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## Clinical validation of expert consensus statements for respiratory physiotherapy management of invasively ventilated adults with community-acquired pneumonia: A qualitative study

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# **Clinical validation of expert consensus statements for respiratory physiotherapy management of invasively ventilated adults with community-acquired pneumonia: A qualitative study.**

## **Implications for clinical practice**

- There was multidisciplinary concurrence that the expert consensus statements for respiratory physiotherapy management of CAP were valuable for guiding clinical practice.
- Clinical stakeholders agreed that the statements can be formalised into clinical practice guidelines.
- Overarching themes of interprofessional teamwork and communication, patient safety and culture were identified as important contextual factors for clinical application of the statements to ensure effective translation to physiotherapy practice and across different ICU settings.
- Further clarification to allow successful translation of some statements, such as use of head down tilt positioning, is required.

## **Introduction**

Community-acquired pneumonia (CAP) is a common lung infection with 10-35% of patients progressing to severe respiratory failure and sepsis requiring admission to an intensive care unit (ICU), and 75% of those requiring mechanical ventilation (Charles et al., 2008; Wilson & Ferguson, 2005; Walden et al., 2014). Physiotherapists frequently contribute to the management of these patients during the acute intubated period to improve pulmonary

function by addressing problems of atelectasis and secretion retention, and to commence early functional rehabilitation (Gosselink et al., 2008; Hanekom et al., 2011).

Currently there is limited evidence to guide respiratory physiotherapy intervention for patients with specific pulmonary conditions admitted to ICU (Stiller, 2013). Whilst no studies to date have examined the effect of respiratory physiotherapy specifically for invasively ventilated adults with CAP, there are some studies which indicate that respiratory physiotherapy improves sputum clearance (Hodgson et al., 2000; Lemes et al., 2009) and lung compliance (Choi & Jones, 2005; Hodgson et al., 2000; Lemes et al., 2009) in small, mixed cohorts of invasively ventilated patients, some of whom had a diagnosis of pneumonia. However, little is known about the impact of respiratory physiotherapy on outcomes of length of stay in ICU or other long term and patient-centred outcomes.

Substantial clinical variability in the respiratory physiotherapy management of intubated patients with CAP exists in Australian ICUs (van der Lee et al, 2017a; van der Lee et al, 2017b). Therefore, in order to provide contemporary clinical guidance for physiotherapy management of this patient cohort, expert consensus was sought through an international panel of clinical and academic experts in critical care physiotherapy using an eDelphi method (van der Lee et al, 2019). These consensus statements, which provided a list of what experts in the field of critical care physiotherapy determined reflected current best practice, have potential to be further formalised into clinical practice guidelines. However, while these consensus statements were derived from international expert consensus around the evidence for best practice, it is possible that clinicians may identify barriers to implementation in Australian ICUs. Therefore, it was important to seek independent stakeholder feedback from Australian ICU clinicians whose practice would be informed by such guidelines to determine how they would best be applied within the clinical setting.

Clinical practice guidelines have been developed in many areas of health care in order to present a summary of detailed synthesis of the best evidence to clinicians in order to optimise patient outcomes through reduction of unwanted variation in clinical practice (Dijkers, Murphy, & Krellman, 2012; Dodek, Cahill, & Heyland, 2010; Grüne, Ottens, & Klimek, 2007; Kredo, Bernhardsson, Machingaidze, et al., 2016). The aim of this study was to conduct a peer-review of the expert consensus statements for respiratory physiotherapy management of CAP to determine their acceptability to Australian multidisciplinary ICU staff and to explore what adaptations might be required to enable them to be developed into a relevant and useful guideline for clinical practice

## **Methods**

### *Design*

A qualitative mixed methods study with an exploratory sequential two-phase design of focus groups, followed by semi-structured interviews was conducted (Cresswell, 2014). The two phases assisted to gain a broad and rich data that would aid to provide a full clinical perspective about the expert consensus statements.

Three focus groups, two physiotherapy and one multidisciplinary, were conducted between September and November 2017. Senior medical, nursing and physiotherapy clinicians working in an Australian Level 2 or 3 ICU (College of Intensive Care Medicine, 2011) were eligible to participate. A purposive sampling strategy using professional networks of the research team was employed to recruit senior ICU clinicians, (classified as having a minimum of five years ICU experience), who would be able to contribute experienced insight into the clinical value and applicability of the consensus statements (Liamputtong, 2011). Targeted potential participants were emailed directly with an invitation to participate. Recruitment through snowballing was also encouraged (Liamputtong, 2011) by asking potential participants to forward the invitation to other senior ICU colleagues. A sample size of between 6 and 12

participants was targeted for each group in order to achieve a balance between generating depth of discussion, maintaining focus, and managing the flow of conversation and group dynamics (Liamputtong, 2011).

