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Research paper

## Approaches and adjuncts used by physiotherapists when suctioning adult patients who are intubated and ventilated in intensive care units in Australia and New Zealand: A cross-sectional survey

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### ABSTRACT

**Background:** Suctioning is an integral component of care for patients who are intubated and ventilated in an intensive care unit (ICU). There appears to be no published data of physiotherapy suctioning practices in Australia or New Zealand.

**Objective:** To describe suctioning practices and the factors which have shaped these practices, of experienced physiotherapists working with adults who are intubated and ventilated in an ICU across Australia and New Zealand. Areas of investigation focused on: (i) suctioning approach (i.e. open vs. closed system); (ii) use of adjuncts to suctioning such as hyperoxygenation, hyperinflation and saline lavage; (iii) use of subglottic suctioning and; (iv) factors influencing suctioning practices.

**Methods:** Electronic surveys were emailed to experienced physiotherapists working in ICUs across Australia and New Zealand which had the capacity to intubate and ventilate adult patients for  $\geq 24$  h.

**Results:** The participation rate was 84.8% (112/132). Closed suction system was used in most ICUs (97/112, 86.6%). Hyperoxygenation was commonly performed on 'all' or 'most' patients *before* suctioning (71/112, 63.4%), but less frequently *after* suctioning (38/112, 33.9%). Hyperinflation was infrequently performed on 'all' or 'most' patients *before* (22/112, 19.6%) or *after* suctioning (22/112, 19.6%). Saline lavage and subglottic suctioning were infrequently performed on 'all' or 'most' patients (3/112, 2.7%; 17/112, 15.2%, respectively). 'Personal experience' and 'established practice in the ICU' had the greatest influence on suctioning practices.

**Conclusions:** Most ICUs in Australia and New Zealand are equipped for closed system suctioning. As hyperoxygenation minimises desaturation during suctioning, there may be scope for a larger proportion of physiotherapists to use this adjunct. The practice of hyperinflation before and after suctioning was uncommon despite the emerging evidence for improved lung compliance with this procedure. Subglottic suctioning was infrequently available as a choice for physiotherapists despite the strong evidence, which suggests an evidence-practice gap.

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### 1. Introduction

Suctioning is a procedure that involves the use of negative pressure to remove secretions from the airway.<sup>1,2</sup> It is an integral

component of care for patients who are intubated and ventilated in an intensive care unit (ICU).<sup>1</sup> Nevertheless, it is often a painful and distressing experience and places the patient at risk of oxygen desaturation, reduced lung compliance, infection, and untoward cardiovascular responses.<sup>2–5</sup> Various approaches and adjuncts to suctioning have been trialed to mitigate these risks. Regarding approaches, both the open suction system (OSS) and closed suction system (CSS) may be available to use in an ICU. An OSS approach involves either completely disconnecting the patient from the ventilator to introduce the suction catheter into

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the airway, or introducing the suction catheter into the airway through a self-sealing port which assists in preserving positive end-expiratory pressure.<sup>1</sup> In contrast, a CSS approach or 'in-line' suctioning, involves using a suction catheter in an enclosed plastic sleeve, which is integrated into the ventilatory circuit. These suction catheters, enclosed in their sleeves, are often left in place for up to 72 h.<sup>1,6</sup> There is emerging evidence that, compared with OSS, CSS reduces the risk of ventilator-associated pneumonia (VAP)<sup>7</sup> but does not influence oxygenation, duration of mechanical ventilation, length of ICU stay, or mortality.<sup>1,6–9</sup>

In addition to different suctioning approaches, adjuncts such as the use of hyperoxygenation, hyperinflation and saline lavage, are available to mitigate risk and/or optimise sputum yield. There is strong evidence that hyperoxygenation performed before, during and after suctioning helps to minimise desaturation after suctioning.<sup>1,10,11</sup> Hyperinflation implemented before and after suctioning has been shown to improve lung compliance following suctioning,<sup>1</sup> and there is some evidence that saline lavage will increase sputum yield, although it is unclear whether or not it increases the incidence of VAP.<sup>12,13</sup> Regarding equipment, some ICUs facilitate subglottic suctioning, which involves removing secretions that have pooled above the cuff of the endotracheal tube, through the use of a specially designed endotracheal tube with a separate dorsal lumen that opens directly above the endotracheal tube cuff.<sup>1,14</sup> There is evidence that subglottic suctioning reduces the risk of VAP, duration of mechanical ventilation, and length of ICU stay.<sup>14,15</sup>

