Abstract of thesis entitled

A guideline-drive protocol of daily sedation interruption for critically ill patients receiving mechanical ventilation

Submitted by

MOK SIU CHUNG

For the degree of Master of Nursing

at The University of Hong Kong

in July 2016

Mechanical ventilation (MV) is a life support method used for the critically ill patients in intensive care units (ICUs). In addition to unfamiliar environment in ICUs, invasive procedures or surrounding medical devices cause anxiety, fear, pain and frustration to patients, particularly those who are under MV. Therefore, MV is accompanied with sedative administration in nearly all cases to minimize the patients’ agitation, optimizes their comfort and facilitates nursing care. Some studies demonstrates that the duration of the use of MV and the length of stay in ICUs significantly decrease when patients regain consciousness. However, nurses become confused in terms of appropriate standard and evidence-based nursing care for
critically ill patients under MV because of various practical guidelines on weaning from sedatives in different hospitals. Considering these phenomena, we aim to evaluate currently available evidence on sedation protocol for MV weaning through a comprehensive literature review and to develop an evidence-based sedation weaning guideline in adult ICU settings in a public hospital in Hong Kong.

Keywords related to daily sedation interruption for critically ill patients under MV were used to search for eligible studies in electronic databases, such as PubMed and CINAHL Plus. Five studies satisfied the inclusion criteria set for this dissertation. A table of evidence was formulated to extract data from these studies. The qualities of these studies were evaluated on the basis of the checklist from critical appraisal tool of the Scottish Intercollegiate Guideline Network (SIGN). Three studies were graded with a higher evidence because they reported statistically significant values in term of the reduction in MV duration.

The implementation potential of sedation guideline was assessed in terms of transferability, feasibility and cost-benefit ratio. Results revealed that the proposed evidence-based guideline for daily sedation interruption is feasible and beneficial to patients, staff, and departments. The proposed guideline is also transferable in the current setting. Therefore, current evidence has been translated into local settings.

An 11-month implementation program was designed with the following
components: approval seeking, stakeholder communication, working group recruitment, guideline promotion, staff training, eight-week pilot study, and actual guideline implementation and subsequent evaluation. Outcomes were classified into three domains to evaluate the effectiveness of the proposed protocol: patients’ outcome (e.g. MV duration), staff outcome (e.g. perception and satisfaction levels), and organizational outcome (e.g. financial cost and quality of care).
A guideline-drive protocol of daily sedation interruption for critically ill patients
receiving mechanical ventilation

Submitted by

MOK SIU CHUNG
BNurs, RN

A thesis submitted in partial fulfillment of the requirement for the Degree of Master of Nursing at the University of Hong Kong

July 2016
Declaration

I declare that this thesis represents my own work, except where due acknowledgement is given 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........................................................................

Mok Siu Chung
ACKNOWLEDGEMENTS

I would like to take this valuable opportunity to express my deep sense of gratitude, thankfulness and appreciation to my dissertation supervisor, Miss KONG HOI MEI, Cecilia for encouraging and guiding me to make the right decisions and improvements throughout the writing of this thesis.

I would also like to extend my gratitude to my classmates and hospital colleagues who shared their grateful support, either morally or physically for me. Last but not least, I sincerely thank my beloved family for their endless love, support and encouragement to my works and studies.
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## Abbreviations

<table>
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<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tr>
<td>Analgesia-Delirium-Sedation</td>
<td>ADS</td>
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<tr>
<td>APACHE</td>
<td>Acute Physiology and Chronic Health Evaluation</td>
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<td>APN</td>
<td>Advanced practice nurse</td>
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<tr>
<td>CIS</td>
<td>Clinical information system</td>
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<tr>
<td>CI</td>
<td>Confidence interval</td>
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<tr>
<td>COS</td>
<td>Chief of service</td>
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<tr>
<td>DOM</td>
<td>Department Operations Manager</td>
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<tr>
<td>EBP</td>
<td>Evidence-based practice</td>
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<tr>
<td>eKG</td>
<td>e-knowledge Gateway</td>
</tr>
<tr>
<td>ETT</td>
<td>Endotracheal tube</td>
</tr>
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<td>e.g.</td>
<td>For example</td>
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<tr>
<td>HA</td>
<td>Hospital Authority</td>
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<tr>
<td>ICU</td>
<td>Intensive Care Unit</td>
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<tr>
<td>LOS</td>
<td>Length of stay</td>
</tr>
<tr>
<td>MO</td>
<td>Medical officer</td>
</tr>
<tr>
<td>MV</td>
<td>Mechanical ventilation</td>
</tr>
<tr>
<td>NC</td>
<td>Nurse consultant</td>
</tr>
<tr>
<td>PICO</td>
<td>Patient Intervention Comparison Outcome</td>
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<tr>
<td>RASS</td>
<td>Ramsay Sedation Scale</td>
</tr>
<tr>
<td>RCT</td>
<td>Randomized Controlled Trials</td>
</tr>
<tr>
<td>RN</td>
<td>Registered Nurse</td>
</tr>
<tr>
<td>SBTs</td>
<td>Spontaneous breathing trials</td>
</tr>
<tr>
<td>SAS</td>
<td>Sedation-Agitation Scale</td>
</tr>
<tr>
<td>SIGN</td>
<td>Scottish Intercollegiate Guidelines Network</td>
</tr>
<tr>
<td>USA</td>
<td>The United States of America</td>
</tr>
<tr>
<td>VAP</td>
<td>ventilator associated pneumonia</td>
</tr>
<tr>
<td>VTE</td>
<td>venous thromboembolism</td>
</tr>
<tr>
<td>WHO</td>
<td>World Health Organization</td>
</tr>
<tr>
<td>WM</td>
<td>Ward Manager</td>
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Chapter 1-Introduction