In order to gain a national physiotherapy perspective, the two physiotherapy focus groups were held across Australia, one on the west coast in Perth and the other on the east coast in Sydney, as previous research identified substantial regional diversity in physiotherapy clinical practice for this patient cohort (van der Lee et al, 2017a, 2017b). To aid recruitment, the Sydney focus group was planned to coincide with a national physiotherapy conference which was attended by many senior ICU physiotherapists from different Australian states. Recruitment to each of the physiotherapy focus groups also targeted participants from different sized ICUs, and both public and private facilities. In order to gain insights from a multidisciplinary perspective a second Perth focus group was conducted, comprised of senior ICU clinicians from the medical and nursing disciplines in addition to physiotherapy. Semi-structured interviews were also conducted in Perth with a small number of ICU medical consultants and senior nurses from a level 3 ICU to triangulate the data from a multidisciplinary perspective, with the aim of increasing the credibility of the findings, and to determine saturation of themes (Liamputtong, 2011).

#### *Focus group procedure*

In preparation for each focus group, the participants were sent the expert consensus statements, which were previously published (van der Lee et al, 2019), and an outline of the key topics for discussion by email one week beforehand. Participants were asked to review and reflect on this information prior to attending the focus group in order to facilitate discussion (Liamputtong, 2011). Each focus group was held at a central location convenient

to participants and was 60-90 minutes in duration. The sessions were conducted by a trained moderator, who was also the primary investigator (LV) and a note-taker (SP).

The moderator led the focus group according to a predetermined framework of key discussion topics based on the domains of the expert consensus statements and facilitated discussion amongst participants. The interview guide is presented in online Appendix 2. Participants were prompted where necessary to stimulate deeper discussion and probing questions were asked to seek further explanation or clarification of meaning (Liamputtong, 2011).

#### *Data collection and analysis*

Each focus group and interview was audio-recorded using an iPhone. Additional information was recorded by the note-taker during each group session, and key themes were summarised on a white board and reviewed by the participants prior to the conclusion of each session. Participants were encouraged to make handwritten notes on a form provided which outlined key discussion topics. On the form, participants were also asked to anonymously write down which three consensus statements they believed were most important to clinical practice. These forms were collected at the end of the session and contributed to the data as a form of method triangulation. The recordings were later transcribed verbatim by the primary investigator (LV) and member checking of the transcripts was performed by three participants of each group with the aim of improving credibility.

All transcribed data and participant notes from focus groups and interviews were collated using Microsoft Excel 2013 and analysed using thematic analysis (Braun & Clarke, 2013). A recursive process was undertaken to search for patterns of meaning and themes of interest

within the data (Braun & Clarke, 2013). Both deductive and inductive approaches to data analysis were employed. Deductive analysis was used to confirm clinical validity and applicability of the expert consensus statements within the domains of the consensus statement framework (van der Lee et al, 2019), whereas inductive analysis identified any new themes which arose from the qualitative data regarding factors perceived by participants to influence the application of the consensus statements into clinical practice.

Ethics approval was provided by the human research and ethics committee of The University of Notre Dame Australia (014126F). All participants provided written informed consent at the outset of the focus groups or interviews.

## **Findings**

### **Participants**

There were 26 participants who expressed interest. All were eligible and included, with 22 participating in the focus groups and four in a one-on-one interview. Participants were senior ICU physiotherapists (n=16, 62%), senior ICU nurses (n=4, 15%) and consultant intensivists (n=6, 23%). The number of physiotherapists were divided equally between Perth and Sydney groups. Participant length of ICU experience is presented in Table 1. Participant jurisdiction of the Sydney focus group, according to state, is presented in Table 2.



## **Participant response to expert consensus statement domains**

There was concurrence from all three focus groups that overall, across the seven domains of physiotherapy assessment, patient selection and prioritisation, positioning, hyperinflation techniques, manual chest wall techniques, normal saline instillation, and active modes of treatment and mobilisation, 76% (n=29) of the expert consensus statements were relevant and clinically applicable within the multidisciplinary ICU setting without modifications or perceived barriers to implementation. Furthermore, physiotherapists stated that the expert consensus statements could provide useful guidance for junior physiotherapists and assist with training of staff new to the complex specialty of intensive care. The list of statements not requiring modification are presented in Appendix 2.

Focus group participants were asked which of the consensus statements they considered to be most important for clinical practice. All physiotherapy assessment items (Statements 5-13), which were grouped together as one category, were rated in the top three most important for clinical practice by 31% of participants (n=7). Other consensus statements which participants most rated in their top three were:

Statements 3 & 4, (23%, n=5): *“These patients should receive a respiratory physiotherapy assessment within 24 hours of intubation...and daily while in ICU.”*

Statement 18, (23%, n=5): *“Assuming haemodynamic stability, patients who have evidence of secretion retention and/or high sputum load and/or impaired gas exchange would benefit from frequent respiratory physiotherapy assessment and treatment.”*

Statement 34, (23%, n=5): *“Once the patient is conscious and able to participate in treatment, active modes of respiratory treatment should be used (e.g. deep breathing*

*exercises, active cycle of breathing techniques, forced expiratory technique) rather than passive treatment modes such as hyperinflation and/or manual chest wall techniques.”*

#### *Participant feedback regarding modifications required to enhance applicability*

No modifications were considered necessary for any statements in the domains of manual chest wall techniques and normal saline instillation.

