An evidence-based guideline on early mobilization of mechanically ventilated patients

Submitted by

Cheung Mei Yee

A dissertation submitted in partial fulfillment of the requirements for the Degree of Master of Nursing at the University of Hong Kong in August 2013
Declaration

I declare that this dissertation represents my own work, except where due
acknowledgment is made and that it has not been previously included in a thesis,
dissertation or report submitted to this University or to any other institution for a
degree, diploma or other qualifications.

Signed _________________________________

Cheung Mei Yee
ACKNOWLEDGEMENT

I would like to send my deepest gratitude to my dissertation supervisor, Dr. Vivian Ngai, who accompanied me to walk through the rocky road of dissertation by offering me direction, inspiration and support. Without her encouragement, my dissertation would not appear probably.

I would also like to extend my heartfelt thanks to Dr. William Li and Dr. Daniel Fong, who gave me a light on the essence of translational nursing research.

Last but not the least; I love my family for supporting me throughout my work and study with infinite encouragement, endurance and love and helping me to keep my endeavor.
Abstract of thesis entitled

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Background

Severe impairment of physiologic functioning brings the focus of intensive care unit (ICU) on the reversal of acute organ failure which will threaten one’s survival if it is left untreated (Morris, 2007). Providing respiratory support to majority of ICU patients, mechanical ventilation (MV) is a life saving intervention. MV patients constitute one-third of ICU patients worldwide and 46% of them are put on ventilator support more than 24 hours having the mean duration ranged from 15.4 to 33.2 days (Adler & Malone, 2012).

The aim of ICU care places most of the attention on resuscitation and survival while the neuromuscular functioning is often overlooked as raised by a number of recent studies. Poor physical functioning was reported by all the patients due to loss of muscle mass, muscle weakness and fatigue (Herridge et al., 2011). Only 50% of them got employed 1 year after recovery while the rest of them were still
unemployed because of persistent fatigue, poor functional status like foot drop and large joint immobility (Herridge at al., 2011).

ICU-acquired weakness accounts for neuropathies and myopathies after recovery from critically illness and respiratory failure as manifested by loss of body mass, severe weakness and physical dysfunction (Cheung et al., 2006). De Jonghe and colleagues (2002) found that 25% of MV patients developed the ICU-acquired weakness and they determined MV as one of the key etiologies. Kasper and colleagues (2002) stressed that muscle atrophy happens within a few hours of bed rest having 4% to 5% depreciation of muscle strength for one week bed rest. Moreover, insulin resistance appears after merely 5 days of bed rest. On the other hand, immobility interferes baroreceptors bringing hypotension and tachycardia, giving rise to reduced cardiac output and gaseous exchange therefore deterioration of cardiac function (Convertino, Bloomfield & Greenleaf, 1997). It is obvious that a viscous cycle is present while leaving survivors from recovery of critical illness immobilized.

Mobilizing MV patients can train up their limb power and their ADL ability (Burtin et al., 2009; Chiang, Wang, Wu, Wu, & Wu, 2005; Martin, Hincapie, Nimchuk, Gaughan, & Criner, 2005). Burtin and colleagues (2009) illustrated that patients receiving mobilization program had a better score in SF-36PF showing the
attainment of better quality of life (QOL). Early mobilization can increase the number of day of ventilator free (Schweickert et al., 2009) and shortening ICU and hospital length of stay (Morris et al., 2008).

**Purpose**

The dissertation is aiming at seeking for the best evidence to establish an evidence – based mobilization guideline for those mechanically ventilated patients. The goal is to optimizing the physical outcomes of mechanically ventilated critically ill patients.

**Method**

The three electronic databases including Medline (Ovid SP), CINAHL (Ovid SP), PudMed and Cochrane Library were searched through while doing the systematic search of scientific literature. Subsequently, five articles confining to the inclusion criteria were sieved in the literature review and evidence extraction was performed. Quality assessment of the 5 studies was done using a critical appraisal tool derived by Scottish Intercollegiate Guideline Network (SIGN) (2008) and thereafter an evidence-based guideline for early mobilization of the mechanically ventilated patients was established.

An implementation plan was then set up which comprised of the communication plan between different level of stakeholders of ICU and the pilot testing. Apart
from communicating with the stakeholders, the plan also delineated the way of
initiating, guiding and sustaining the change.

A pilot study was planned to execute in order to test the sufficiency of training
workshop, determine the feasibility of the mobilization protocol and the evaluation
plan.

Lastly, an evaluation plan was considered to assess the success of mobilization
guideline in terms of patient outcomes, healthcare provider outcomes and
organizational outcomes.
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CHAPTER 1 STATEMENT OF PROBLEM

Introduction

Severe impairment of physiologic functioning brings the focus of intensive care unit (ICU) on the reversal of acute organ failure which will threaten one’s survival if it is left untreated (Morris, 2007). Providing respiratory support to majority of ICU patients, mechanical ventilation (MV) is a life saving intervention. MV patients constitute one-third of ICU patients worldwide and 46% of them are put on ventilator support more than 24 hours having the mean duration ranged from 15.4 to 33.2 days (Adler & Malone, 2012).

The aim of ICU care places most of the attention on resuscitation and survival while the neuromuscular functioning is often overlooked as raised by a number of recent studies. Poor physical functioning was reported by all the patients due to loss of muscle mass, muscle weakness and fatigue (Herridge et al., 2011). Only 50% of them got employed 1 year after recovery while the rest of them were still unemployed because of persistent fatigue, poor functional status like foot drop and large joint immobility (Herridge at al., 2011).

ICU-acquired weakness accounts for neuropathies and myopathies after recovery from critically illness and respiratory failure as manifested by loss of body mass, severe weakness and physical dysfunction (Cheung et al., 2006). De Jonghe and
colleagues (2002) found that 25% of MV patients developed the ICU-acquired weakness and they determined MV as one of the key etiologies. The exact mechanism is not clearly defined, however, the ICU-acquired weakness probably results from skeletal muscle proteolysis and atrophy due to systemic inflammation leading to muscle injury and progressive deconditioning due to immobility (Bednarik, Lukas & Vondracek, 2003). Kasper and colleagues (2002) stressed that muscle atrophy happens within a few hours of bed rest having 4% to 5% depreciation of muscle strength for one week bed rest. Moreover, insulin resistance appears after merely 5 days of bed rest. On the other hand, immobility interferes baroreceptors bringing hypotension and tachycardia, giving rise to reduced cardiac output and gaseous exchange therefore deterioration of cardiac function (Herridge et al., 2011). It is obvious that a viscous cycle is present while leaving survivors from recovery of critical illness immobilized.

Mobilizing MV patients can train up their limb power and their ADL ability (Burtin et al., 2009; Chiang, Wang, Wu, Wu, & Wu, 2005; Martin, Hincapie, Nimchuk, Gaughan, & Criner, 2005). Burtin and colleagues (2009) illustrated that patients receiving mobilization program had a better score in SF-36PF showing the attainment of better quality of life (QOL). Early mobilization can increase the number of day of ventilator free (Schweickert et al., 2009) and shortening ICU and
hospital length of stay (Morris et al., 2008).

Although the health care professionals understand the detrimental effect of bed rest on the body system, the complicated environment of ICU deters people from adopting the mobilization program. Numerous catheters and supportive equipments connecting to the patients’ body are commonly found on the MV patients. Incidentally dislodgement causes harm to patients themselves due to increased risk of infection during reinsertion process (Needham et al., 2010).

Nevertheless, the unwanted stress is created to both the patients and their family members who have already had the existing pressure due to the medical acuity. Literatures illustrate that the activity-associated untoward events like line removal, self-extubation and physiological responses for instance tachycardia, tachypnea and desaturation (Morris et al., 2007).

**Affirming needs and significance**

An effective protocol means systematic, focused in scope and easily applicable.

By which, at the same time, practice can be consistent with quality assurance (Burns et al., 2003). There are different kinds of mobilization protocols as published in the literatures, however, the mobilization interventions varies widely without being standardized, ranging from passive range-of-motion exercise to ambulate while intubated (Burtin et al., 2009, Chiang at al., 2006, Martin el al., 2005, Morris et al.,
2008, Schweickert et al., 2009).

In a local public hospital, MV patients constitute a big proportion of ICU patients. From January of 2010 to August 2010, 66.7% of total admission needed MV.

Usually, the MV patients in ICU having the condition stabilized will be transferred to the ventilator ward for ventilator weaning. For the current practice of mobilization exercise, it is mainly focused on the passive range-of-motion (ROM) exercises on 4 limbs on both unconscious and conscious patients. For the latter ones, even they are conscious and alert to obey commands, the physiotherapist merely help them to mobilize their joints having them lying on their own bed without training their ADL skills like sitting out of bed, standing up or even having a few steps walk. Obviously and definitely, it is difficult to achieve in ICU which is such an acute setting. However, as mentioned above, mechanically ventilated patients will be transferred to the ventilator ward when they are hemodynamically stable. Thus, apart from those passive ROM exercises, these patients can participate into those active ROM exercises having instructions given by the health care professionals and later further advance to those with higher difficulty. While muscle strength and the Barthel Index are the reliable and valid tools to evaluate patients’ physical outcomes and functional status (Hsueh, Lee & Hsieh, 2001), active ROM exercises on both upper and lower limbs, cycling session and a variety
of ADL training show improvements in these outcomes measures (Burtin et al., 2009; Chiang et al., 2006; Martin et al., 2005; Morris et al., 2008; Schweickert et al., 2009).