1.1 Background:

Mechanical ventilation (MV) is a lifesaving technique employed to maintain the airway and to support the respiratory system of nearly one-third of patients in intensive care units (ICUs) (Esteban, Anzueto, Frutos & Tobin, 2002). However, approximately 70% of patients in ICUs suffer from moderate to severe pain during treatment (Alderson, & McKechnie, 2013; Chanques et al., 2006; Simini, 1999). Patients under MV in ICUs also experienced anxiety, agitated, fear, frustration, disturbed sleep, inability to speak, feeling of isolation and loneliness (Tembo, Higgins, & Parker, 2014). These problems may have been triggered by invasive procedures, such as endotracheal tube (ETT) intubation, central line insertion, and by other factors, such as unfamiliar environment, lack of control, feeling uncertainty on their prognosis, and communication barrier (Desbiens & Mueller-Rizner, 2000). Thus, sedatives have been commonly administered to patients in ICUs to alleviate their discomfort and agitation, to decrease oxygen consumption, to reduce anxiety and stress, and to facilitate nursing care routines and ventilator synchronization (Jacobi et al., 2002). Continuous sedative infusion can provide a consistent level of sedative effects, but it may also cause adverse effects such as oversedation, delirium, and prolonged MV (Pandharipande et al.,
Likewise, inappropriate sedation can trigger adverse effects. Therefore, appropriate sedative application is an important component for critically ill patients under MV (Sessler & Varney, 2008). However, appropriate administration patterns and dose are difficult to determine (Weinert & Calvin, 2007).

Patients under sedation exhibit agitation and restlessness, increase their oxygen consumption, and trigger ventilator desynchronization; as a consequence, the use of MV is prolonged (Devlin, Fraser, Kanji, & Riker, 2001). These patients are also at a high risk of unintentional removal of lifesaving devices and catheters and experiencing unpleasant memories (Fraser, et al., 2000). As such, nursing staff must increase the sedation infusion or administer a bolus dose to these patients to sedate them again, but this procedure results in oversedation. Oversedation extends the dependence of patients on ventilation and leads to difficulty in weaning; as a result, several complications, such as ventilator-associated pneumonia, barotrauma, venous thromboembolic disease, or bacteremia, may occur and subsequently cause prolonged confinement in ICUs (Frutos-Vivar et al., 2009). Extended sedation may also lead to confusion on intensivist staff who determines whether the changes in the mental status of a patient are due to the effects of a brain injury or sedatives. Hence, neurological diagnostic studies should be performed to rule out any new neurological injuries, but these factors can contribute to medical
and financial burdens. In other words, sedative application can positively and negatively affect patients. Therefore, the advantages of administering sedatives must be weighed against their disadvantages.

1.2 Affirming the need:

Oversedation is highly prevalence in ICUs worldwide (Weinert & Calvin, 2007). This condition is similarly observed in local ICU settings. In local settings, 20 ICU beds are documented in unpublished data from my unit. From January 1, 2015 to December 31, 2015, 1,246 patients were admitted to the ICU. Of these patients, 1,007 patients used mechanical ventilators, and the proportion of the sedation usage was nearly 35% of the total sedation usage of the hospital. The average duration of MV was 5.5 days to 16 days, but standardized sedative protocols have yet to be established. This phenomenon is also observed in other public hospital. As such, sedation protocols should be standardized to achieve optimum comfort and safety levels for critically ill patients (Jacobi et al., 2002). Sedation usage is under the discretion of physicians in most cases, and sedation strategies differ because of a physician’s preferences in terms of sedation therapies and practices, which do not usually agree with those of other physicians with different levels of seniority and experiences (Augustes & Ho, 2011). The absence of a standardized sedation protocol result in excessive sedation, which is a common
problem, especially in the weaning of ventilators (Payen et al., 2007). Nursing staff may also experience confusion regarding the amount of sedatives because of the absence of a protocol and therefore may indiscriminately estimate the sedation level of patients on the basis of nursing experiences alone; this phenomenon may also lead to excessive sedation (Nassar, Zampieri, Ranzani, & Park, 2015).