#### *Domain – Manual Chest Wall Techniques*

Physiotherapists reported using these techniques and concurred with the statements that these techniques “*may be beneficial*” in practice. However, there was general concurrence that chest wall vibrations would be used more commonly than percussion or rib cage compression. Use of these techniques was acceptable across disciplines, with one intensivist commenting:

*“I’d like to see them (manual chest wall techniques) being used, it seems sensible and intuitively good to me...”* (Intensivist, >20 years ICU experience)

#### *Domain – Normal Saline Instillation*

Although the use of normal saline instillation appeared controversial, participants from all disciplines concurred that all consensus statements in this domain reflected current practice that normal saline instillation “*should not be routinely instilled in the airway prior to airway suctioning*” (van der Lee et al, 2019), but would be appropriate “*only when the secretions are very tenacious and unable to be cleared using other techniques*” (van der Lee et al, 2019).

One physiotherapist commented:

*“...sometimes there’s a good plug and the suction catheter is going through it and not actually getting it, not until you get the saline down there...”*

(Senior Physiotherapist > 30 years ICU experience)

One intensivist commented:

*“If you told me that’s what you do I wouldn’t complain, I wouldn’t say absolutely not, if you told me you didn’t do it I wouldn’t say do it. I don’t think its routine...”*

(Intensivist, > 20 years ICU experience)

Participants indicated that modifications for nine statements (24%) would enhance clinical utility across the following domains; assessment (n=3), patient selection and prioritisation (n=1), positioning (n=2), hyperinflation techniques (n=2), and active treatment modes and mobilisation (n=1).

#### *Domain – Physiotherapy Assessment*

There was strong concurrence from all disciplines with the following statement:

*Statement 2: These patients should receive a respiratory physiotherapy assessment within 24 hours of intubation. (van der Lee et al, 2019)*

with agreement that physiotherapy assessment should be conducted soon following ICU admission in order to *“get a good handle on the patient early to determine illness severity and respiratory requirements”* (Intensivist, > 20 years ICU experience). However, physiotherapists from all three focus groups reported that physiotherapy staffing capacity and service models are potential barriers for provision of physiotherapy assessment within the first 24 hours of intubation, particularly for smaller or rural hospitals which often have less

allocated physiotherapy staffing in ICU, especially on weekends, which might affect translating this guideline statement into practice. Similarly, physiotherapists also concurred that application of the following statement:

*Statement 4: These patients should receive a respiratory physiotherapy assessment more than once a day while in ICU when indicated by assessment or treatment findings.*

would be also partially dependent on the physiotherapy staffing available to the ICU during both normal working hours and after-hours. Therefore, the availability of staffing resources was viewed as a potential barrier to translation of these statements into practice in some facilities.

Participants also indicated that the following statement:

*Statement 5: Respiratory physiotherapy assessment should include ventilation support settings.*

would be improved by modification to include, where available, elements of mean and plateau airway pressure and lung compliance in order to enhance risk stratification.

Regarding airway pressure, two intensivists commented:

*“Mean airway pressure to me reflects how sick the patient is and how hard you are needing to ventilate....the degree of lung damage”.* (Intensivist, > 20 years ICU experience)

*“...I would attach more weight to plateau (pressure) than peak (pressure) for risk stratification to make sure you don't hurt the patient”.* (Intensivist, > 20 years ICU experience)

Physiotherapists indicated that assessment statements would be enhanced by inclusion of inspiratory capacity, as measurement of inspiratory strength requires specific equipment not readily available in most settings. One physiotherapist commented:

*“I’d be looking at somebody’s ability to cough and deep breathe which I’d say is inspiratory capacity and that I would say should be in the standard of assessment.”*

(Senior Physiotherapist, > 10 years ICU experience)

Knowledge of current and pre-morbid respiratory medication usage was also considered important for inclusion.

#### *Domain – Patient selection and prioritisation*

Physiotherapists concurred that the following statement:

*Statement 18: Assuming haemodynamic stability, patients who have evidence of secretion retention and/or high sputum load and/or impaired gas exchange would benefit from frequent respiratory physiotherapy assessment and treatment.*

required further detail to indicate that patient selection for respiratory intervention must be based on “*physiotherapy treatable problems*” (Senior Physiotherapist, > 30 years ICU experience). Participants from all disciplines concurred that when physiotherapy intervention is indicated it should be provided according to a patient-centred approach, “*based on what the patient needs at the time*” (Senior Nurse, > 5 years ICU experience).

#### *Domain - Positioning*

There was general concurrence by physiotherapists with the following two statements, regarding use of side-lying position to target affected lung regions:

Statement 20: *When the lung pathology is unilateral, the patient should be positioned in side-lying with the affected lung uppermost for respiratory physiotherapy treatment.*

Statement 22: *When the lung pathology is bilateral, the patient should be positioned in alternate side-lying for respiratory physiotherapy treatment.*

However, while statements were considered correct, further information was needed to emphasise use of the full side-lying position, rather than a tilt, in order to enhance clinical practice. There was general concurrence among nurses and physiotherapists that the full side-lying position is more clinically beneficial but underutilised compared to a tilt away from supine, particularly by inexperienced clinicians. One nurse commented:

*“Side-lying has to actually be side-lying, as opposed to shoulder turn or tilt, that’s not side-lying”* (Senior Nurse > 5 years ICU experience)

The following two consensus statements regarding head down tilt (HDT) were seen to be controversial among participants.