To conclude, aggressive mobilizing interventions may be harmful to patients while too cautious to do so may cause patients to develop ICU-acquired weakness (Hopkins, Spuhler & Thomsen, 2007). Yet, currently no related evidence-based guideline exists. In view of this, it is essential to develop an evidence-based mobilization protocol in the local setting.

Research Hypothesis, Aim, and Objectives

Having the affirmed needs and significance of evidence-based protocol, the research hypothesis, aim and objectives of the dissertation are set up.

Research hypothesis

An evidence-based mobilization guideline is more effective than passive ROM in optimizing the physical outcomes of mechanical ventilated patients

Aim

To develop an evidence-based early mobilization protocol for the mechanically ventilated patients

Objectives

1. To review empirical evidence on the effectiveness of mobilization interventions in
optimizing the physical outcomes of mechanical ventilation of critically ill patients

2. To conduct a quality assessment of the systematically identified research studies.

3. To develop an evidence-based mobilization protocol for mechanical ventilated patients
CHAPTER 2  LITERATURE REVIEW

Searching strategies of evidence

The searching strategy of literature, evidence extraction, critical appraisal and data summary and synthesis will be illustrated.

The inclusion and exclusion criteria of participants were established prior to the literature search and review.

**Inclusion criteria**

- Adult
- Mechanically ventilated patients
- Conscious and alert
- Hemodynamic stability – No hypotension, not using inotropes and oxygen requirement < 55%
- Barthel Index score $\geq 70\%$ (obtained 2 weeks before admission)

**Exclusion criteria**

- Raised intracranial pressure (ICP)
- Co-morbid neurological diseases
- Rapid development of neuromuscular diseases
- Pre-existing diagnosis of neuromuscular weakness
- History of cardiac arrest or resuscitation of current admission
• Conditions interfering ambulation e.g. absence of limb, trauma or surgery over lower limbs and spinal cord

• Under any sedative or paralytic agents

Having patients who had neurological impairment and those who were on sedation or paralytic medication being excluded, the neurological and physical integrity of the selected candidates can be ensured. Moreover, the ICP of these patients required vigilant monitoring, thus, they should not be included in the mobilization program so as to prevent the unnecessary risk and complication. Lastly, for those post cardiac arrest and resuscitation patients, they might develop hypoxic brain injury and their conscious level is probably irreversibly impaired (De Jonghe et al., 2005).

**Searching process**

The three electronic databases including Medline (Ovid SP), CINAHL (Ovid SP), PudMed and Cochrane Library were searched through while doing the systematic search of scientific literature. A large variety of current professional and peer reviewed health care articles can be found in these search engines. To sort out those relevant journals, boolean search was adopted. The key terms “mobility”, “exercises”, “physical therapies” combining with “mechanical ventilation” to do the literature search. The search was limited to adults and those journals written in English published between January 1, 2000 and June 1, 2011. The titles and abstract
of the studies were examined for further selection. The articles were then sieved according to the inclusion and exclusion criteria as mentioned above. Those reviewed articles were excluded. On the other hand, hand search of the related articles of the relevant reference lists was performed. Those doctoral dissertations in library of The University of Hong Kong were sought, but no relevant literature could be identified. Subsequently, five articles were included in the literature review (See Figure 1).
Figure 1
Searching process of literatures

Medline (Ovid SP), CINAHL (Ovid SP), PubMed & Cochrane

1. mobility (47283)
2. exercises (6572)
3. physical therapies (56433)
4. mechanical ventilation (3175)

1 and 2 and 3 and 4 (172)

Non-adult (77)
Adult (95)

Reviewed studies (8)
Primary research studies (87)

Duplicated (52)
Not duplicated (35)

Unmatched with the selection criteria (30)
Matched with the selection criteria (5)
Table of Evidence

The findings of the 5 selected journals were concluded using the table of evidence including the components of study design, level of evidence, setting, participants’ characteristics, intervention, outcome measures, study results and their effect sizes. The outcome measures mainly focused on muscle strength and Barthel Index. (Table 1-5)
<table>
<thead>
<tr>
<th>Article</th>
<th>Study design</th>
<th>Evidence level</th>
<th>Setting</th>
<th>Patient characteristics</th>
<th>Intervention</th>
<th>Control</th>
<th>Outcome measures</th>
<th>Effect size</th>
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<tbody>
<tr>
<td>Burtin et al., 2009</td>
<td>Prospective RCT</td>
<td>1+</td>
<td>MS ICU</td>
<td>MV patients Age = 59 +/- 17 years old (n=67)</td>
<td>Same as control group, + 20-minutes-cycling session× 5 days/week (n=36)</td>
<td>UE &amp; LE training + functional training programme 5 days/week (n=31)</td>
<td>Within 8 weeks of training</td>
<td>(1) ICU d/c vs. Hospital d/c&lt;br&gt; 1.83 vs 2.37 (p=0.01)&lt;br&gt; Control: 1.86 vs. 2.03 (p=0.11)&lt;br&gt; Intervention vs Control&lt;br&gt; (2) 21 vs. 15 (p&lt;0.01)&lt;br&gt; (3) 196 vs. 143 (p&lt;0.05)&lt;br&gt; (4) 25 vs. 24 (p=0.014)&lt;br&gt; (5) 36 vs. 40 (p=0.15)&lt;br&gt; (6) 6 vs. 6 (p=0.04)</td>
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### Table 2 Table of evidence

<table>
<thead>
<tr>
<th>Article</th>
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<th>Evidence level</th>
<th>Setting</th>
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<th>Control</th>
<th>Outcome measures</th>
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<tbody>
<tr>
<td>Chiang et al., 2006</td>
<td>Prospective RCT</td>
<td>1+</td>
<td>RCC</td>
<td>MV patients</td>
<td>UE &amp;LE training + breathing training + functional training × 5 days/week × 6 weeks (n=20, 3 died during 6-week intervention period)</td>
<td>Standard therapy for the underlying disease, patient care including proper positioning and assistance with ADL (n=19, 4 died during 6-week intervention period)</td>
<td>At the 3rd and 6th week of training (1) Limb muscle strength (kg) a. Shoulder Flexor (kg) b. Elbow flexor (kg) c. Knee extensors (kg) (2) Respiratory muscle strength a. PImax (cmH2O) b. PEmax (cmH2O) (3) BI</td>
<td>Intervention vs. control (1) The 3rd week a. 4.1 vs. 0.9 (p&lt;0.05) b. 6.6 vs. 1.8 (p&lt;0.05) c. 6.6 vs. 2.0 (p&lt;0.05) The 6th week a. 4.5 vs. 0.9 (p&lt;0.05) b. 7.3 vs. 1.1 (p&lt;0.05) c. 7.3 vs. 1.8 (p&lt;0.05) (2) The 3rd week a. 58 vs. 34 (p&lt;0.05) b. 58 vs. 32 (p&lt;0.05) The 6th week a. 60 vs. 30 (p&lt;0.05) b. 62 vs. 35 (p&lt;0.05) (3) The 3rd week: 20 vs. 0 (p&lt;0.05) The 6th week: 35 vs. 10 (p&lt;0.05)</td>
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</table>

Note: RCC = respiratory care center, UE = upper extremities, LE = lower extremities, PImax = Peak inspiratory pressure, PEmax = Peak expiratory pressure, BI = Barthel Index
Table 3 Table of evidence

<table>
<thead>
<tr>
<th>Article</th>
<th>Study design</th>
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<th>Setting</th>
<th>Patient characteristics</th>
<th>Intervention</th>
<th>Control</th>
<th>Outcome measures</th>
<th>Effect size</th>
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<tbody>
<tr>
<td>Schweickert et al., 2009</td>
<td>Prospective RCT</td>
<td>1++</td>
<td>Medical ICU</td>
<td>MV patients Age &gt; 18 years old (n=104)</td>
<td>UE &amp;LE exercise, trunk control &amp; balance activities, functional training including ADL × 7 days/week (n=49)</td>
<td>Standard care with physical &amp; occupational therapy (n=55)</td>
<td>Within 8 weeks of training</td>
<td>Intervention vs. control</td>
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<td></td>
<td>(1) FIM</td>
<td>(1) 29 vs. 19 (p=0.02)</td>
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<td></td>
<td>(2) ICU delirium (days)</td>
<td>(2) 2 vs. 4 (p=0.03)</td>
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<td></td>
<td>(3) Hospital delirium (days)</td>
<td>(3) 2 vs. 4 (p=0.02)</td>
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<td>(4) BI at hospital d/c</td>
<td>(4) 75 vs. 45 (p=0.05)</td>
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<td></td>
<td>(5) ICU-acquired paresis at hospital d/c</td>
<td>(5) 15 vs. 27 (p=0.09)</td>
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<td>(6) Ventilator-free days</td>
<td>(6) 23.5 vs. 21 (p=0.05)</td>
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<td></td>
<td>(7) MV days</td>
<td>(7) 3.4 vs. 6.1 (p=0.02)</td>
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<td></td>
<td>(8) ICU LOS (days)</td>
<td>(8) 5.9 vs. 7.9 (p=0.08)</td>
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<td></td>
<td>(9) Hospital LOS (days)</td>
<td>(9) 13.5 vs. 12.9 (p=0.93)</td>
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<td>(10) Hospital mortality</td>
<td>(10) 9 vs. 14 (p=0.53)</td>
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</table>