In the weaning stage, sedative infusions should be reduced to awake patients and initiate their breathing. However, patients become more anxious and agitated as their discomfort exacerbates, leading to incorporate and restlessness. As such, they may try to remove their endotracheal or catheter. Therefore, nursing staff may oversedate patients to facilitate nursing care; consequently, patients’ breathing effort is reduced, weaning is extended and MV is prolonged (Eremenko & Chemova, 2014). With possible serious consequences of prolonged MV and inappropriate sedation administration, various strategies, such as protocol-directed sedation, bolus sedation administration instead of continuous infusion, sedatives with short action durations, and daily sedation interruption, have been developed to reduce the excessive sedation and MV duration among critically ill patients (Nikoda et al., 2015). For these reasons, effective evidence-based sedation guideline must be established to provide standardized intervention in local settings and thus prevent oversedation.
1.3 Objectives and significance:

The following objectives of this dissertation must be achieved to establish and facilitate an evidence-based guideline for critically ill patients with MV in a local ICU setting:

1. To evaluate the benefits and complications of daily sedation interruption versus current sedation practices in ICU

2. To critically appraise various clinical practices of identified in relevant studies

3. To develop an evidence-based guideline for sedation of patients in ICUs

4. To assess the transferability and feasibility of implementing the guideline in ICU in a local public hospital

5. To devise an implementation and evaluation plan for assessment of the proposed guideline in the local setting

The establishment and implementation of evidence-based guideline to prevent oversedation in patients with mechanical ventilators can provide several benefits in various aspects. For ICU patients, the reduction in MV duration and length of stay in ICU is the objectives of treatment plans. An evidence-based guideline can facilitate the reduction in the usage of sedation, which decrease MV duration, morbidity, mortality, and length of stay in ICUs and hospitals. Moreover, safety can be enhanced when patients are subjected to the proposed sedation
protocol because it reduces the occurrence of nosocomial complications, such as ventilator-associated pneumonia (VAP), barotrauma, venous thromboembolic disease, which are commonly observed in ICU patients. For ICU nurses, the effective use of evidence-based practice (EBP) guideline can facilitate sound decision making of nurses performing sedation titration and thus minimizes the variations in practice to ensure a systemic approach in nursing care. This preferred practice can ensure high-quality of nursing care in ICUs and promote the confidence and work efficiency of nurses. For healthcare organizations, an evidence-based guideline can decrease the incidence rate of complications and length of stay in ICUs and hospitals. Consequently, total health care costs are reduced and financial and services burdens on public healthcare sectors are decreased. Therefore, the establishment and application of an evidence-based sedation protocol for MV weaning is an essential innovation in clinical practice for the local ICUs.

With the affirmed necessity and significance of the issue, the dissertation aimed to determine the subsequent literature search.
Chapter 2: Critical appraisal

2.1 Search and Appraisal Strategies:

A Patient Intervention Comparison Outcome (PICO) framework was used to develop the search strategies used in the databases and to conduct our research question (Courtney & McCutcheon, 2010) based on the following parameters:

- Patient population: critical ill patients undergoing MV
- Intervention: daily interruption of sedative administration
- Comparison: conventional sedation techniques
- Outcome: duration of ventilator usage, length of stay in ICUs and hospitals, and incidence of complications associated with prolonged intubation and MV

Selection criteria

Studies were included if they satisfy the following criteria:

1. All ICU patients were aged 18 years and above and required MV for 12 hours or more
2. Patients were under full ventilator support and undergoing weaning from ventilation.
3. MV duration, length of stay ICUs, and incidence of MV-related complications were considered as outcome measurements.

Studies were excluded if they satisfy any of the following criteria:
1. Target patients were infants or in a pediatrics population.

2. Patients were transferred from an outside institution where sedatives were administered, subjected to continuous MV for 2 weeks or longer, or removed from life support.

3. The articles were systematically designed reviews.

Search strategy:

Database and keywords: a systematic literature search was performed on PubMed and CINAHL from September 2015 to November 2015. Medial Subject Headings (MeSH) terms were extracted to search for keywords. The following terms and phrases were used: (1) mechanically ventilated, (2) daily sedation interruption or daily interruption of sedatives (3) critically ill, and (4) not children. Identical keyword search was used for MeSH and database search to ensure the consistency of the search strategies. In addition, the journals published before 2000 were excluded to prevent acquisition of outdated data, and no language limitation was used to maximize the acquisition of information. The title and abstracts of the articles were initially screened to identify those that satisfy the selection criteria. The full texts of the selected articles were then obtained for further searching. Randomized control trials (RCT) were targeted to ensure higher quality. Moreover, the citations of excluded articles were manually scanned to search for possible
relevant and useful articles. A PRISMA flow diagram (Moher, Liberati, Tetzlaff, Altman & The PRISMA Group, 2009) was used to illustrate the process and the searching history (Table 1) to show the details of the literature search.

