiratory therapists; ICU nurses are responsible for managing, assessing and making collaborative or autonomous decisions for patients receiving invasive MV.

At the time this research was undertaken, the education delivered to ICU nurses by this ICU consisted of five main components, summarised in Table 1. The first component was an educator assisted orientation provided as part of the intensive care based orientation programme and held in the first week of employment. The second component was an assisted bedside orientation, where the new starter (novice and experienced) RNs work in partnership with senior ICU nurses in a supernumerary capacity over a two-day period. During this time the new RNs receive one-on-one education on looking after a ventilated patient, depending on the RN's level of experience.<sup>14</sup>

The third component was a self-directed learning package (SDLP) on adult ventilation management, developed by a clinical nurse specialist within this ICU, which focuses on seven key areas

**Table 1**

Components of the continuing education delivered to intensive care nurses on invasive mechanical ventilation in a level three intensive care unit in regional New South Wales, Australia.

- 
1. Educator assisted orientation
    - Assessment of knowledge and skills on invasive mechanical ventilation for nurses new to the intensive care unit environment
    - Orientation to ventilators, location of consumables, and intranet resources (learning packages, guidelines and procedures, competency programme)
    - Practical hands-on teaching session
      - assembly of ventilators
      - initial settings and modes
  2. Bedside orientation
    - Demonstration of respiratory physical assessment:
      - auscultation, inspection, signs of respiratory distress
      - indications, modes and complications of invasive ventilation
      - airway security, position of the endotracheal tube, cuff pressure
      - documentation
    - Demonstration of the airway safety equipment and placement
    - Discussion of respiratory interventions:
      - patient positioning
      - endotracheal tube suctioning
      - blood gas interpretation
      - humidification and nebulisers
  3. Adult Ventilation Management Self Directed Learning Package (SDLP)
    - Airway management
    - Invasive ventilation indications and contraindications
    - Description of the role of the intensive care unit nurse
    - Ventilation modes and other settings
    - Intubation equipment and medications
    - Nursing care, communication with the patient and ventilation documentation
    - Weaning methods and extubation
  4. Recognition in Prior Professional Learning, Experiences, and Skills programme (RIPPLES) – care of a ventilated patient in intensive care:
    - Ventilation objectives
    - Servo-i ventilator
    - Evita 4 ventilator
    - Intubation objectives
    - Intubation skills
    - Tracheostomy objectives
    - Tracheostomy percutaneous insertion
    - Tracheostomy tube change
    - Intercostal catheter management objectives
    - Intercostal catheter removal skills
  5. In-service session
- 

with activities related to each topic.<sup>15</sup> The Recognition in Prior Professional Learning, Experiences, and Skills (RIPPLES) programme was the fourth component, a competency-based programme designed to assess nursing practice and determine acceptable clinical competency levels.<sup>16</sup> RIPPLES was also developed within the ICU by a team of ICU nurses and implemented in 2005; organised into 10 sections related to clinical practice (5 compulsory and 5 optional) and was assessed by a clinical nurse educator, clinical nurse specialist or an ICU nurse who has completed the whole programme. To satisfactorily complete each section ICU nurses need to demonstrate sufficient knowledge or skill on the topic. When RNs did not know a specific answer, they were assisted with complementary education material, information on relevant short courses or library resources, and offered one-on-one tuition.<sup>17</sup> The final component refers to in-service education sessions on topics such as modes of ventilation and common ventilator trouble shooting, delivered as ad-hoc topics.

This study aims to determine: (1) how novice and experienced ICU nurses perceived the current education resources designed to improve and update knowledge, and ability to make clinical decisions about invasive MV; (2) how novice and experienced ICU nurses perceived current and suggested forms and topics of education on invasive MV; and (3) factors

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