

# Development of a Performance Standard and Assessment Tool for Ventilator Hyperinflation Competency

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## Abstract

**Background and objective:** It is imperative that the clinical workforce in the health sciences professions has the right qualifications, skills and approaches to provide safe and high-quality health-care. The reduction of variability and improved consistency of practice are key goal of professional practice across the health science professions, particularly with regard to evidence-based techniques. The objective of this study was to develop a performance standard and assessment tool for the assessment of competency in the performance of ventilator hyperinflation by physiotherapists.

**Method and results:** Development of the performance standard was facilitated by an allied health professional with expertise in competency-based training and coupled with a subject matter expert. Key components of the performance standard developed included the elements and the performance criteria which are based on the required skills and knowledge to perform a selected task (in this case ventilator hyperinflation) independently. The performance standard was successfully implemented as part of the training program within the department.

**Conclusions:** An assessment tool based on the development of a performance standard can be used to assess competency in the performance of clinical tasks, such as ventilator hyperinflation by physiotherapists, for the primary purposes of reducing practice variability, optimizing evidence-based practice, evaluation of training efficacy and in research. External validation of the performance standard and assessment tool is required and future research should focus on evaluating these in the context of Kirkpatrick's hierarchy including healthcare delivery and patient outcomes.

**Keywords:** Lung Hyperinflation; Education; Clinical Competence; Checklist; Mechanical Ventilation; Physiotherapy; Performance Standard

## Background

The clinical workforce in the health sciences professions must have the right qualifications and skills to provide safe, high-quality health-care. Improved consistency of practice is a key goal of governance, particularly in context of evidence-based practice and minimum standards [1]. Many methods for competency assessment exist, however with little consensus or consistency in their application, to enhance skill acquisition and delivery.

In physiotherapy, undergraduate training may not include key evidence-based tasks (or training is insufficient to achieve the standard required in the workplace). Tasks must therefore be taught in professional practice. For example, physiotherapists working in Intensive Care Units provide ventilator hyperinflation (VHI) to improve patient outcomes [2]. Ventilator lung hyperinflation was originally described by Berney and Denehy as an alternative to manual lung hyperinflation, involving manipulation of ventilator settings, specifically respiratory rate, tidal volume and inspiratory flow, wave form and inspiratory pause to achieve a peak airway pressure of 40 cm H<sub>2</sub>O, for six sets of six breaths [2]. Subsequent clinical studies have demonstrated that ventilator hyperinflation is safe with minimal risks and as effective as manual hyperinflation in sputum clearance and other respiratory parameters such as lung compliance and oxygenation [2-6]. However, VHI is not widely used and the lack of training is the most common barrier [7].

Training may be ineffective where clear definitions of task performance don't exist and tools to facilitate assessment against such specific criteria are lacking. Competency assessments have been previously used in critical care [8] and facilitate consistency in assessment, as well as clear delineation of task requirements.

The objective of this report was to develop a performance standard as the foundation for an assessment tool to guide and record assessment of competency in VHI performance by physiotherapists (Table 1).

## Performance Standard and Assessment Tool

### Concept

The concept of the performance standard and assessment tool was to clearly outline the expectations and task knowledge, skills and performance required of a practicing physiotherapist to perform VHI independently. The aim was to gather this information and translate this into an assessment tool to facilitate and record assessment of competency in the task. VHI was selected as a key task for development as it is i) a frequently used evidence-based technique, posing potential clinical risk (although as outlined in the Introduction, few adverse events occur with correct application of the technique); ii) currently not a core requirement of physiotherapy undergraduate curriculum; and iii) lacks a professionally endorsed standard, position statement or practice/guideline outlining the requisite components for its safe and effective delivery.