**Appraisal strategy:**

Scottish Intercollegiate Guideline Network (SIGN) checklist was used to appraise the studies. It is a useful tool to assess the methodological quality and the level of evidence of the studies and to ensure the internal validity of each study (Scottish Intercollegiate Guidelines Network, 2014). After the systematic and critical appraisal of the studies was performed, their levels of evidence were graded in accordance with the coding system suggested by the handbooks from SIGN. The checklists of the five chosen articles were included in the present study (Appendix 4 & 5). The details of the grading code are shown in Appendix 9.

**2.2 Results:**

Using the keywords mentioned above, we collected 51 articles through advanced searching with “and”, “or”, and “not” in PubMed and 8 articles in CINAHL Plus. Three identical articles were fund between these databases. Using the inclusion and exclusion criteria, we selected three RCT studies and two retrospective chart reviews for this dissertation. The search records are presented in Appendix 1.
Table 1: PRISMA flow diagram

Records identified through database (PubMed) searching (n=51)

Records after duplicates removed (n=56)

Records screened (n=56)

Records excluded due to irrelevant abstract and title (n=51)

Full-text articles assessed for eligibility (n=5)

Full-text articles excluded, with unmatched inclusion criteria and exclusive criteria (n=0)

Studies included in qualitative synthesis (n=5)
Table of Evidence:

The selected studies were extracted into a table of evidence (TOE), shown in Appendix 2. The TOE included the study design, setting, patient characteristics, intervention, control, outcome measurements, and effect sizes.

Overview of the studies:

Study type and setting:

The selected studies were primary studies. Three RCTs (Girard et al., 2008; Kress et al., 2000; Mehta et al., 2012), and two retrospective chart reviews (Robinson et al., 2008; Schweickert et al., 2004) were obtained. Four studies were conducted in the USA (Girard et al., 2008; Kress et al., 2000; Robinson et al., 2008; Schweickert et al., 2004) and one study was performed in Canada (Mehta et al., 2012). No local study was obtained. Two of the studies have multi-centered designs (Girard et al., 2008; Mehta et al., 2012). The remaining studies employed a single-centered design, which was carried out in their respective settings. Three studies were performed in medical ICU (Girard et al., 2008; Kress et al., 2000; Schweickert et al., 2004). One study was conducted in a surgical ICU (Robinson et al., 2008). One study was completed in a medical-surgical ICU (Mehta et al., 2012).

Patient characteristics:
Five studies included all adult patients confined in ICUs. Their median age was 50-60 years (Girard et al., 2008; Kress et al., 2000; Mehta et al., 2012; Schweickert et al., 2004). The median age of the patients included in the study of Robinson and his colleagues in 2008 was approximately 35-37 years, and 50% of the patients were female. Approximately 48% of the patients included in the study of Girard et al. in 2008 were females. Meanwhile, 50% and 54% of the patients in the studies of Kress et al. in 2000 and Schweickert et al. in 2004, respectively, were also females. Approximately 61% of the patients in the study of Mehta et al. in 2012 were females. Kress et al. (2000), Mehta et al. (2012), Schweickert et al. (2004) reported that no demographic differences are observed between intervention and control groups.

**Description of the intervention:**

Two studies focus on the comparative effectiveness between daily interruption of sedation on patients and continuous sedation with interruptions from ICU physicians (Kress et al., 2000; Schweickert et al., 2004). One study focused on the daily interruption of sedatives with spontaneous breathing trials (SBTs) and usual care with SBTs (Girard et al., 2008). One study compared protocol-based sedation therapy with daily interruption of sedation and the protocol-based sedation therapy (Mehta et al., 2012). One study examined the effectiveness of
Analgesia-Delirium-Sedation (ADS) protocol compared with the usual care (Robinson et al., 2008).

**Outcome measurements:**

All of the included studies measured the effect of the daily interruption of sedation on the duration of MV and the length of stay in ICUs and hospitals (Girard et al., 2008; Kress et al., 2000; Mehta et al., 2012; Robinson et al., 2008; Schweickert et al., 2004). Three of three studies also measured the incidence of complications, such as self extubation, self-removal of central venous catheter, and ventilator-associated pneumonia, (Kress et al., 2000; Mehta et al., 2012; Schweickert et al., 2004). One study measured seven common complications, namely, VAP, upper gastrointestinal hemorrhage, bacteremia, barotrauma, venous thromboembolism, cholestasis and sinusitis (Schweickert et al., 2004). Two studies measured the incidences of tracheostomy (Girard et al., 2008; Mehta et al., 2012). Three studies measure mortality rate (Girard et al., 2008; Kress et al., 2000; Mehta et al., 2012). Two studies measured the incidence of delirium (Girard et al., 2008; Mehta et al., 2012). The dosages of the sedations were also measured in two studies (Mehta et al., 2012; Robinson et al., 2008). Only one study determined the number of the patients who need to be undergo diagnostic tests in order to assess the changes in their mental states (Kress et al., 2000).
**Methodological quality:**