Statement 23: *Positioning the patients with head down tilt is beneficial to target drainage of the lower lobes as long as there are no contraindications and the patient is stable enough to tolerate this position.*

Statement 24: *If the head down tilt position is used, to minimise risk of aspiration of gastric contents into the lungs it is ideal to either stop enteral feeds for at least 30 minutes prior to treatment and/or ensure stomach is emptied by aspirating the nasogastric tube.*

Differences in attitudes and beliefs both within and between disciplines regarding safety and practicality of application into practice, variable clinician use of HDT due to workplace

cultural influences and previous experiences, as well as a lack of guiding evidence for management of enteral feeds with HDT were reported by participants as potential barriers to clinical translation of these statements. There was general concurrence by physiotherapists that it would be pertinent to highlight explicit contraindications for the use of HDT when including these statements in a guideline; such as patients that “have reflux or are not absorbing feeds” (Senior Physiotherapist > 30 years ICU experience), or are “vomiting or have distended bellies who are at high risk of aspiration (Senior Physiotherapist > 5 years ICU experience), to enable end-user clinicians to make the best-informed choice when weighing up potential benefit versus risk to the patient. There appeared to be reluctance among nurses regarding use of HDT. One nurse commented:

*“I would have great difficulty in positioning a patient head down and I would need a direct order from the consultant (intensivist) to tell me to do that....I couldn’t bring myself to do it to be honest....I just couldn’t”*

(Senior Nurse > 5 years ICU experience)

There was a general concurrence among all disciplines that enteral feeds should be stopped prior to HDT, however there was uncertainty regarding the optimal time period of withholding. One intensivist reported:

*“Nobody knows. If you use the analogy for airway protection in anaesthesia you would have to make it much longer than that and in a critically ill or trauma analogy the consensus would be that (patients) are never in a fasted state in terms of their aspiration risk.”* (Intensivist, > 20 years ICU experience)

One physiotherapist commented:

*“... (I) would probably stop the feeds but go more on guidance from nursing staff about (gastric) aspirates they’ve been getting for the previous 12-24 hours...and if*

*there are any concerns then just stop (the feed) and have it aspirated beforehand.”*

(Senior Physiotherapist, > 30 years ICU experience).

Some intensivists believed that stopping enteral feeds throughout the day for periods of physiotherapy intervention may result in difficulty achieving targets for caloric intake. One intensivist reported that *“because of issues such as interrupting nutrition, somebody needs to do a large study looking at patient centred outcomes to look at these questions because of controversial interacting interventions...”* (Intensivist, > 20 years ICU experience)

#### *Domain – Hyperinflation Techniques*

There was general concurrence with the following statements;

*Statement 25: Patients with reduced consciousness should receive physiotherapy treatment with lung hyperinflation techniques when there is increased sputum volume.*

*Statement 26: Intubated patients with reduced consciousness and high sputum viscosity may also benefit from hyperinflation techniques in conjunction with measures to increase airway humidification.*

with one intensivist commenting that *“manual and ventilator hyperinflation if done correctly by someone who’s experienced....in appropriately selected patients with appropriate application of either technique is safe and effective in my opinion.”* (Intensivist, > 20 years ICU experience). However, some physiotherapists concurred that these statements would also be applicable for patients who are conscious but unable to actively generate sufficient increase in tidal volumes, or sustain these during treatment, to enable treatment to be effective. Therefore, modification to statements to be more inclusive to reflect this would enhance practicality.



### *Domain – Active treatment modes and mobilisation*

There was general concurrence with all consensus statements in this domain. However, some physiotherapists concurred that the following statement:

*Statement 35: The patient should be mobilised out of bed as soon as they are conscious and haemodynamically stable*

could be modified to include to patients with reduced levels of consciousness, provided that appropriately supportive seating was available to ensure patient safety. One physiotherapist commented:

*“...if GCS is low and the chair doesn’t have any lateral support, they (the patient) are at high risk of sliding if the nurse walks away...In the majority of units, patients would be conscious or interacting in some form before you commence mobilisation.”*

(Senior Physiotherapist, > 15 years ICU experience).

### **Overarching themes**

Three overarching themes were identified from the focus groups and interviews; teamwork and communication, patient safety, and culture. These themes provided insight into the clinicians’ perspectives about practical aspects of applying the expert consensus statements in the “real-world” environment of the ICU. These overarching themes provided the context within which the consensus statements would need to be presented to be used as a clinical guideline in ICU.

### ***Teamwork and communication***

Participants from medicine and nursing strongly concurred that regular communication between the physiotherapist, bedside nurse, and senior medical staff was essential to ensure coordinated, high quality patient care in the ICU.