### Development

Development was based on principles applied within any

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| Candidate's name:   | Assessment timeframe:   |  |           |          |
|---|---|--|-----------|----------|
| Name(s) and designation of assessor(s):   |   |  |           |          |
| Unit of competency:   | Perform ventilator hyperinflation (VHI) in an adult intubated patient   |  |           |          |
| Elements and performance criteria<br>Did the candidate provide evidence of the following?                           | Performance cues  | Tick appropriate box, date and sign each tick. |           | comments |
|   |   | Not yet competent                              | Competent |          |
| <b>1. Determine if VHI is indicated</b>   |   |  |           |          |
| Design and conduct an appropriate assessment of the patient   | Collate relevant patient information from a variety of sources (health record, obs. chart, treating staff, information systems)<br>Perform an appropriate physical assessment                                 |  |           |          |
| Accurately interpret assessment findings  | Accurately interpret chest XR<br>Discern the likelihood of lung collapse and sputum retention from assessment findings  |  |           |          |
| Identify and prioritise patient's problems  | Differentiate and prioritise patient's problems   |  |           |          |
| Ensure all <i>contraindications and/or precautions</i> to the application of VHI are identified                     | Ensure it was safe to proceed   |  |           |          |
| Appropriately determine a <i>treatment plan</i>   | Clearly identify indicators for treatment<br>Treatment plan meets all the client's needs  |  |           |          |
| <b>2. Prepare for intervention</b>  |   |  |           |          |
| Discern when consultation with the treating medical consultant is required prior to the intended application of VHI | Identify patients requiring consultation with medical staff prior to treatment with VHI<br>Gains permission to proceed  |  |           |          |
| Plan for and access available staff to facilitate efficient and safe treatment                                      | Use porters to facilitate treatment time planning<br>Allow for ready location of nursing and other staff during treatment   |  |           |          |
| Position the patient to achieve treatment goals   | Use appropriate positioning<br>Maintains patient comfort and safety throughout  |  |           |          |
| Facilitate <i>medication management</i> of the patient if required  | Identify need<br>Initiate discussion with Nursing or Medical staff re Meds.<br>Time treatment appropriately with respect to meds.   |  |           |          |
| Prepare the environment   | Gather necessary equipment before commencing  |  |           |          |
| Explain the technique to the patient  | Gain consent where able<br>Explain the procedure to the patient   |  |           |          |
| <b>3. Perform VHI when indicated</b>  |   |  |           |          |
| Establish patient's baseline/normal <i>ventilation settings</i>   | Include all relevant parameters<br>Vt.<br>MV<br>f<br>PEEP<br>PS<br>RR<br>TInsp<br>Ventilation Mode  |  |           |          |
| Select alarm limits and alter where appropriate to incorporate VHI parameters                                       | Select alarm limits and alter where appropriate to incorporate VHI parameters<br>Increase PIP>41-45 cm H <sub>2</sub> O<br>Increase TV alarm to 2L<br>Check other alarm limits with respect to VHI parameters |  |           |          |
| Alter the ventilation settings as per the VHI clinical guidelines to deliver VHI                                    | Alter the <i>ventilation settings</i> as per the VHI clinical guidelines to deliver VHI<br>Decrease f<br>Increase TInsp<br>Increase Vt  |  |           |          |
| Provide <i>appropriate monitoring</i> throughout  | Provide <i>appropriate monitoring</i> throughout  |  |           |          |
| Perform appropriate suction, as indicated throughout procedure  | Perform suction according to organisational procedure, when indicated   |  |           |          |
| Provide appropriate dosage and frequency of treatment of VHI  | Provide appropriate dosage and frequency of treatment of VHI  |  |           |          |
| Return ventilator settings and alarm limits to baseline/original settings   | Return ventilator settings and alarm limits to baseline/original settings   |  |           |          |

|  |   |                          |                           |  |
|--|---|--------------------------|---------------------------|--|
| Analyse, generate and apply solutions to <i>troubleshoot</i> unpredictable issues that arise when performing VHI.      | Discern event requiring troubleshooting<br>Identify an appropriate course of action in response to the identified event   |                          |                           |  |
| Identify when <i>cessation of VHI within a session</i> may be needed, and take appropriate action                      | Discern conditions when cessation is indicated<br>Liaise with senior Physiotherapist / or senior medical staff as appropriate   |                          |                           |  |
| Evaluate effectiveness of VHI  | Consider<br>Pts. ability to extubate<br>CXR changes<br>Oxygenation values<br>Lung compliance<br>Secretion clearance   |                          |                           |  |
| Incorporate VHI into overall <i>treatment plan</i>   | Incorporate VHI into overall <i>treatment plan</i><br>Within a session<br>Within further treatments that day / following day  |                          |                           |  |
| <b>4. Comply with supervisory requirements/operate within individual strengths and limitations</b>                     |   |                          |                           |  |
| Identify areas that are outside skills and expertise and consult or refer to a more senior physiotherapist             | Identify areas that are outside skills and expertise and consult or refer to a more senior physiotherapist  |                          |                           |  |
| <b>5. Document patient information</b>   |   |                          |                           |  |
| Document assessment findings according to accepted practice and relevant clinical protocols                            | Document assessment findings according to accepted practice and relevant clinical protocols   |                          |                           |  |
| Document PT interventions including application of VHI in the patient's progress notes                                 | Include all relevant information about<br>Ventilator mode<br>Patients position<br>Number of breaths delivered<br>Max volumes reached<br>Insp time/plateau time<br>Patients response to treatment<br>Any changes to medication management throughout<br>Secretions<br>Adverse responses and action taken<br>Plan for frequency and dosage of treatment |                          |                           |  |
| <b>6. Apply evidence based practice</b>  |   |                          |                           |  |
| Locate and apply relevant current evidence to own physiotherapy practice   | Locate and apply relevant current evidence to own physiotherapy practice  |                          |                           |  |
| <b>7. Apply risk management</b>  |   |                          |                           |  |
| Minimize risk associated with assessment and intervention  | Minimize risk to the patient<br>Minimize risk to the therapist  |                          |                           |  |
| Identify adverse events (actual or 'near miss') associated with assessment or intervention and take appropriate action | Document in health record<br>Log incident on Riskman<br>Seek medical attention as needed  |                          |                           |  |
| <b>Overall competency result</b>   | Competency achieved<br>Not yet competent  | Date:                    | Signature of assessor(s): |  |
| <b>Comments/further action</b>   |   |                          |                           |  |
| <b>Name added to data base/copy in candidate's file</b>  | ~ Yes ~ No  |                          |                           |  |
| <b>Author:</b>   | A. Pearce, E. Skinner   | <b>Last review date:</b> | May 2012                  |  |
| <b>Version:</b>  | V1_2012   | <b>Next review date:</b> | May 2013                  |  |