Note: FIM = Functional independence measure
<table>
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<tr>
<th>Article</th>
<th>Study design</th>
<th>Evidence level</th>
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<th>Patient characteristics</th>
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<th>Control</th>
<th>Outcome measures</th>
<th>Effect size</th>
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</thead>
<tbody>
<tr>
<td>Morris et al., 2008</td>
<td>Prospective cohort study</td>
<td>2+</td>
<td>Medical ICU</td>
<td>MV patients Age &gt; 18 years old (n=330)</td>
<td>Mobility protocol Level I: For unconscious patients, PROM to UE &amp; LE joints 3x/day For level II to IV, patients were conscious &amp; alert, advancing from maintaining sitting position, via sitting on the edge of the bed, to active transfer to chair (OOB) (n=165)</td>
<td>PROM &amp; Q2H turning (n=165)</td>
<td>(1) The proportion of patients surviving to hospital discharge who received ICU physical therapy (2) Days to the 1st OOB (3) MV days (4) ICU LOS (5) Hospital LOS</td>
<td>Intervention vs. control (1) 80% vs. 47.4% (p&lt;0.001) (2) 5 vs. 11.3 (p&lt;0.001) (3) 8.8 vs. 10.2 (p=0.163) (4) 5.5 vs. 6.9 (p=0.025) (5) 11.2 vs. 14.5 (p=0.006)</td>
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Note: PROM = passive range-of-motion exercise
<table>
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<tr>
<th>Article</th>
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<th>Evidence level</th>
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<th>Patient characteristics</th>
<th>Intervention</th>
<th>Outcome measures</th>
<th>Effect size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Martin et al., 2005</td>
<td>Pre-post cohort</td>
<td>2+</td>
<td>VRU</td>
<td>Chronic MV adult patients (n=49)</td>
<td>UE &amp; LE training, trunk control tasks; cycle ergometry, inspiratory muscle training &amp; functional training x 5 days weekly</td>
<td>(1) Extremities motor strength score a. UE b. LE (2) Respiratory rate (3) Tidal volume (4) NIF</td>
<td>Admission vs. Discharge (1) a. 1.9 vs. 3.6 (p&lt; 0.001) b. 1.5 vs. 2.7 (p&lt; 0.001) (2) 25 vs. 20 (p=0.07) (3) 0.22 vs. 0.26 (p=0.02) (4) 24 vs. 35 (p&lt; 0.001)</td>
</tr>
</tbody>
</table>

Note: VRU = ventilation rehabilitation unit
Appraisal strategies of evidence

Quality assessment of the studies

To assess the quality of the identified article, Critical Appraisal Skills Programme (CASP) was used (Public Health Resources Unit, National Health Service, 2007). By mean of SIGN coding system (Scottish Intercollegiate Guidelines Network, 2008) (Appendix A & B), level of evidence according to the study design and the quality of each identified study was evaluated.

Studies overview

All the five studies were primary studies. Three of them were randomized control trials (RCT) (Burtin et al., 2009; Chiang et al., 2006; Schweickert et al., 2009) while one was prospective cohort study (Morris et al., 2008) and one was pretest-posttest cohort study (Martin et al., 2005). One study was carried out in Belgium (Burtin et al., 2009), one in Taiwan (Chiang et al., 2006) and three in the United States (Martin et al., 2005; Morris et al., 2008; Schweickert et al., 2009). No local study could be found. In terms of the study setting, one study was conducted in medical-surgical ICU (Burtin et al., 2009), two studies were done in medical ICU (Morris et al., 2008; Schweickert et al., 2009) and two were performed in the respiratory rehabilitation centres (Chiang et al., 2006; Martin et al., 2005). Except Schweickert and colleagues (2009) conducted their study in the ICU of the two universities, the others adopted the single-centered methodology.

For the interventions, all the five studies performed the active and passive upper and lower extremities exercises and ADL training while Burtin et al. (2009) and Martin et al. (2005) included cycling exercise in adjunction.

Studies critique

The research objective of all the articles was clear, focusing on the effectiveness of
mobilization training on the mechanically ventilated patients. For the RCT (Burtin et al., 2009; Chiang et al., 2006; Schweickert et al., 2009), level of evidence ranged from 1++ to 1+ and they satisfied greater than 70% of CASP criteria. However, blinding of all of these studies could not be attained. In order to maintain the objectivity of outcomes, blinding to candidates allocation was strongly recommended in order to eliminate potential biases originating from the awareness of study groups, people carrying out interventions and data analysts (Pilot & Beck, 2008). In these studies, though patient allocation was kept confidential as using concealed opaque envelopes which was only known to the investigator, the health care team of both the intervention group and control group could note the allocation when they performing the interventions. Implementation of mobilization protocol of the intervention group might be aware by the nurses in control group and they therefore may insidiously change their practice. This may affect the outcomes of the studies. Yet, failure to blind could not be avoided since nurses should perform the mobilization program in the intervention group by following the protocol. On the other hand, in the study of Burtin et al (2009) and Chiang et al. (2006), the findings were analyzed by the principle of intention-to-treat. The withdrawal of patients was due to death and refusal in the midways of the research. The quality of RCT was included in Table 6 in details.

For the cohort study (Morris et al., 2008) and pretest-posttest control study (Martin et al., 2005), both of them were graded to have level of evidence as 2+ and fulfilled 85% of CASP criteria. Due to the study design, the effect of mobilization interventions on the selected eligible patients was compared and therefore certain degree of blinding of patient assignment could be achieved. This sorted out the potential bias of nurses due to unknown patient allocation. Moreover, as mentioned by Polit and
colleagues (2004), large amount of data could be readily accessible in comparing with the new practice. Nevertheless, the study design is prone to be contaminated by the time-related confounders like change in practice which might bring outcomes deviation. Among these studies, luckily, the practice was consistent throughout the research period without introducing new innovation into usual practice and the severity of illness in pre and post group was similar as mentioned by the authors. The details of quality assessment of these two studies were illustrated in Table 7. For the common limitations, among all the five studies, none of them took the compliance of nurses and the health care team with the mobilization program into consideration, which might affect the quality of mobilization program performed by the health care providers and in return affect the clinical outcomes. Lastly, none of the studies demonstrated power analysis in calculating the desirable sample size necessary for the significant results.
Table 6: Quality assessment of the selected RCT with CASP

<table>
<thead>
<tr>
<th>Article</th>
<th>Burtin et al., 2009</th>
<th>Chiang et al., 2006</th>
<th>Schweickert et al., 2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Clearly-focused question</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>2. Appropriate RCT</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>3. Appropriate allocation</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>4. Blinding</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>5. All participants were accounted for conclusion</td>
<td>X ITT</td>
<td>X ITT</td>
<td>✓</td>
</tr>
<tr>
<td>6. Participants were followed up &amp; data collected</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>7. Sufficient sample size</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>8. Presentation of main result(s)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>9. Precision of result(s)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>10. Applicability of results</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>% of criteria fulfilled</td>
<td>70%</td>
<td>70%</td>
<td>80%</td>
</tr>
</tbody>
</table>

Notes: Yes = ✓, No = X, Intention-to-treat = ITT
Table 7: Quality assessment of the selected control study & cohort study with CASP

<table>
<thead>
<tr>
<th>Articles</th>
<th>Morris et al., 2008</th>
<th>Martin et al., 2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Clearly-focused question</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>2. Appropriate control study</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>3. Cases were recruited in an acceptable way</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>4. Controls were selected in an acceptable way</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>5. Exposure was accurately measured to minimize bias</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>6. A) Authors identified all important confounding factors</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>B) Authors have taken account of confounding factors in design and analysis</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>7. Sufficient sample size</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>8. Main result(s) of study</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>9. Precision of result(s)</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>10. Believe the results</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>11. Applicability of result</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>12. Results fit with other available evidence</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>% of criteria fulfilled</td>
<td>85%</td>
<td>85%</td>
</tr>
</tbody>
</table>

Notes: Yes = √, No = X
CHAPTER 3 DATA SUMMARY & DATA SYNTHESIS

Data summary

Among the five reviewed articles, three of them (Burtin et al., 2009; Chiang et al., 2006; Martin et al., 2005) compared the effect of cycling session on the intervention group with control group and at the same time both group received the upper and lower extremities exercise. On the other hand, Chiang et al. (2006), Schweickert at al. (2009) and Morris et al. (2008) tried to compare upper and lower extremities exercises and functional training with passive ROM and regular positioning.