The nurses felt that collaboration between physiotherapists and nurses is essential, *“rather than each profession working in isolation”*. (Senior Nurse, > 5 years ICU experience)

Nurses agreed that airway suction should not be considered a substitute for respiratory physiotherapy and concurred that physiotherapists should provide regular assessment and *“have a conversation with the nurse about how they are managing secretions”*. (Senior Nurse, > 15 years ICU experience) The nurses strongly concurred that it was important for the physiotherapist to discuss their assessment findings and treatment goals with the bedside nurse and provide recommendations for optimisation of the patient’s respiratory status. One nurse commented:

*“I think physio should still be coming in and assessing. Routine practice I don’t look at my CXR and say that side’s worse than this side I need to do this positioning...I quite often do that in consultation with the physio....”* (Senior Nurse, > 10 years ICU experience)

There was strong concurrence that multidisciplinary consultation is important when the physiotherapist is concerned about a patient’s haemodynamic stability to safely receive respiratory physiotherapy. There was strong concurrence from all nurses and intensivists that the clinical decision regarding whether a patient is too unstable for respiratory physiotherapy treatment should not be made without multidisciplinary consultation. One nurse summarised this perspective when stating:

*“it needs to be a decision that’s made in conjunction with medical and nursing teams because I have had occasions where the physios have decided of their own accord that the patient wasn’t haemodynamically stable enough to treat without actually discussing it with the bedside nurse or a medic, I just think it should be reinforced that it should be a team decision, not a unilateral decision...”* (Senior Nurse, > 5 years ICU experience)

### ***Patient Safety***

Participants concurred that it is paramount to consider patient safety when applying the consensus statements into practice. Participants indicated that haemodynamic instability is common early in the ICU admission for this cohort. The nurses and intensivists concurred that the bedside nurse has the best knowledge of the patient. They agreed that patient responses to routine nursing procedures, such as turning and suctioning, provide a good indication of likely haemodynamic stability with physiotherapy and therefore a conversation with the bedside nurse would be an integral part of assessment of haemodynamic stability. One nurse commented *“I think the bedside nurse is the first port of call, they know the patient very, very well. They can then refer to a relatively senior doctor if still uncertain”*. (Senior Nurse, >5 years ICU experience) One intensivist suggested that if there are concerns regarding haemodynamic stability, it would be most appropriate discussing with *“senior registrar or above as they would be more likely to have the insight for risk stratification than junior doctors do”*. (Intensivist, > 20 years ICU experience) All disciplines concurred that *“if the physiotherapist is junior, they should first seek further guidance from a senior physiotherapist, if available, if uncertainty persists after discussion with the bedside nurse”*. (Senior Physiotherapist, > 30 years ICU experience) Physiotherapists from the Sydney group concurred that liaison with the bedside nurse to up titrate infused inotropes by as much as 2-

3mL if required, enabled mean blood pressure to be maintained within an acceptable range for the patient to receive respiratory physiotherapy intervention.

### ***Culture***

The data highlighted workplace cultural factors related to geographical location and differences in discipline specific beliefs which may influence the application of the consensus statements into clinical practice. Regional differences in physiotherapy clinical reasoning and clinical practice were apparent across Australia. Physiotherapists in the Sydney group were more inclined to treat patients in the horizontal side-lying or HDT positions and were more likely to use chest wall vibrations or percussion to assist with secretion clearance. None of the Sydney participants described the technique of “rib springing” which was reported by Perth physiotherapists. The majority of participants from Perth from all disciplines reported strong reluctance for use of HDT positioning. The strong influence of culture on practice is highlighted on the comment below:

*“(Having been to) courses in London, certainly majority of people there used HDT, so I think it’s a geographical thing regarding what normal practice is.” (Senior Physiotherapist, > 5 years ICU experience)*

Some nurses and Perth physiotherapists reported reluctance to deviate from the 30 degree head up semi-recumbent position for respiratory intervention due to concerns of increasing risk of ventilator associated pneumonia. This contrasted with the beliefs of some Perth intensivists, who were comfortable with the patient being positioned in the horizontal side-lying position for respiratory intervention in concurrence with physiotherapists from the Sydney focus group.

*“...only during treatment time which doesn’t last very long anyway, sometimes when they (the patient) are washed they are flat....so if they are flat they wouldn’t be longer*

*than 20-30 mins, so no I don't really have any major objections because I can't see it would cause any major harm for 20-30 mins really....evidence or not". (Intensivist, > 20 years ICU experience).*

## **Discussion**

In the absence of higher levels of evidence these expert consensus statements provide the best level of evidence currently available regarding best practice of respiratory physiotherapy for adults invasively ventilated with CAP, and provide a minimum standard to guide best clinical practice for this patient cohort. However, clinical peer-review was necessary before these statements can be implemented in clinical practice. This peer-review process by multidisciplinary senior ICU clinicians established that 76% of consensus statements for respiratory physiotherapy for CAP in ICU that were agreed on by an expert panel were clinically relevant and applicable for the Australian ICU setting. These findings confirmed the earlier e-Delphi process, suggesting that clinicians also supported translation of the evidence on which these statements were based (van der Lee et al, 2019) into practice even though it is limited research (Kwong et al., 2016).

Participants indicated that a thorough physiotherapy assessment, conducted within the first 24 hours of intubation and daily thereafter during the ICU admission was important, and that patients would benefit from frequent physiotherapy assessment and treatment when evidence of secretion retention and impaired gas exchange are evident. However, the availability of allocated physiotherapy staffing to ICU, particularly on weekends, for smaller and rural facilities was identified in this study as a potential barrier to translation of consensus statements indicating need for physiotherapy assessment within 24 hours of intubation or

increased frequency of assessment and/or intervention. Participants also felt it was important that active respiratory treatment modes are used once the patient is awake and able to participate, provided the patient has sufficient ability to perform them effectively.