VHI=ventilator hyperinflation; XR=X-ray; Meds=medications; Vt=tidal volume; MV=minute volume; f=frequency; PEEP=positive end expiratory pressure; PS=pressure support; RR=patient respiratory rate; Tinsp=Inspiratory time; PIP=Peak inspiratory pressure; CXR=Chest X-ray

**Table 1:** Assessment tool: Perform Ventilator Hyperinflation (VHI) in the adult intubated patient (Monash Health).

competency-based training system. Central to this is a documented performance standard against which evidence of competency is gathered and systematically mapped to provide proof of achievement to perform VHI independently. Development was facilitated by an allied health professional with expertise in competency-based training (AP) coupled with a subject-matter expert (ES). Key components of the performance standard included the elements and performance criteria based on the required skills and knowledge, which describe the observable and assessable behaviors that comprise clinical practice, and specify the level of performance required to demonstrate achievement. The process from performance standard development to assessment tool implementation can be summarized thus: i) observe/ interview

a best practice performer (i.e. senior ICU clinical physiotherapist with > ten years experience); ii) define the performance standard; iii) verify standard with a wider reference group; iv) establish the amount and type of evidence required to support competency decisions; v) develop learning strategies and materials for training; vi) review and select assessment methods, vii) develop and document the assessment plan; viii) select and develop assessment tools and ix) implement and evaluate.

### Implementation

Training was implemented using a 'train the trainer' model. The team leader (ES) completed the program with ICU physiotherapy

staff, beginning with the most senior. The training program comprised supervised performance and teaching of VHI in patient treatment sessions in the clinical setting (a 26-bed tertiary ICU in Melbourne, Australia). Sessions were delivered as necessary to fulfill the requirements of the tool. Once senior staff successfully completed the assessment tool, they were able to assess junior staff, continuing until all ICU physiotherapists were deemed competent. In particular, junior staff members felt the tool and process clarified expectations and removed fear from a task, which they previously felt to be ill-defined, despite the existence of VHI protocols and procedures within the organization.

## Discussion and Limitations

There are many potential roles for feasible clinical assessment tools. First, existence of this tool permits standardization of clinical skills assessment, for the benefit of learners, educators and other stakeholders. This helps learners monitor their own progress; improves learners' understanding of expectations and possibly subsequent performance. Secondly, improved consistency in training and assessment may improve education efficiency and reduce practice variability; both important quality indicators, with potential implications for more efficient training and practice resource use. For stakeholders, assessment provides a way of determining whether staff has the required knowledge and skills and may be linked to credentialing. Tools such as the TIDieR checklist also underscore the importance of checklists such as the one presented here (Table 1). The TIDieR checklist, or Template for Intervention Description and Replication, is designed to improve the reporting of interventions used in clinical trials [9], particularly complex interventions such as lung hyperinflation, or rehabilitation interventions for example. It is necessary for investigators to clearly report full details of their interventions in order they can be reproduced, in clinical practice for the purpose of translation and in future studies. Assessment tools such as the VHI tool presented in the current manuscript have a role in research to standardize and ensure intervention reproducibility, particularly complex non-pharmacological interventions and in clinical practice to ensure translation of interventions found to be effective.

Future research should concentrate on rigorous multi-level evaluation of performance standards and assessment tools such as these, measuring outcomes according to the four levels of Kirkpatrick's hierarchy [10]. External validation of elements and performance criteria included for VHI by a panel of expert physiotherapists is required to promote standardized delivery of ventilator hyperinflation. Further studies are required to define the optimal parameters for ventilator hyperinflation, as few clinical studies have compared these, with bench-top studies the primary studies in this area [6,11] although it should be noted that previously reported parameters are effective [4].

## Conclusions

This performance standard and assessment tool can be used to

assess achievement of competency in the performance of VHI by physiotherapists and modified for implementation in any clinical task. The performance standard and assessment tool aims to reduce practice variability, optimize evidence-based practice, in research and to evaluate training efficacy, and further studies using the tool are required.

## Author Contributions

ES (Guarantor) was involved in the conception and design of the performance standard and assessment tool and completed the initial draft of the manuscript; AP was involved in the conception and design of the performance standard and assessment tool and revised the manuscript for intellectually important content; TS was involved in conception and design of the study, and revised the manuscript for intellectually important content.

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