Patients’ characteristics

The age of the participants of two studies ranged from 59 to 79 years old (Burtin et al., 2009; Chiang et al., 2006), two specified to be 18 years old and above while Martin et al. (2005) did not clearly point out but only mentioned that all of them were adults. The sample size fell within 39 and 330 and the duration of MV at start of interventions varied. Burtin et al. (2009), Morris at al. (2008) and Schweickert et al. (2009) chose those patients who were MV for at least 5 days while Chiang at al. (2006) and Morris at al. (2008) set their criteria as those who were MV for 14 days due to their rehabilitation settings.

Interventions

The duration of mobilization training program lasted from 5 to 7 days weekly and it
continued until the patients were weaned off from MV except in the study of Chiang et al. (2006) setting the intervention duration as 6 weeks at most.

All the studies included the upper and lower extremities exercises as one of the main components of the mobilization program. It was divided into the passive and active ROM exercises. All the interventions were introduced step by step. For those patients who were unable to move, passive ROM exercises for all extremities in all directions and repeated for ten times. Once patients became strong enough and they were able to mobilize their limbs themselves, active ROM exercises with or without assistance in the supine position started. As long as they were tolerated, the mobilization exercises were leveled up to postural change – changing from supine to cardiac chair upright position. ADL trainings were then introduced in order to train up their independence with functional jobs. After that, the mobilization training advanced to transfer training – sit-to-stand, transfer to chair from bed and eventually ambulation training.

In the study of Burtin et al. (2009) and Morris et al. (2008), cycling exercise was one of the components of the mobilization training program as well. Burtin and colleagues (2009) used a bedside cycling ergometer to perform active and passive cycling having a total of six levels of intensities. Patients were positioned in semi-fowler position and each cycling session lasted for 20 minutes having the
intensity adjusted as patients tolerated. However, in the study of Morris et al. (2008), the detail of cycling training was not mentioned.

**Upper and lower extremities muscle strength (MS)**

In the study of Chiang at al. (2006) and Martin et al. (2005), the limb muscle strength was shown improved. Chiang and colleagues (2006) reported that the muscle strength of flexor of shoulder, elbow and knee was increased obviously at the time of the 3rd and 6th week admission (p<0.05). Martin et al. (2005) illustrated that the motor strength score of upper and lower extremities at admission was 1.9 and 1.5 respectively whilst at discharge was 3.6 and 2.7 respectively (p<0.001). In Burtin et al. (2009), isometric quadriceps force was used to measure whether cycling session would improve the quadriceps muscle force (IQF). They reported that at hospital discharge the IQF of the intervention group was 0.54 Nkg⁻¹ more than that at ICU discharge (p=0.01) while there was only 0.17 Nkg⁻¹ increment in the control group (p=0.11).

**Barthel Index (BI)**

The BI is an instrument for measuring one’s independence in term of ADL (Hsueh, Lee & Hsieh, 2001). It consists of 10 items of different weights. The BI is equivalent to the sum of 10 items ranging from 0 to 100, i.e. from totally dependent to independent to basic ADL. The higher the BI means the higher the level of
independence. The details of the BI are illustrated in Appendix G.

In the study of Chiang et al. (2006) and Schweickert et al. (2009), the BI was adopted as one of the outcome criteria. Both studies showed that there was an improvement in the BI after implementation of intervention. Chiang et al. (2006) measured the BI at the 3rd and 6th week illustrating that the intervention group got 20 and 35 respectively while the control group remained 0 in static (p<0.05). Another study performed by Schweickert and colleagues (2009) also reported a better BI as 75 in the intervention group than the control group having the BI as 55 (p=0.05).

Data synthesis

After concluding the result of journals, it was obvious that upper and lower extremities training and cycling session could improve patient’s physical outcomes. Physical outcomes were indicated by the upper and lower extremities muscle strength and BI. In the study of Burtin et al. (2009), IQF was used to measure the quadriceps muscle strength which only focuses on the quadriceps. Since the training program involved both upper and lower limbs, it would be better to make a consensus to use muscle strength of the upper and lower extremities as the outcome of muscle strength. The application of mobilization training program can ensure a standardized manner in carrying out mobilization training. It is strongly recommended that the results concluding from the five identified studies can be applied in the ICU and the
ventilator ward by developing an evidence-based mobilization training program.
CHAPTER 4  IMPLEMENTATION POTENTIAL

The literature review illustrated that a mobilization training program could optimize the physical outcomes of mechanically ventilated patients. It is hypothesized that the potential benefits of the protocol can be transferred to the ICU of a local hospital. According to Pilot and Beck (2004), it is crucial to evaluate the implementation potential of the protocol in the local setting in terms of 3 components namely transferability of the synthesized findings, the feasibility of the proposed protocol and cost-benefit ratio of the innovation.

Transferability of the synthesized findings

The synthesized findings are considered to be transferable if they attain the following criteria:

1. The innovation fits in the proposed setting.

2. The target population in the research is similar to that in the new setting.

3. The proposed innovation suits the philosophy of care in the new setting.

4. The number of benefit clients is adequate.

5. The time required for implementation and evaluation is reasonable without being too long.

Similarity of setting

The target ICU of the local public hospital contains a total bed stat of 22, comprising
of a variety of specialties including medical, surgical, neurological and trauma while there are a total bed stat of 10 in the ventilator ward. In the literature review, one study was in medical-surgical ICU (Burtin et al., 2009), two in medical ICU (Morris at al., 2008; Schweickert et al., 2009) and the remaining two in the ventilator rehabilitation unit (Chiang et al., 2006; Martin et al., 2005). Since the innovation will be implemented in the ICU and the ventilator ward, it is homogeneous in term of setting between the target ICU and the selected studies.

**Consistency of population**

The minimum age for admission to the target ICU is 18 years old. With regards to the consistency of the target population, the age of the participants of two studies ranged from 59 to 79 years old (Burtin et al., 2009; Chiang et al., 2006), two specified to be 18 years old and above while Martin et al. (2005) did not clearly point out but only mentioned that all of them were adults.

Regarding to the racial background, all the reviewed studies were conducted in the western countries having majority of them were mainly Caucasian. It is totally different from those in the target ICU. Yet, since the aim of the translational nursing research is to translate the synthesized findings from literature review to the local setting, thus, whether it is transferrable or not will be shown in the evaluation outcomes.
**Philosophy of care**

To have the innovation well implemented in the target ICU, its underlying philosophy of care should be coherent with that of the target setting. Hospital Authority (2009) emphasized the philosophy of care is maintaining good health for public through the provision of safe and better quality service having the utilization of enhanced quality systems and clinical governance. Hospital Accreditation Program (2010), moreover, appreciated that evidence based guidelines were available to the health care professionals. While the aim of the innovation is to develop an evidence based protocol so as to optimize patient’s physical outcomes including muscle strength, Functional Independence Measures and Barthel index, the proposed innovation is entrenched the prevailing philosophy.

**The number of benefit clients**

From the findings of the Clinical Data Analysis and Reporting System (CDARS) of HA, in the period from January 2010 to August 2011, 569 patients constituting 66.7% of total admission required ventilator support. Significant portion of benefit clients convinced the implementation of the new innovation.

**Implementation and evaluation time of the innovation**

The period of the implementation and evaluation of the new protocol will last for one year, having 2 months will be allocated to the session of briefing and training.
months for the implementation of the pilot study of the protocol and 3 months for the evaluation. The timeframe is reasonable and easily achieved in terms of training, data collection, implementation of evaluation of new guideline.

To conclude, due to the great extent of homogeneity of the setting, the target population and the philosophy of care together with the large number of benefit patients and the acceptable implementation and evaluation time frame, it is recommended that the innovation will be well transferable to the target ICU setting.

**Feasibility**

Pilot and Beck (2008) suggested that the feasibility of the new innovation could be manifested by the following factors:

**Nurses’ autonomy to control the innovation**

Nurses’ autonomy is crucial for successful implementation of the new intervention. After the physicians prescribe the mobilization therapy, the ICU nurses can judge according to their professional knowledge to decide whether the patient is a suitable candidate for the protocol. Moreover, the nurses are capable to monitor the condition of the patients if they are safe to continue the mobilization training program and terminate whenever any de-conditioning occurs. Overall, the nurses have great freedom in exercising the innovation.
Interference on current staff function

In the current practice, the ICU nurses only have a little participation into the mobilization program of the patients. They are only required to assist the physiotherapist to do the turning of the patients. In the new innovation, nurses need to collaborate with the physiotherapists to assess the suitability of client for the program. To guarantee the nurses holding good compliance to the mobilization training program, mandatory charting is required to explain the rationales of such decision. Definitely, these acts increase the workload of the nurses and moderately interfere on the current staff practice but the improvement in patients’ outcomes is much more worthy.

Administration support and organizational climate

The target ICU provides the adequate administration support and maintains a good organizational climate conducive to research application. HA (2009) illustrated that the target hospital is one of the pilot hospital in running the Hospital Accreditation Program having the emphasis stressing on developing the evidence-based guideline in order to ensure better patient outcomes and quality health care. Moreover, a campaign called “Wiser Movement” was run to encourage innovative interventions (Hung, 2010).