There were nine statements that were deemed to require some modification or explicit further commentary, to enhance clinical utility, such as inclusion of contraindications for the use of HDT. In this study it appears that greatest variability exists for areas of clinical practice, such as use of HDT and manual chest wall techniques, where there is uncertainty due to little or conflicting evidence. While HDT resulted in greater sputum yield and lung compliance in one study involving ventilated patients (Berney et al., 2004), this position has been associated with increased incidence of gastro-oesophageal reflux (Elkins et al., 2005), which may be undiagnosed, and literature is unavailable to guide the management of enteral feeds. Despite use of manual techniques for ventilated patients in clinical practice (van der Lee et al, 2017b), studies have been unable to demonstrate significant benefits in sputum clearance, compliance or oxygenation (Genc et al., 2011; Guimaraes et al., 2014; Unoki et al., 2005).

Although the consensus statements achieved strong approval and concurrence, further strong overarching themes of communication and teamwork, patient safety and culture were viewed by clinicians as essential in order to provide context for applying this evidence in ICU physiotherapy clinical practice. These themes provided important insight into the values and preferences of clinician end-users which are important considerations to facilitate successful development of the expert consensus statements into a relevant clinical practice guideline.

Intensive Care is a highly specialised clinical environment which cares for the most severely ill patients; where technology is complex, treatments are complicated, and potential for staff stress is high (Bjurling-Sjöberg et al., 2017). Therefore these overarching themes appear to

be necessary to incorporate into the guideline. When working with critically ill patients, who are often clinically unstable, the stakes are high. The clinical context is dynamic, as the medical condition of the patient can fluctuate moment to moment and over a period of time (Bjurling-Sjöberg et al., 2017). Therefore, quality of care and patient safety are inextricably connected and strongly reliant on the ability of healthcare workers from different disciplines to communicate effectively with each other and function as a team (Alexanian et al., 2015; Bjurling-Sjöberg et al., 2017; Dietz et al., 2014; Paradis et al., 2013). The literature describes a unique form of “interprofessional” teamwork within the ICU setting (Bjurling-Sjöberg et al., 2017; Ervin et al., 2018; Kendall-Gallagher et al., 2017), whereby staff from different disciplines interact to achieve a shared outcome involving “high level of communication, mutual planning, collective decision making and shared responsibilities” (Bjurling-Sjöberg et al., 2017). Effective interprofessional teamwork in ICU has been linked to reduced harm and improved patient outcomes (Alexanian et al., 2015; Bjurling-Sjöberg et al., 2017; Dietz et al., 2014; Ervin et al., 2018). In this study, doctors and nurses advocated for shared decision making with physiotherapists when determining whether patients have sufficient haemodynamic and physiological stability to be suitable for respiratory physiotherapy interventions, in order to ensure the necessary treatment is provided optimally and within the limits of patient safety. Doctors and nurses concurred that physiotherapists are a valuable part of the ICU team, and highlighted the benefit of early and regular communication between physiotherapist and bedside nurse regarding physiotherapy respiratory assessment and treatment goals, as this assists nurses to optimise patient respiratory function throughout the day. This also indicated the importance of shared knowledge between disciplines, another important feature of interprofessional teamwork (Ervin et al., 2018). Lack of communication and knowledge sharing between professions may hinder optimisation of care, as different professions may have opposing priorities despite mutual goals (Bjurling-Sjöberg et al., 2017).

When evidence is limited or conflicting, clinicians tend to rely on their own individual knowledge, beliefs, values and experiences (Hanekom et al., 2010), as well as on professional group norms and what is considered acceptable practice within their local setting (Dodek et al., 2010; Kaper et al., 2015). These factors are determinants of organisational culture, defined as “the way we do things around here” (Dodek et al., 2010). In this study it is possible that a combination of scant availability of guiding evidence for some aspects of practice, and large distances between cities, has contributed to geographical variations in practice and different sub-cultures of practice norms within Australia. Cultural influences are likely to impact the translation of guidelines into practice (Dodek et al., 2010; Kaper et al., 2015; Williams et al., 2015), acting as either a barrier or facilitator depending on local norms for accepted practice. Therefore when developing these expert consensus statements into a guideline, the values and preferences of clinicians and cultural variations in practice need to be considered when determining the strength and wording of recommendations, particularly for grey areas of practice (Munn et al., 2014), such as those related to use of HDT and manual chest wall techniques. These expert consensus statements can facilitate national benchmarking of clinical practice across Australia, enable comparison of patient outcomes between facilities, and provide a foundation for future clinical trials. Seven countries (Australia, Belgium, New Zealand, South Africa, Sweden, The Netherlands, United Kingdom) were represented on the e-Delphi expert panel used to derive the consensus statements (van der Lee et al, 2019) which provides broader external validity to the findings of this study. However it would be useful for the consensus statements to be locally peer-reviewed in other countries also in order to establish translatability. International translation of these minimum standards for respiratory physiotherapy practice will facilitate future international benchmarking of patient outcomes and standardisation of usual care to facilitate



comparison between countries for clinical research. The consensus statements may also be beneficial for clinicians from countries not represented on the expert panel, as they can be used as a benchmark for comparison of what is considered best practice abroad, and may inform and stimulate reflection regarding optimal clinical practice.