To ensure the validity and the reliability of the methodological designs, the methodological design of each study were individually assessed (Burns & Grove, 2009), and the SIGN checklists were used as an assessment tool (Scottish Intercollegiate Guidelines Network, 2014). The assessment checklists of three studies (controlled trials and cohort studies) are listed in Appendix 4 and 5. Based on SIGN checklist, the criteria of the study must be checked. The checklist was used in the selected studies. An appropriate and clearly focused question was addressed in each study. All of the studies focused on the effectiveness of the daily interruption of the sedation for the critically ill patients in ICU. The content of each study is related to the research question.

**Randomized control study:**

The evidence level of the studies of Girard et al. (2008) and Kress et al. (2000) were 1++, and the study of Mehta et al. (2012) was 1+. For the sampling recruitment and sample group assignment, a randomization method was used to minimize the bias in the affirming of treatment effects in three randomized control trials (RCT) (Girard et al., 2008; Kress et al., 2000; Mehta et al., 2012). The eligible patients in these studies were divided into either intervention or control group through computerized allocation (Girard et al., 2008; Kress et al., 2000;
Mehta et al., 2012). In the study of Girard et al. (2008), the patients were assigned into intervention or control groups using a computer-generated and permuted-block randomization scheme, that is, the subjects of the study were divided into a large number of blocks, and then simple randomization scheme was done in each block. This method can ensure the approximate balance at the end of recruitment (Chow & Liu, 2008).

For concealment method, two studies used a tri-fold piece of paper enclosed in a consecutively numbered, sealed, and opaque envelop to do the concealment (Girard et al., 2008; Kress et al., 2000). However, the remaining RCT (Mehta et al., 2012) did not comprehensively described the concealment.

Blinding in the treatment allocation in these studies was not achieved. Although the allocation of the patients to the intervention group or the control group was only known by the principle investigators, it might also cause potential bias to the nurses. In these studies, nurses in the intervention group were guided by the daily sedation interruption protocol during their daily practice, whereas nurses in the control group performed their usual sedative practices, thus the use of protocol and usual treatment, and the allocations of the patients were also known by nurses in both groups. The use of protocol may also potentially increase the awareness of control group nurses in patient monitoring, and thus possibly
changing their usual practice in sedation management, which could affect the outcomes of the studies. However, the blinding cannot be prevented because the nursing staff has to be informed beforehand which patients belonged to the intervention groups and they need to perform sedative interruption in the intervention groups by following the steps of protocol, assessing the patient, informing the physician and restarting sedative infusions with the proposed protocol.

The total number of eligible patients and that of assigned groups of each experimental group were completely documented. The characteristics of the recruited patients such as age, sex, and weight were recorded for the basic measurement in all studies, which all reported the absence of demographic differences between the subgroups of each experimental group.

In these three studies, the outcomes were measured using a standardized, reliable, and valid method. In addition, the result have been stated clearly in all the articles. The primary outcome was the time to successful extubation (the duration of MV), and the secondary outcomes were the length of stay in ICU and hospital, and the incidence of any unintentional device removal. The study of Girard et al. (2008) used the Richmond Agitation-Sedation Scale to monitor the sedation level of the patients. The study of Kress et al. (2000) used the Ramsay Sedation Scale to
measure the sedation level of the patients. The study of Mehta et al. (2012) used the Sedation Agitation Scale to measure the sedation level of the patients.

In addition, Girard et al. (2008) reported that only one patient withdrew from the intervention group in their study because of withdrawal of consent. Mehta et al. (2012) reported that seven patients withdrew because of withdrawal of consent (four patients in the intervention group and three patients in the control group). Kress et al. (2000) reported that 22 patients were excluded because either the endotracheal tube was removed or they died on the first or second day in ICU (seven patients in intervention group and 15 patients in control group). All studies (Girard et al., 2008; Kress et al., 2000; Mehta et al., 2012) each have applied the intention-to-treat analysis to generate an unbiased estimation for the assessment of the effectiveness of the experimental intervention at the level of adherence and of the variations in compliance observed during the clinical trial (Montori & Guyatt, 2001). Furthermore, only the study of Kress et al. (2000) was conducted solely in one medical ICU in Chicago, and was conducted the study in different neonate-ICU located at the southeastern part of the United States, whereas the participants of the other studies were recruited from several centers in Canada and the USA.