Regarding to the administrative management level, the frontline staff receive great
support from the department management officer, ward manager and nurse specialists in conducting research and adopting evidence-based practice. The senior colleagues share a variety of nursing literatures regularly, for instance, the most effective skin disinfectant on the site of central line. Moreover, the physicians show great enthusiasm in sharing the latest research findings. With the supportive administrative level and organization climate, a road of success is paved for the new innovation.

**Consensus among staff and administrators**

It is vital to meet a consensus among the staff and administrator in order to facilitate the implementation. The main concerns of the administrator focus on the cost analysis, risk management and patient outcomes while in the perspective of frontline staff, the quality, safety and cost of patient care are their focus with the constrain of limited manpower. Providing quality health care with patients’ safety ensured is the premier goal interested by the frontline staff and the administrators. The new innovation can improve patients’ muscle strength and ADL level and in return reduce medical expenses. Therefore, the consensus can be obtained.

**Potential friction**

Apart from the physicians, the main collaboration partner is the physiotherapist. The physiotherapists should be well informed about the new guideline and should have
consensus on each individual steps. For example, they should know whether the patient is a suitable candidate for the training and sign and symptoms for patient to terminate. Clarification should be made in case of any discrepancy. Moreover, it is necessary to make arrangement on the assisted devices like walking frame, cycling device etc. in advance to avoid conflicts between two parties e.g. time clashing.

**Skill requirement**

To implement the innovation, skill and knowledge of the ICU nurses are required to adopt the mobilization training program. They need to assess whether the client is the suitable candidate for the program according to the patient’s medical record, vital sign and current medication therapy. In order to facilitate the implementation, a consistent judgment should be made and thus training workshop is a must.

**Equipment and facility**

In terms of the equipments, the assisted devices like walking frame and bedside cycling device are readily available in the hospital arranged by the physiotherapy department. Good communication between the nurses and the physiotherapists is the pre-requisites of success.

**Staff training opportunity**

As concurred above, the managerial level of the target ICU welcome the evidence-based guideline development and utilization and thus the staff will be released in
small group to attend the workshop as long as the unit operation is undisturbed.

**Innovation evaluation**

To evaluate the outcome of the innovation, the Barthel Index will be used to assess patients’ ADL level. On the other hand, a tool in form of a questionnaire will be developed to assess the nurses’ perceived workload, the extent of satisfaction and the perceived knowledge on mastering the new guideline. Another clinical audit questionnaire will be used to assess the nurses’ understanding and compliance of the guideline.

**Cost/ Benefit Ratio of the Innovation**

**Risk of implementation of the innovation**

Literatures illustrate that the activity-associated untoward events like line removal, self-extubation and physiological responses for instance increasing in heart rate, respiratory rate and desaturation (Morris et al., 2007). However, as mentioned before, the nurses are capable in assessing whether the client is a suitable candidate for the innovation and thus these risks can be prevented.

**Potential benefits of implementation of the innovation**

The implementation of the mobilization guideline is thought to be effective in optimizing the physical outcome of mechanical ventilated patients. The physical outcome is manifested by the upper and lower extremities muscle strength and the
Barthel Index. As a result, it will be beneficial to the hospital in terms of cost saving.

Staff morale will also be improved when the nurses see the patients without suffering from the ICU acquired weakness.

**Risk of maintaining current practice**

Current practice of merely performing passive range-of-motion exercise in the bed imposes a greater potential of developing insulin resistance and muscle atrophy resulting in sepsis and ICU acquired weakness (Kasper, Talbot & Gaines, 2002).

**Non-material cost of implementing the innovation**

The potential non-material costs of implementing the innovation are the possible worsening of staff morale, staff turnover and absenteeism. At the beginning, the colleagues may not get used to the additional charting and communication with the physiotherapists, which may burden them due to extra workload. It is expected that the staff may feel stressful in front of the new changes. Staff morale may be depreciated which may lead to absence from duty or even resignation.

**Material cost of implementing the innovation**

*Medical equipment cost*

As the ventilators, oxylog and those walking devices are readily available in the unit, they are free of charge in implementing the innovation.

Nursing manpower expenditure - The new guideline will require all the nurses to
attend from assessing the suitability of candidates to participating into patients’
mobilization. In a rough estimation, 15 minutes is required to assess to patients and
at most half an hour is needed for mobilizing the patients, which will be performed
daily. The total time for the intervention daily will therefore be 45 minutes and 9450
minutes in a period of 7-month. With regards to the current pay scale of the target
ICU at point 21 as the mean basic salary, the daily monetary expense in nursing
manpower per staff is HK $134. For the total 7-month implementation, the expense
is HK $28208.

*Training cost*

All the staff will be officially relieved to attend a 2-hour training course distributed a
handout costing HK $3. Accordingly, the cost for training per person is HK $361.
On the other hand, a copy of protocol will be posted at each bedside for reference.
To summarize, the sum of expense spent on each patient for the guideline is HK
$28866. Table 8 will illustrate the nursing manpower expenditure and the training
cost in details.
Table 8 Estimation on the monetary cost for implementing the mobilization protocol

**Nursing manpower expenditure**

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost (HKD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time for patients’ assessment &amp; mobilization</td>
<td>Daily: 15+30 = 45 minutes</td>
</tr>
<tr>
<td></td>
<td>Monthly: 45x30 = 1350 minutes</td>
</tr>
<tr>
<td></td>
<td>7-month: 45x30x7 = 9450 minutes</td>
</tr>
</tbody>
</table>

Working hour per nurse weekly: 44 hours

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost (HKD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Point 21 nurse’s basic salary per minute</td>
<td>31,525 / (4x44x60) = 2.985</td>
</tr>
</tbody>
</table>

**Cost of implementation of innovation**

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost (HKD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost of nursing time for implementation</td>
<td>2.985x9450 = 28,208</td>
</tr>
<tr>
<td>(7-month)</td>
<td></td>
</tr>
</tbody>
</table>

2-hour training course

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost (HKD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost for every nurse to attend</td>
<td>2.985x120 = 358</td>
</tr>
<tr>
<td>Cost for handout for 80 staff</td>
<td>3x80 = 240</td>
</tr>
<tr>
<td>Cost for handout for 20 bedside</td>
<td>3x20 = 60</td>
</tr>
</tbody>
</table>

Total expenses 28866
CHAPTER 5 EVIDENCE BASED GUIDELINE

Establishment of an evidence-based guideline

On the basis of the evidence from the literature review, an evidence-based practice guideline was established. As suggested by the Scottish Intercollegiate Guidelines Network (2008), the level of evidence of the studies in the integrated review were graded from 1++ to 4 (See Appendix A) while the recommendations were rated using the scale of A to D (See Appendix B).

Title of the evidence-based guideline

An evidence-based guideline on early mobilization of mechanically ventilated patients

Objectives

- To optimize the physical outcomes of the mechanically ventilated patients
- To standardize the steps of mobilizing the mechanically ventilated patients

Target population

- Age $\geq 18$ years old
- Mechanically ventilated patients
- Conscious and alert
- Hemodynamic stability – No hypotension, not using inotropes and oxygen requirement $< 55\%$
- Barthel Index score $\geq 70\%$ (obtained 2 weeks before admission)

**Recommendations**

The following recommendations will be performed 5 times weekly for 8 weeks. For the $3^{rd}$ to $6^{th}$ recommendation, the pace of progress to the next recommendation will be judged by the whole health care team comprising of the ICU doctors, nurses, physiotherapists and occupational therapists.

*Recommendation 1*

Sedation should be interrupted 2 hours in advance (as prescribed by physicians) and patient should be conscious and alert before performing the mobilization training program. Contraindications to interruption of sedation include persistent neuromuscular blockade, unstable seizure, increasing trend of sedation utilization due to persistent agitation and suspicious of increased intracranial pressure (Grade A)

- Sedation interferes with patient’s consciousness and makes patient unable to perform active range-of-motion exercises which is the pre-requisites of the mobilization training program. (Burtin et al., 2009 [1+]; Schweickert et al., 2009 [1++]  

*Recommendation 2*

A list of readiness parameters for instance the blood pressure, heart rate, respiratory rate etc. should be screened in patient assessment (See Appendix C) for the initiation
and continuation of the mobilization training program and apply for continuous monitoring during the interventions. (Grade A)

- A checklist helps nurses to assess the suitability of patient to mobilize having patient’s safety ensured. (Martin et al., 2005 [2+]; Morris at al., 2008 [2+]; Schweickert et al., 2009 [1++])

**Recommendation 3**

Training starts with upper-extremity and lower-extremity range-of-motion exercise in supine position (See Appendix D). (Grade A)

- Starting with the easiest step increases the chance of success by training up the muscle gradually and promoting one’s self confidence. (Chiang et al., 2006 [1+]; Burtin et al., 2009 [1+]; Morris at al., 2008 [2+]; Martin et al., 2005 [2+]; Schweickert et al., 2009 [1++])

**Recommendation 4**

If active ROM is tolerated, maintaining in upright sitting position 45 degree can be tried for 5 minutes and at most 15 minutes. (Grade A)

- Maintaining in sitting position strengthens the back muscles. (Morris at al., 2008 [2+]; Schweickert et al., 2009 [1++])

**Recommendation 5**

Once the bed mobility exercise can be tolerated, activities of daily living (ADL) (See
Appendix E) and bedside cycling exercise can be participated for 5 minutes and at most 15 minutes. (Grade A)

- Upper limbs muscle can be strengthened and simultaneously functional independency can also be trained up having the motions being fine tuned. Bedside cycling exercise can train up the lower limbs muscles. (Chiang et al., 2006 [1+]; Burtin et al., 2009 [1+]; Martin et al., 2005 [2+]; Schweickert et al., 2009 [1++])

**Recommendation 6**

When bedside cycling exercise is tolerated, walking exercise with 5-minute intermittent rest can be tried. (Grade B)

- Good tolerance to bedside cycling exercise symbolizes the likely successful rate to walk. (Burtin et al., 2009)
CHAPTER 6  IMPLEMENTATION PLAN

The implementation plan comprises of the communication plan between different level of stakeholders of ICU and the pilot testing.