This study provided peer-review from a multidisciplinary perspective and also included physiotherapy representation from a wide variety of Australian states, and ICUs of different sizes and classifications, providing good external validity within Australia. The majority of group participants were already known to each other, and the researchers professionally, due to the highly specialised nature of critical care. This had the benefit of facilitating deep discussion of key topics based on the shared experiences of the participants as senior clinicians within the ICU specialty, and enabled rich data to be collected. The use of multiple focus groups of different professional composition, location, and semi-structured interviews determined saturation of themes.

The lead researcher was an experienced clinical ICU physiotherapist, which was advantageous for facilitating depth of discussion to gain relevant insights from participants. This may have introduced moderator bias (Tong et al., 2017), however there was no managerial or supervisory relationship with any of the participants which otherwise may have limited participant sharing of insights and experiences.

## **Limitations**

Despite best efforts to recruit participants over long distances there were no senior doctors or nurses in the Sydney focus group which is a limitation of this study. Attainment of a national

multidisciplinary perspective would have provided further insight into what degree the apparent regional differences in physiotherapy clinical practice are influenced by medical and nursing beliefs and culture within Australian ICUs. Most of the Sydney focus group participants resided in Sydney due to convenience of location which may have introduced bias. Furthermore, the presence of sub-cultures among ICU physiotherapists in Australia may have developed due to vast distances between Australian cities, in particular between the east and west coasts of Australia, which may account for variations in practice as a result of local clinician beliefs and practices in the absence of clear evidence to guide some aspects of clinical practice. This should be considered when interpreting the results. Further stakeholder feedback is required to determine values and preferences from the patient/family perspective. Additionally these expert consensus statements, while forming the best evidence available to date for respiratory physiotherapy for invasively ventilated adults with CAP, are limited as expert consensus is regarded as level 5 evidence (Munn et al, 2014). Further research of large, high quality clinical trials is required to assist in providing level 1 evidence which can be used in future clinical guidelines in this area.

## **Conclusion**

A series of expert consensus statements for intubated adults with CAP was validated from a multidisciplinary perspective in order to facilitate further development and translation into the Australian clinical ICU environment as a clinical practice guideline. Areas of variation in practice, including head down positioning and manual chest wall techniques, require further clinical research. Commentary relating to teamwork, safety and culture were seen as critical to include to provide overarching context to the guidelines. Further research is required to evaluate application of the guideline statements into clinical practice.

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## **Conflict of Interest**

The authors have no conflicts of interest to declare.

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**Table 1: Participant experience in ICU**

<b>Years</b>	<b>n</b>	<b>%</b>
5-10	6	23.0
11-19	10	38.5
20+	10	38.5

**Table 2: Sydney focus group participant jurisdiction**

<b>Participant jurisdiction (state)</b>	<b>Focus group location</b>	<b>n</b>	<b>%</b>
Australian Capital Territory	Sydney	1	12.5
New South Wales	Sydney	5	62.5
Queensland	Sydney	1	12.5
Victoria	Sydney	1	12.5

## Appendix 1: Focus group facilitator topic guide

### *What is best physiotherapy practice for intubated and mechanically ventilated adults with community acquired pneumonia?*

#### 1. Assessment:

Brief discussion that all items in assessment category achieved over 80% consensus in Delphi study, with 86% of items achieving 90% or greater. So all will be included in minimum standards.

Any assessment items that people believe should not be in there or any factors missed?

#### 2. Treatment:

The questions which reached below 80% all relate to patient treatment, which reflects large variability in clinical practice and paucity of guiding evidence.

##### a) Positioning:

1. How should physiotherapists decide what *position* patients should be placed in for Rx?
2. Should patients be treated with the bed flat in *side-lying*?
3. Should patients be treated in the *head down* position (35-45 degrees)?
4. If patients are treated head down, does the *nasogastric feed* need to be stopped for a specific period of time prior to treatment or the NGT aspirated to minimise risk of gastric contents entering the lungs?

Explore, amplify....

##### b) Treatment techniques:

5. If *sputum volume* is high, is it necessary for a physiotherapist to treat the patient, or only if secretions are thick resulting in plugging and volume loss?
6. When do you think *lung hyperinflation techniques* should be used?
7. When do you think *lung hyperinflation techniques* should not be used?
8. When do you think *manual techniques*, such as chest wall vibrations, percussion or external ribcage compressions should be used? When do you think these techniques should not be used?
9. What are your views on use of *normal saline instillation* as part of physiotherapy intervention? When should this be used? When should it not be used?

Explore, amplify....

### **3. Any new input?**

Regarding all consensus statements, are there any further comments/information that is not contained within the consensus statements?

*Explore, amplify....*

### **4. Global questions**

In the multidisciplinary context, do these consensus statements represent what ICU clinicians believe should be best physiotherapy practice for intubated adults with pneumonia?

Are these consensus statements realistic in the clinical setting?

Are there any statements which are not clinically applicable or valid?

Are there any statements which people believe are controversial and why?