Although the main outcomes of the RCT in the study of Metha et al. (2012) reported results contradictory to the results of the other studies, the potential benefit
of proposed protocol from the study of Metha et al. (2012) is still recognized. In the study of Metha et al. (2012), the intervention group does not differ from the control group, because the strategy used in the control group targeted the light sedation, which is superior to “usual care”, that is, light sedation is superior to “usual care”.

**Cohort studies:**

The evidence level of the studies Schweickert et al. (2004) and Robinson et al. (2008) were level 2+. Both studies addressed an appropriate and clearly focused question and were conducted in medical ICU and in the surgical ICU, respectively. For selection bias, the characteristics of patients in the intervention groups and the control groups were similar and met the eligibility requirements, and the characteristics of the populations selected were summarized and presented in a table format, in which no significant demographic differences between the groups (Schweickert et al., 2004; Robinson et al., 2008). Moreover, the endpoints or outcomes were clearly specified and used in the analysis. For detection bias, the primary outcome measures used were clearly stated in both studies.

The advantage of these control studies was that a large amount of data can be easily accessed and can be used for comparison with the new practice (Polit & Beck, 2004). However, the design in this study is exposed to time-related confounders, such as the evolution of critical care protocols, hospital transfer
policies, and change in clinical practice, which all may affect the outcomes. Only study of Robinson et al. (2008) defined time-related confounders in the control period. However, the study indicated no changes in the ventilator or weaning protocols in this period.

The study of Schweickert et al. (2004) has notable limitations. The described complications were not prospectively defined and followed up in the original investigation. Although the database was reviewed by investigator blinded to the assignment of each patent, these investigators had never seen the database before this study and thus can have potential bias in the retrospective evaluation. In addition, this study mentioned that the relatively small sample size from this single-center investigation limits the identification of relative impact and importance of each evaluated complication. In addition, the data were analyzed with the intention-to-treat principle in the study of Robinson et al. (2008). The reason was due to death of the patient.

**Sum up:**

The methodologies of the included studies could be described as high quality, even though certain limitations should be considered in the studies and in the compliance level of the nursing staff with the proposed sedation protocols, which was not examined in all RCTs and retrospective cohort studies, and the level of
compliance of the nursing staff related to achievement of the desirable clinical outcomes was difficult to determine. Therefore, the results in the selected studies could be directly used as a basis for further development of a sedation protocol in a local ICU setting and for our dissertation.

2.3 Summary and synthesis:

Data Summary:

All of the studies aimed to compare the use of daily interruption sedation protocol with routine sedation management (Girard et al., 2008; Kress et al., 2000; Mehta et al., 2012; Robinson et al., 2008; Schweickert et al., 2004).

Duration of MV:

The primary outcomes of these studies were the duration of the MV. Four studies reported that the duration of the MV is shorter in the intervention group (Girard et al., 2008; Kress et al., 2000; Robinson et al., 2008; Schweickert et al., 2004). The protocol group had 2.4 less ventilator days compared with the control group (P=0.004) in the study (Kress et al., 2000). In the study of Girard et al. (2008), the protocol group had 3.1 more ventilator-free days than the control group (P=0.02). In the study of Schweickert et al. (2004), the protocol group had 2.5 days less ventilator-free days compared with the control group (P=0.003). In the study of Robinson et al. (2008), decrease in the median duration of MV (2 days, P=0.027)
was observed. Mehta et al. (2012), reported the days to successful extubation between the intervention and the control groups were 7 days (P=0.52).

**ICU and hospital length of stay:**

The study of Girard and his colleagues in 2008 reported that the proposed protocol could decrease both the length of stay in the ICU and the length of stay in the hospital. The median ICU days of the protocol group was 3.8 days lesser than the control group and median hospital length of stay of the protocol group was 4.3 days lesser than the control group (P=0.01 and P=0.04). Two studies showed that ICU length of stay decreased in the proposed protocol (Kress et al., 2000 & Schweickert et al., 2004), and is 3.5 days lesser (P=0.02) in Kress et al. study in 2000, and 2.5 days lesser (P=0.003) in Schweickert et al. study in 2004 in the protocol group than the ICU length of stay in their control groups. In the study of Robinson (2008), although the reduction in the ICU length of stay was not shown, hospital length of stay was reported to have reduced by 6 days (P=0.036).

**Incidence of complications:**

In the study of Schweickert et al. (2004), the incidences of complications, such as VAP, bacteremia, and venous thromboembolism, were greatly reduced in the intervention group than in the control group. Thirteen different kinds of complications were found in the intervention group, whereas twenty-six different
kind of complications were found in the control group. No complications of cholestasis, sinusitis, and barotrauma were found in the intervention group.