Communication Plan

The purpose of a communication plan is to facilitate a change in mobilization practice in the target ICU setting. Apart from communicating with the stakeholders, the plan also delineate the way of initiating, guiding and sustaining the change, which is indeed paving the successful pathway of implementation of the mobilization protocol (Pilot & Beck, 2004).

Stakeholders

According to Pilot and Beck (2008), stakeholders have the power and ability of affect changes while simultaneously they are interested in the new innovation. In the situation of mobilization guideline, the stakeholders are the ICU nurses, nurses specialists (NSs), the advanced practice nurses (APNs), ward manager (WM), department operation manager (DOM), ICU directors, ICU doctors, physiotherapists (PTs) and occupational therapist (OTs).

Communication with stakeholders

Aiming at acquiring consensus, cooperation and support form stakeholders, the bottom-up communication approach will be adopted to communicate with them so as
to deliver discrete details on the mobilization practice.

While NSs and APNs are the key persons promoting the evidence-based practice, starting the discussion with them on the new guideline is the first step. The essence of implementing the mobilization protocol, the need of change of the existing practice, the evidence of supporting the new practice and the feasibility of change will be emphasized. The discussion will be continuous with probably some hurdles may be needed to overcome in order to reach consensus.

After getting approval on the new guideline by NSs, a formal meeting will be hold to deliver the proposed protocol to the WM, DOM and ICU directors. They are described as the gatekeepers having the authority to approve the implementation and financial support of the new practice. The need and significance of the change of mobilization practice will be delineated. A proposal of innovation, comprising of the necessary material resources, the essential manpower, the estimated expenditure and the schedule of implementation of the intervention, will be presented. In case of disapproval of the proposal, further discussion will be hold for further elaboration and the seek of valuable opinions which helps to adjust the plan and obtain final agreement then.

Once the gatekeepers approve the proposal, the latest version of guideline can be disseminated to the remaining stakeholders e.g. the ICU nurses, ICU doctors,
physiotherapists (PTs) and occupational therapist (OTs) by sending emails to their hospital intranet account. Since the ICU nurses and the doctors are the important people to implement and master the new protocol, their opinions and cooperation are treasured.

**Change Initiation**

When the proposal is approved, a committee will be established to implement the new mobilization guideline, which serves the purpose of preparing, guiding and sustaining the change. The key committee members are the author, NSs, three senior nurses and ICU directors. The ICU director is the one who leads the communication, implementation and evaluation of the new innovation. The three senior nurses are knowledgeable, experienced and well-respected by the colleagues so that they can act as the role model for facilitating the implementation of innovation.

The success of implementation of the new innovations depends very much on the cooperation of the ICU doctors and nurses. Unclear concept on the new innovation inhibits colleagues to implement which may generate discrepancy in outcome. It is essential to make sure all the colleagues are familiar with the mobilization protocol and the related appropriate skills. In view of this, a briefing session and training workshop will be prepared for them.

A 30-minute briefing session will be provided to the frontline staff to alert them about
the new innovation and to deliver the related details to them. The briefing session are going to be conducted in the conference room. The author will illustrate the mobilization protocol in the mechanically ventilated patients, the necessity of change and invite them to take part into the new protocol. On the other hand, the committee will prepare the information sheet for the colleagues, which includes the content of the briefing session. The information sheet will be put on the staff notice board for easy seek of reference. Generally, it is difficult to have all the colleagues to attend the briefing session at the same time. To make sure that all the staffs expose to the new innovation, a “read-and-sign” approach will be adopted. After attending the briefing session, the staff will be arranged a training 1.5-hour workshop which will take place in the conference room every afternoon. To facilitate and ensure all the frontline staff attends the mandatory workshop, the staff will be officially relieved to join flexibly whenever they are available. Power-point presentation will be used to illustrate the skills on patient assessment and evaluation. Video will be played to highlight the techniques of mobilizing the mechanically ventilated patients. At the end of presentation, some case scenarios will be brought forwards to discuss which can show that whether the staffs understand clearly or not. Questioning session is available as well, which promotes knowledge exchange. Handout will be distributed for easy reference.
**Change Guidance**

Some difficulties will be probably encountered especially at the very beginning of guideline implementation even though the staff has attended both the briefing session and the training workshop. To tackle with this, a “train the trainer” approach will be used. The committee members especially the three senior nurses act as the clinical guidance, which allows on-going early clarification of wrong concepts and solicitation of skills. Moreover, the committee members take notes on the problems encountered by the frontline staff which will be discussed and solved in the bi-weekly committee meeting. The protocol is updated accordingly which will be posted on the staff notice board and at bedside as a quick guide.

**Change Sustain**

The differences in ward culture and individual behavior of frontline staff give cues to show whether the change sustains successfully. Melnyk and Fineout-Overholt (2005) pointed out that the opinion leaders, who attain the required knowledge and skills and have already gain trust and respect from the organization member, are able to convince others therefore facilitates changes to take place. Having the existing committee members, the APNs, WM and the ICU doctors can be invited to be the opinion leader. On the other hand, in order to sustain the behavioral change of the frontline staff, the committee member is necessary to keep an eye on staff’s practice
so as to perform continuous assessment and clinical guidance of the staff daily practice on mobilization guideline. Colleagues are welcome to approach the committee member whenever they encounter any problem. Additionally, the committee members should keep on searching up-to-date evidence-based literatures on the mobilization practice and post on the staff notice board for sharing.

**Pilot Study Plan**

Pilot and Beck (2008) emphasized that a pilot study, which is just like a rehearsal, is crucial to be conducted before the complete implementation of the new protocol. This act can determine any revision of inadequacies probably happening in the full implementation of innovation. The purpose of pilot study is to test the sufficiency of training workshop, determine the feasibility of the mobilization protocol and the evaluation plan. The pilot study will be conducted in the target ICU. It is compulsory to acquire the ethical approval of the ICU research committee before conducting the pilot study.

**Sufficiency of training workshop**

Ten ICU nurses will be recruited to attend the half hour briefing session and the 1.5-hour training workshop in the pilot study. They will be briefed by the power-point presentation and scenario discussion having the handout being distributed. During the workshop, the committee members will keep an eye on the
non-verbal and personal response of the nurses to monitor the perception and
enthusiasm towards the new mobilization guideline. Moreover, the participants will
be asked to fill in the evaluation questionnaire to detect the staffs’ satisfaction, their
readiness and skill of working on the new mobilization practice. The validity of the
evaluation questionnaire will be checked by the two NSs and three experienced senior
nurses (working in ICU for more than 10 years). Lastly, the committee members
will time the duration of the training workshop so that they can refine the timeframe
for future implementation to meet better time management.

**Feasibility of the proposed guideline**

Convenience sampling method will be used to enroll fifteen patients for the pilot
study. The eligible patients are at least eighteen years old, mechanically ventilated,
conscious and alert, hemodynamically stable with BI scoring 70% or above. The
approximate timeframe of patient recruitment is two weeks according to the ICU
registry for the mechanically ventilated patients and the implementation period is
around one month. Throughout the pilot study, the committee will listen to the
participants’ opinion and perception towards the new guideline, which is crucial for
further modification of the protocol.

**Feasibility of the evaluation plan**

The evaluation plan will last for one month and all the staffs take part in the pilot
study will be invited to join the evaluation plan. To assess the feasibility of the evaluation plan, the author and the committee will observe the process of patient recruitment, data collection and analysis so that limitations can be identified if any. After that, the last week of evaluation will be used to discuss the weaknesses and make certain refinement on the proposed guideline.