To date, there appears to be no published data of the approach and adjuncts to suctioning used by physiotherapists working in ICUs across Australia or New Zealand (NZ). As such, it is difficult to ascertain whether evidence is shaping current suctioning practices, so that safety and effectiveness of the procedure are optimised. Therefore, the aim of this study was to report the current suctioning practices of experienced physiotherapists working with adult patients who are intubated and ventilated in an ICU in Australia or NZ. The scope of this investigation was limited to: (i) the use of OSS vs. CSS; (ii) the use of adjuncts to suctioning such as hyperoxygenation, hyperinflation and saline lavage; (iii) the use of subglottic suctioning and; (iv) factors that have shaped suctioning practices.

## 2. Materials and methods

### 2.1. Study design

A cross-sectional observational study was conducted across Australia and NZ with data collection taking place between January 2014 and March 2014. Ethical approval was obtained from the Human Research Ethics Committee at Curtin University, Western Australia (approval number PT254/2013).

### 2.2. Setting and eligibility criteria

A list of ICUs in Australia and NZ were identified via the Australian and NZ Intensive Care Society Centre for Outcome Resource Evaluation database<sup>16</sup> and the National Health Performance Authority of Australia website.<sup>17</sup> Hospitals from this list with the capacity to intubate and ventilate adult patients for  $\geq 24$  h were eligible for inclusion. Hospitals were excluded if the ICU accommodated primarily a neonatal or paediatric case mix. Staff at each hospital were contacted via telephone to confirm that their ICU met the eligibility criteria.

For hospitals that met the study criteria, the manager of the Physiotherapy Department was contacted either via telephone or email, and asked to provide the contact details of the physiotherapist with the most experience in this clinical area who

maintained a clinical caseload in the ICU. This physiotherapist was then invited to participate in this study and provided with a participant information sheet via email. Each physiotherapist was asked to complete an electronic survey within two weeks. Return of the completed survey was implied as consent to participate in the study. Participants were informed that on completion of data collection, prior to analysis, data would be saved in a de-identified format.

### 2.3. Optimising the participation rate

A modified Dillman approach was used to optimise participation rate,<sup>18</sup> as this has been demonstrated to be effective in other studies.<sup>19,20</sup> Reminder emails were sent every two weeks until such time as the survey had been completed. A maximum of three reminders were sent to the physiotherapist, followed by one reminder email to the manager of the Physiotherapy Department as a last attempt to facilitate participation.

### 2.4. Survey format and variables

An electronic (i.e. online) survey was developed using the Qualtrics survey software program (see online supplement for a copy of the survey).<sup>21</sup> In order to optimise readability and face validity, the survey was piloted by five experienced cardiopulmonary physiotherapists prior to use. The final survey comprised four sections and a total of 44 questions. Sections 1 and 2 included questions pertaining to the characteristics of the ICU and physiotherapists who completed the survey, respectively. Section 3 focused on the factors that shaped the suctioning practices (entry level training, textbooks, established practice in ICU, published journal articles, personal experience, professional development and postgraduate education). Section 4 included questions pertaining to OSS vs. CSS, adjuncts (hyperoxygenation, hyperinflation and saline lavage) and whether or not subglottic suctioning was available to the physiotherapist. The responses to most questions were in the format of a 5-point Likert scale (e.g. 'All patients', 'Most patients', 'Some patients', 'A few patients' or 'None of the patients'). A small proportion of questions were in the format of multiple choice or open-ended responses.

### 2.5. Data analysis

Categorical data were expressed in terms of count, frequency and proportions. Free text was analysed by development of themes and reported qualitatively. To facilitate interpretation of data obtained in Section 4 of the survey, responses of 'all' and 'most' were collapsed and reported together. This is because a response of 'all' and 'most' to any question in this section indicated that the physiotherapist applied the approach in the majority of patients. As this study was descriptive and did not test any hypotheses, no sample size calculations were undertaken.

## 3. Results

### 3.1. Pilot study

In response to piloting of the survey, eight questions were changed to improve the face validity and two questions were altered to improve the readability.

### 3.2. Participation rate

Results of the screening process and final participation rate are summarised in Fig. 1. Briefly, 136 hospitals were identified as meeting the eligibility criteria. However, on four occasions, one

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