The patients also have less days of coma in the intervention group when compared with the control group (2 vs 3, P=0.002), indicating that the patients could have more days to respond to verbal or physical stimulation or respond with movement and eye opening in the intervention group (Girard et al., 2008).

In the study of Kress et al. (2000), 9% of the patients in the intervention group had changes in their mental states, whereas nearly 27% of patients in the non-protocol group underwent diagnostic testing to assess changes in their mental states (P=0.02).

Both studies of Girard et al. (2008) and Mehta et al. (2012) reported that few patients in the intervention group underwent tracheostomy (7% & 3.1% lesser, P=0.06 & P=0.46), indicating that the durations of MV were reduced, and more cases could be extubated without undergoing tracheostomy.

**Usage of sedative infusion:**

Sedation usage was reduced (Robinson et al., 2008). Opiate usage with 824 mg was lesser (P<0.001) in the protocol group, and propofol infusion used was 9,175 mg more (P=0.01) in the control group. Both opiate and propofol were administered in lesser amounts to the patients in the protocol group, facilitating the patient to be more awake and also reducing the duration of MV and the incidences
of the complications.

**Data synthesis:**

The integrated results of the selected articles provide the evidence that the use of sedation protocol, i.e. daily interruption of sedation, facilitates the reduction in the duration of MV in critically ill patients confined in ICUs, in the length of stay in both the ICU and the hospital, and in the incidences of the complications. Apart from the positive outcomes of the proposed intervention, the study of Mehta et al. (2012) showed that the daily interruption of sedation did not increase the incidences of unintentional device removal by patients when they wake up. Removal of the gastric tube is 5.4% lesser in patients in the intervention group (P=0.08) and removal of the urinary catheter is 3.4% lesser in patients in the intervention group (P=0.09). Furthermore, the patients in the intervention group had lesser chances of being re-intubated within 48 h after extubation (2.1% lesser, P=0.39). This finding indicated that few complications occur during MV and patients have more days to undergo a successful extubation.

The reviewed studies showed that a valid agitation assessment scale is significant as it provided a reference for nursing staff to measure the sedation and agitation level, which can assist nurses to decide whether to proceed or to end the protocol according to the clinical conditions of the patients. Thus, the validity of
the scales must be taken into consideration. However, the studies did not identify which scale is the most effective in the sedation-agitation assessment of the patients. One study used Ramsay Sedation Scale (Kress et al., 2000), and two studies used Richmond Agitation-Sedation Scale (RASS) (Girard et al., 2008; Robinson et al., 2008). Another one used Sedation-Agitation Scale (SAS) (Metha et al., 2012). All these studies did not report the validity of the used scales. Ramsay Sedation Scale and SAS had been validated and recommended for use in other previous studies (Riker et al., 1999; Devlin et al., 1999; Hansen-Flaschen et al., 1994). Although Ramsay Scale and SAS have been proven to be valid and reliable, the effect size of the studies that used the SAS assessment (Appendix 10) is more statistically significant in MV weaning than those of the studies that used the Ramsay Scale (Jacobi et al., 2002).

The overall use of sedation was reduced by using daily interruption of sedation protocol, as the nurses needed to withhold the sedation infusion until the patient became awake, and then they will closely monitor the patients’ sedation-agitation level and may resumed the sedation according to their clinical condition.

The application of proposed sedation protocol could achieve the target clinical outcomes. The characteristics of the eligible patients and the ICU settings of the
above studies are similar to the local setting, thus the results from these studies provide significant evidence and could be synthesized, generalized, developed, and translated into evidence based practice for the critically ill patients under MV in the local ICU setting, which could be a standardized and structural approach in the weaning process of the MV.
Chapter 3: implementation potential and clinical guideline

The current studies systematically reviewed in Chapter 2 showed that the application of a sedation protocol in ICUs can reduce the duration of MV for ICU patients, and this observation is supported by evidence. This evidence-based practice guideline could be transferred to local ICUs. Three areas, namely, transferability, feasibility, and cost-benefit ratio, should be evaluated to assess the implementation potential (Polit & Beck, 2010).

3.1 Transferability of Research Findings:

Population

In most cases, the local ICU clients are critically ill patients under MV. Based from the local unpublished data from January 1, 2015 to December 31, 2015, 1,132 patients were admitted to ICU, and 1007 patients were under MV, and their Acute Physiology and Chronic Health Evaluation II (APACHE II) score ranged from 20-30, which is used to calculate the severity of the illness. In the integrated review, the study participants were also ICU patients with MV, and their APACHE II score was within the same range.

Demographic characteristics:

The study participants were patients eighteen years old or older, which matches with the admission criteria of the target ICU. All studies were carried out
on Western Caucasians. Meanwhile, our study targets were Chinese individuals. Nevertheless, the research findings from the integrative studies can be translated into a local setting, which is the main goal of the translational nursing research.