The purpose of the evaluation plan is to determine the effectiveness of the mobilization guideline, which serves as the indicator of whether the innovation is worthy to proceed or not. Three types of outcome namely patient outcomes, healthcare provider outcomes and system outcomes will be evaluated. Patient outcomes belong to the short term outcomes while healthcare provider and system outcomes are categorized as the long term outcomes.
CHAPTER 7 EVALUATION PLAN

Nature of involved patients

Eligibility criteria

The patients to be recruited should attain the inclusion criteria of being conscious and alert, who are adults aged 18 or above receiving mechanical ventilation. Apart from this, they should be hemodynamically stable without hypotension, inotropic support and oxygen demand > 55%. Lastly, their BI score should be 70% or above at the time of 2 weeks before admission. Patients who are having raised intracranial pressure, history of neuromuscular diseases, history of cardiac arrest or resuscitation in current admission, conditions interfering ambulation like absence of limbs and spinal cord injury, receiving paralytic or sedative agents and suffering from co-morbid neurological diseases, should be excluded to join the mobilization guideline.

Sample size calculation

The primary outcome of the evaluation plan is the patient outcome as reflected by the Barthel Index. It is expected that the Barthel Index should show improvement after implementation of the proposed guideline. The anticipated effect size and the standard deviation are obtained from the results of the studies which have been reviewed and appraised. The effect size of Chiang et al (2006) and Schweickert et al (2009) is 0.14 and 0.17 respectively. Thus, 0.14 is taken as the effect size 0.14
since it is the lowest comparatively and the standard deviation is 40%. By making use of the homepage of Russ Lenth’s Power and Sample Size (Lenth, 2006-2009) for sample size calculation, test for one proportion is considered together with the statistically significance defined as less than 0.05. According to these criteria, 80 candidates should be recruited minimally. Yet, from the literature review, approximately 20% drop out rate is noted and therefore the pre-requisite sample size is 96. Based on the data of ICU registry dated from September 2012 to December 2012, there were 200 patients needed ventilator support in the target ICU. Considering 40% of ineligible patients such as trauma cases and those not requiring mechanically ventilation, the total of eligible patients per month is around 30. The recruitment of eligible patients is probably achievable within 4 months.

Data Analysis

For the patients’ demographic data e.g. age, diagnosis, it will be analyzed using descriptive statistics. These data will be shown in percentage, mean ± standard deviation (SD) for normal distributed variables whereas the non-normal distributed variables will be represented in median ± interquartile range. The two-tail z test will be used to examine the difference in upper and lower extremities MS and the BI after the implementation of the mobilization protocol. Aiming at attain the optimal statistical power, the significance level and power will be set at 0.05 and 0.8
respectively.

Regarding to the compliance rate of the ICU staff towards the new protocol, it will be calculated in percentage with 95% confidence interval using the program of SPSS.

In view of the data collected for the perceived skill, confidence and knowledge in implementing the mobilization protocol and job satisfaction towards the new innovation, they are scored according to the 5-points Likert scale having point 1 and 5 equal to “Extremely Disagree” and “Extremely Agree” respectively. Mean ± SD will be calculated for each questions.

**Data collection, measurement and basis of effective change of protocol**

**Patient outcomes**

Since the objective of the evidence-based mobilization protocol is to optimize the physical outcomes of the mechanically ventilated patients, the upper and lower extremities muscle strength (MS) and BI are chosen to measure. It is expected that the application of the mobilization protocol would improve the muscle strength and Barthel Index of the mechanically ventilated patients.

PTs will assess patients’ upper and lower limbs MS at the time of admission, everyday after physiotherapy session till discharge using a five point motor scale which covered strength and ROM in all major muscle groups (See Appendix F). With reference to the literatures, it was found that the increment of MS of the upper and lower limbs
between the time of admission and discharge is around 89% and 80% respectively.

Thus, to make a conservative judgment, the increment of MS of the upper and lower limbs reached 70% or above is considered to be an effective protocol.

On the other hand, the BI is an instrument used for measuring one’s independence in term of ADL (Hsueh, Lee & Hsieh, 2001). The BI is equivalent to the sum of 10 items ranging from 0 to 100, i.e. from totally dependent to independent to basic ADL. The higher the BI means the higher the level of independence. The details of the BI are illustrated in Appendix G. BI in the study of Chiang et al. (2006) and Schweickert et al. (2009) at discharge ranged from 35 to 75, thus, being conservative, BI which is 55 or above is counted as an effective mobilization guideline.

**Healthcare provider outcomes**

Tilten, Cullen and Ardery (2002) stated that maintaining a good atmosphere and high acceptance of new guideline can enhance good job satisfaction and compliance rate. The perceived skill, confidence and knowledge in implementing the mobilization protocol, job satisfaction and compliance towards the new innovation of the ICU nurses are therefore under the umbrella of the healthcare provider outcomes. They can be measured by asking to participants to fill in the evaluation questionnaire (Appendix H) at the study. Moreover, the committee members will observe the staffs’ compliance and skills by using an audit form (Appendix I). In order to know
the actual staff’s compliance towards the guideline, observation by the committee members will be performed indefinitely. Moreover, the frontline staff will be required to try some clinical scenario to test whether they understand the protocol thoroughly.

The new guideline is considered to be effective if the rate of compliance is 80% or above while the evaluation questionnaire asking about the job satisfaction, perceived skill, confidence and knowledge in manipulating the proposed protocol scored at least 80%. The evaluation questionnaire will be distributed by the end of the study.

**System outcomes**

Under the circumstances of healthcare budget constraint, prudent resources utilization is essential for long-term monetary sustainability. Undoubtedly, the reduction in healthcare expenditure and good healthcare service quality are the obvious indicators showing the effectiveness and success of the new innovation.

Effective bed utilization is one of the indicators of good resources utilization. One of the related parameters is the hospital length of stay (LOS). Schweickert et al., (2009) found that the intervention group had a shorter hospital LOS than the control group.
Conclusion

To conclude, the literature review inspires the health care professions that early mobilization of mechanically ventilated patients yields optimization of patients’ physical outcomes. Communication with stakeholders, estimation of manpower and material cost, development of evidence-based guidelines and conduction of a pilot study determine the success of protocol implementation. Nevertheless, a comprehensive evaluation including the outcomes of healthcare providers, patient and organization is crucial to measure the efficacy of the mobilization protocol.
References


### Levels of evidence
(Scottish Intercollegiate Guidelines Network, 2008)

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1++</td>
<td>High quality meta-analyses, systematic reviews of RCTs, or RCTs with a very low risk of bias</td>
</tr>
<tr>
<td>1+</td>
<td>Well conducted meta-analyses, systematic reviews, or RCTs with a low risk of bias</td>
</tr>
<tr>
<td>1-</td>
<td>Meta-analyses, systematic reviews, or RCTs with a high risk of bias</td>
</tr>
<tr>
<td>2++</td>
<td>High quality systematic reviews of case control or cohort studies</td>
</tr>
<tr>
<td></td>
<td>High quality case control or cohort studies with a very low risk of confounding or bias and a high probability that the relationship is causal</td>
</tr>
<tr>
<td>2+</td>
<td>Well conducted case control or cohort studies with a low risk of confounding or bias and a moderate probability that the relationship is causal</td>
</tr>
<tr>
<td>2-</td>
<td>Case control or cohort studies with a high risk of confounding or bias and a significant risk that the relationship is not causal</td>
</tr>
<tr>
<td>3</td>
<td>Non-analytic studies e.g. case reports, case series</td>
</tr>
<tr>
<td>4</td>
<td>Expert opinion</td>
</tr>
</tbody>
</table>
Appendix B

**Grades of recommendations**
(Scottish Intercollegiate Guidelines Network, 2008)

<table>
<thead>
<tr>
<th></th>
<th>At least one meta-analysis, systematic review, or RCT rated as 1++, and directly applicable to the target population; Or A body of evidence consisting principally of studies rated as 1+, directly applicable to the target population, and demonstrating overall consistency of results</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>A body of evidence including studies rated as 2++, and directly applicable to the target population, and demonstrating overall consistency of results; Or Extrapolated evidence from studies rated as 1++ or 1+</td>
</tr>
<tr>
<td>B</td>
<td>A body of evidence including studies rated as 2+, and directly applicable to the target population, and demonstrating overall consistency of results; Or Extrapolated evidence from studies rated as 2++</td>
</tr>
<tr>
<td>C</td>
<td>Evidence level 3 or 4 Or Extrapolated evidence from studies rated as 2+</td>
</tr>
</tbody>
</table>
Appendix C

A checklist for patient’s readiness for the mobilization training program

Any “√” on either box in the checklist indicates the unsuitability or immediate discontinuation of therapy.