## Appendix 2: Consensus Statements\* not requiring modification following clinical stakeholder feedback

Statement number	Physiotherapy Assessment
	<i>Domain: Assessment</i>
1	Respiratory physiotherapy assessment is a high priority during the acute intubated phase, when the patient is unconscious.
3	These patients should receive a respiratory physiotherapy assessment daily while in ICU.
6	Respiratory physiotherapy assessment should include signs of impaired gas exchange e.g. ABG, FiO <sub>2</sub> , SpO <sub>2</sub> .
7	Respiratory physiotherapy assessment should include signs of increased work of breathing e.g. minute ventilation, respiratory rate, respiratory pattern, ventilator synchrony.
8	Respiratory physiotherapy assessment should include signs of atelectasis e.g. CXR interpretation, auscultation, chest expansion.
9	Respiratory physiotherapy assessment should include signs of secretion retention e.g. CXR interpretation, auscultation, fremitus, inspiratory strength and cough effectiveness.
10	Physiotherapy assessment should include pre-morbid respiratory disease, functional ability and smoking history.
11	Respiratory physiotherapy assessment should include signs of cardiovascular instability e.g. arterial BP, MAP, HR and rhythm, rate and dosage of vasoactive and inotropic medications.
12	Physiotherapy assessment should include current neurological function.
13	Physiotherapy assessment should include current musculoskeletal function.
	<b>Physiotherapy Treatment</b>
	<i>Domain: Patient selection and prioritisation</i>
14	Respiratory physiotherapy treatment is a high priority during the acute intubated phase, when the patient is unconscious.
15	Respiratory physiotherapy treatment is important during the acute intubated phase, even if the patient is conscious and is able to participate actively with intervention.
16	Respiratory physiotherapy treatment is important during the acute intubated phase, even if the patient is conscious but unable to actively participate due to neurological dysfunction or weakness of respiratory muscles.
17	Regular airway suctioning by the nursing staff should <i>not</i> be considered a substitute for respiratory physiotherapy treatment.
19	Intubated patients with high sputum viscosity would benefit from measures to increase airway humidification, such as use of heated humidifiers, regular saline nebs and fluid optimisation.
	<i>Domain: Positioning</i>

20	When the lung pathology is unilateral, the patient should be positioned in side-lying with the affected lung uppermost for respiratory physiotherapy treatment.
21	When the pathology is bilateral, and alveolar recruitment or secretion clearance is the goal of treatment, the patient should be treated in multiple positions with the target area for treatment uppermost, not just in the upright position.
22	When the lung pathology is bilateral, the patient should be positioned in alternate side-lying for respiratory physiotherapy treatment.
	<b><i>Domain: Hyperinflation techniques</i></b>
27	Patients should receive physiotherapy treatment with lung hyperinflation techniques to improve alveolar recruitment when signs of atelectasis are present on CXR or auscultation.
	<b><i>Domain: Manual chest wall techniques</i></b>
28	Intubated patients with high sputum viscosity may benefit from manual chest wall techniques (such as percussion or chest wall vibrations/expiratory rib cage compressions) in conjunction with measures to increase airway humidification.
29	Intubated patients with high sputum viscosity may benefit from combination of hyperinflation and manual chest wall techniques (such as percussion or chest wall vibrations/expiratory rib cage compressions) in conjunction with measures to increase airway humidification.
30	Intubated patients with large volumes of sputum may benefit from manual chest wall techniques (such as percussion or chest wall vibrations/expiratory rib cage compressions) to assist secretion clearance.
31	When hyperinflation techniques cannot be used or tolerated, manual chest wall techniques (such as percussion, chest wall vibrations/expiratory rib cage compressions) may be beneficial in assisting secretion clearance in combination with positioning, provided they are not also contraindicated.
	<b><i>Domain: Normal saline instillation</i></b>
32	When performing respiratory physiotherapy treatment, normal saline should <i>not</i> be routinely instilled in the airway prior to airway suctioning.
33	When performing respiratory treatment, normal saline should be instilled in the airway prior to endotracheal suctioning only when the secretions are very tenacious and unable to be cleared using other techniques.
	<b><i>Domain: Active modes of treatment and mobilisation</i></b>
34	Once the patient is conscious and able to participate in treatment, active modes of respiratory treatment should be used (e.g. deep breathing exercises, active cycle of breathing techniques, forced expiratory technique) rather than passive treatment modes such as hyperinflation and/or manual chest wall techniques?
36	Respiratory physiotherapy treatment is still important once the patient is able to participate in active mobilisation.
37	Once the patient is conscious and medically stable, early mobilisation does not replace respiratory physiotherapy treatment but is complementary to it.

38	Respiratory physiotherapy techniques should be continued to be used after mobilisation of the patient commences, until the patient is able to achieve sufficient alveolar recruitment and/or airway clearance with mobilisation alone.
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Abbreviations: ABG, arterial blood gas; BP, blood pressure, CAP, community acquired pneumonia; CXR, chest xray; FiO<sub>2</sub>, fraction of inspired oxygen; HR, heart rate; ICU, intensive care unit; IQR, interquartile range; MAP, mean arterial pressure; SpO<sub>2</sub>, pulse oxygen saturation.

\* Adapted from original consensus statements previously published; Author XXXX., 2019. Expert consensus for respiratory physiotherapy management of mechanically ventilated adults with community-acquired pneumonia: A Delphi study. *J Eval Clin Pract*, 25, 230–243.  
<https://doi.org/10.1111/jep.13077>