<table>
<thead>
<tr>
<th>Readiness Parameters</th>
<th>Before commencement</th>
<th>During commencement</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAP &lt; 65 mmHg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MAP &gt; 110 mmHg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SBP &gt; 200 mmHg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HR &lt; 40 bpm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HR &gt; 130 bpm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RR &lt; 5 /min</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pulse oximeter &lt; 88%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ventilator unsynchrony</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patient’s distress as evidenced by non-verbal cues, gestures e.g. shortness of breath</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arrhythmia</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ECG changes e.g. ST elevation</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: MAP = mean arterial blood pressure
SBP = systolic blood pressure
HR = heart rate
RR = respiratory rate
Appendix D

Upper and lower extremities Range-of-motion exercises (Chiang et al., 2006)

Upper-extremity range-of-motion exercises include:
- Wrist; elbow and shoulder flexion and extension
- Shoulder abduction, adduction and internal and external rotation
With 10 repetitions of each motion per set for 2 sets

Lower-extremity range-of-motion exercises include:
- Ankle dorsiflexion and plantar flexion
- Hip and knee flexion and extension
- Straight leg raising
With 10 repetitions of each motion per set for 2 sets

**Training starts from assisted range-of-motion exercise to total independent**
Appendix E

Components of ADL activities (Chiang et al., 2006)

- Turning from side to side on the bed;
- Transfers to and from the bed, chair, and wheelchair
- Eating – use of cutlery, spoon and chopsticks
- Grooming – hair combing, face washing
- Dressing – putting on clothes, taking off clothes
- Using the toilet – ability to control bowel and voiding, use of bedpan, commode and toilet
- Bathing
### Appendix F

**Motor score** (Hsueh, Lee, & Hsieh, 2001)

<table>
<thead>
<tr>
<th>Muscle Activity</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ability to hold the test position against gravity and maximum pressure</td>
<td>5</td>
</tr>
<tr>
<td>Same as above, except holding against moderate to minimal pressure</td>
<td>4</td>
</tr>
<tr>
<td>Ability to hold the test position against gravity</td>
<td>3</td>
</tr>
<tr>
<td>Ability to move a body part through a partial arc of motion (with gravity lessened by the observer)</td>
<td>2</td>
</tr>
<tr>
<td>Contraction of muscle, prominence of tendon without visible motion of body part</td>
<td>1</td>
</tr>
<tr>
<td>No contraction felt in the muscle</td>
<td>0</td>
</tr>
</tbody>
</table>
Appendix G

Barthel Index (Hsueh, Lee, & Hsieh, 2001)

<table>
<thead>
<tr>
<th>Activity</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Feeding</strong></td>
<td></td>
</tr>
<tr>
<td>0 = unable</td>
<td></td>
</tr>
<tr>
<td>5 = needs help cutting, spreading butter, etc., or requires modified diet</td>
<td>0 5 10</td>
</tr>
<tr>
<td>10 = independent</td>
<td></td>
</tr>
<tr>
<td><strong>Bathing</strong></td>
<td></td>
</tr>
<tr>
<td>0 = dependent</td>
<td>0 5</td>
</tr>
<tr>
<td>5 = independent (or in shower)</td>
<td></td>
</tr>
<tr>
<td><strong>Grooming</strong></td>
<td></td>
</tr>
<tr>
<td>0 = needs to help with personal care</td>
<td></td>
</tr>
<tr>
<td>5 = independent face/hair/teeth/shaving (implements provided)</td>
<td>0 5</td>
</tr>
<tr>
<td><strong>Dressing</strong></td>
<td></td>
</tr>
<tr>
<td>0 = dependent</td>
<td>0 5 10</td>
</tr>
<tr>
<td>5 = needs help but can do about half unaided</td>
<td></td>
</tr>
<tr>
<td>10 = independent (including buttons, zips, laces, etc.)</td>
<td></td>
</tr>
<tr>
<td><strong>Bowels</strong></td>
<td></td>
</tr>
<tr>
<td>0 = incontinent (or needs to be given enemas)</td>
<td></td>
</tr>
<tr>
<td>5 = occasional accident</td>
<td>0 5 10</td>
</tr>
<tr>
<td>10 = continent</td>
<td></td>
</tr>
<tr>
<td><strong>Bladder</strong></td>
<td></td>
</tr>
<tr>
<td>0 = incontinent, or catheterized and unable to manage alone</td>
<td></td>
</tr>
<tr>
<td>5 = occasional accident</td>
<td>0 5 10</td>
</tr>
<tr>
<td>10 = continent</td>
<td></td>
</tr>
<tr>
<td><strong>Toilet Use</strong></td>
<td></td>
</tr>
<tr>
<td>0 = dependent</td>
<td>0 5 10</td>
</tr>
<tr>
<td>5 = needs some help, but can do something alone</td>
<td></td>
</tr>
<tr>
<td>10 = independent (on and off, dressing, wiping)</td>
<td></td>
</tr>
<tr>
<td><strong>Transfers (bed to chair and back)</strong></td>
<td>0 5 10 15</td>
</tr>
<tr>
<td>0 = unable, no sitting balance</td>
<td></td>
</tr>
<tr>
<td>5 = major help (one or two people, physical), can sit</td>
<td></td>
</tr>
<tr>
<td>10 = minor help (verbal or physical)</td>
<td></td>
</tr>
<tr>
<td>15 = independent</td>
<td></td>
</tr>
<tr>
<td><strong>Mobility (on level surfaces)</strong></td>
<td>0 5 10 15</td>
</tr>
<tr>
<td>0 = immobile or &lt; 50 yards</td>
<td></td>
</tr>
<tr>
<td>5 = wheelchair independent, including corners, &gt; 50 yards</td>
<td></td>
</tr>
<tr>
<td>10 = walks with help of one person (verbal or physical) &gt; 50 yards</td>
<td></td>
</tr>
<tr>
<td>15 = independent (but may use any aid; for example, stick) &gt; 50 yards</td>
<td></td>
</tr>
<tr>
<td><strong>Stairs</strong></td>
<td>0 5 10</td>
</tr>
<tr>
<td>0 = unable</td>
<td></td>
</tr>
<tr>
<td>5 = needs help (verbal, physical, carrying aid)</td>
<td></td>
</tr>
<tr>
<td>10 = independent</td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL (0 - 100)</strong></td>
<td></td>
</tr>
</tbody>
</table>
Appendix H

Evaluation questionnaire on the mobilization guideline in ICU (Self developed)

Dear colleagues,
Thank you for your active participation into the pilot study of the mobilization guideline in ICU. You are now invited to fill in the evaluation questionnaire to feedback on the workload, satisfaction, perceived knowledge and skill on the new protocol. The questionnaire is graded using the 5-point Likert Scale, having 1 = Extremely disagree, 2 = Slightly disagree, 3 = no comment, 4 = Slightly agree and 5 = Extremely agree.

<table>
<thead>
<tr>
<th>Workload</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>The implementation of mobilization guideline has increased my workload</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Satisfactory level towards the new guideline**

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. It is easy to follow.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. It is clear and concise.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. I am satisfied with the new mobilization guideline.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. I am satisfied with the recommendations listed in the protocol.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e. I am satisfied with the implementation process.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>f. The protocol can standardize the staffs’ practice on the mobilization of mechanically ventilated patients.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>g. The evidence listed on the mobilization guideline is convincible.</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Job satisfaction**

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. The protocol implementation gives you sense of achievement.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. The protocol implementation boosters nurses’ autonomy.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. The protocol implementation increases your job satisfaction.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Perceived knowledge and skill on manipulating the new guideline**

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. I am confident enough to implement the new guideline.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. I am skillful enough to implement the new guideline.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. I am knowledgeable enough to implement the new guideline.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. The content of training workshop is useful enough to master the new guideline.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix I

Evaluation questionnaire on staff’s compliance and skill towards the mobilization guideline (Self developed)

Please circle Yes (Y) or No (N) for the following statements to grade whether the staff is able to fulfill the requirement.

** Note: O = Observation   D = Documentation

<table>
<thead>
<tr>
<th>Audit items</th>
<th>Ways of audit</th>
<th>Yes (Y)/No (N)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A. Initial assessment</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Identify suitable candidates for mobilization protocol</td>
<td>O / D</td>
<td>Y/N</td>
<td></td>
</tr>
<tr>
<td>- Complete patient’s readiness checklist accurately(Appendix C)</td>
<td>O / D</td>
<td>Y/N</td>
<td></td>
</tr>
<tr>
<td>- Acquire consensus from the parties involved</td>
<td>O / D</td>
<td>Y/N</td>
<td></td>
</tr>
<tr>
<td>- Gather all necessary equipments needed for the interventions</td>
<td>O / D</td>
<td>Y/N</td>
<td></td>
</tr>
<tr>
<td><strong>B. Implementation</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Sedation interruption 2 hours in advance</td>
<td>O / D</td>
<td>Y/N</td>
<td></td>
</tr>
<tr>
<td>- Follow the training protocol according to guideline and patient’s ability</td>
<td>O / D</td>
<td>Y/N</td>
<td></td>
</tr>
<tr>
<td><strong>C. Evaluation</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Perform continuous assessment on patient’s mobilization ability</td>
<td>O / D</td>
<td>Y/N</td>
<td></td>
</tr>
<tr>
<td>- Able to judge and terminate mobilization intervention when patient’s condition deteriorates</td>
<td>O / D</td>
<td>Y/N</td>
<td></td>
</tr>
<tr>
<td><strong>D. Documentation</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Well documentation of interventions and the level of patient’s ability reached</td>
<td>O / D</td>
<td>Y/N</td>
<td></td>
</tr>
</tbody>
</table>