**Setting:**

The target ICU setting is similar to that in the integrated studies. Three studies were performed in medical ICU (Girard et al., 2008; Kress et al., 2000; Schweickert et al., 2004). One study was conducted in a surgical ICU (Robinson et al., 2008). One study was conducted in a mixed medical-surgical ICU (Mehta et al., 2012). Therefore, the settings of these studies are comparable with the proposed ICU because the innovation will be implemented in a mixed medical-surgical ICU.

**Philosophy of Care:**

The definition of philosophy of care varies among department and settings. The philosophy of care in the integrated studies states that the mechanical ventilator must be weaned off as soon as possible with appropriate sedative drugs and that complications related to the usage of mechanical ventilator and sedative medications must be prevented.

In addition, the code of ethics of the Nursing council of Hong Kong has suggested that a professional nurse must provide high-quality care to patients (Nursing council of Hong Kong, 2015). The implementation of an evidence-based
practice has been encouraged and promoted by hospital authority in the local healthcare system to further enhance the standard nursing care. Because the philosophy of care for the local setting is in line with the suggested innovation, evidence-based practice can be established and implemented.

**Benefits to the target patients:**

Approximately 2000 critically ill patients with MV are admitted into target ICU annually, and all these will be benefited from this evidence-based practice if implemented.

**Duration of implementation and evaluation:**

The time frames of the integrated studies with regard to their implementation and evaluation vary. The innovation proposed that evidence-based practice is implemented as a pilot program in one local ICU, as elaborated in Appendix 11. The Department of Operation (DOM) and the ward manager approved the 11-month implementation of the innovation, during which the initial two months will be used for introduction, guideline promotion, staff training, and material preparation. The pilot program will be then carried out in the clinical area for data collection. The evaluation stage and the feedback process will be conducted for approximately two months after the start of the innovation. The demographic data, setting, the philosophy of care, duration of implementation, and evaluation of the
target ICU are similar to the parameters used in the reviewed studies. These findings suggest that the innovation can applied to the local ICU setting.

3.2 Feasibility:

In the implementation of a new evidence-based practice, the following aspects must be considered to assess its feasibility.

Organization climate:

The progress of an evidence-based practice requires the support from the hospital management. In the target ICU, a research committee was formed to establish a conducive research atmosphere. The committee members comprise the nursing consultant (NC), advanced practice nurses (APN), and the senior nursing staff. They will share and post updated information on current clinical practice on the notice board to update the staff on new nursing research topics.

Moreover, research studies, clinical guidelines, and electronic journals are available in the e-Knowledge Gateway (eKG) database, which can be easily accessed through the Hospital Authority intranet. The nursing staff can develop their own research by using these resources.

Professional autonomy:

Nursing staff autonomy is essential for the successful implementation of the new protocol. In ICUs, the nursing staff provides 24-hour care to the critically ill
patients. Apart from the basic nursing care, ICU nurses are authorized to titrate the sedative medications within the target range prescribed by physicians, which is based on the clinical condition of the patients. Therefore, ICU nurses can implement the new protocol in the target ICU.

**Consensus:**

Agreement between the nursing staff, medical colleagues, and the Department of Pharmacy is essential for the proposed guidelines, which involve the use of sedative drugs and administration of dangerous drugs, such as morphine and midazolam. The nursing staff performs the clinical assessment and sedation, which is first checked by the pharmacy personnel to ensure that the appropriate sedation dosage is used. The Department of Pharmacy supply the medicines to all hospital units, so before the special types of sedative medications can be used, a recommendation from the pharmacy must be obtained to prevent any error in the administration of the sedative medications.

**Interruption of routine staff functions:**

In the assessment of the consciousness of the patients, sedation level must be included in the ICU routine. However, standardized assessment protocol is not available in the designated ICU, and the nurses have been used to depend on their own experiences and knowledge when they evaluate the clinical conditions of the
patients and when they use a certain sedation dosage. This sedation protocol can thus provide a standard guide for the frontline nurses for the assessment of the sedation level to reduce their workloads.

In this protocol, each assessment only requires four minutes, and when the nurses become familiar with the assessment through practice, they can perform the assessment in shorter periods.

Conflict with frontline staff:

Some staff members may be reluctant to the new protocol because they probably do not want any change or they experience difficulties in learning new knowledge in addition to the workload issue. The research committee will thus assist the staff members to overcome any difficulty or problem during the implementation stage. To respect the rights and the freedom of the staff members, they are encouraged to express their consent and feedback. The advantages and benefits of the new protocol will be then explained to them. Particularly, they will be told that the protocol will not increase their workloads because it provides an efficient method for assessing the agitation of the patients. With the definitive positive outcome and the support to the frontline staff to gain their cooperation, the implementation of the new protocol can proceed without complications.
**Skill needed:**

The new protocol includes three stages: the preparation stage, the implementation stage, and the evaluation stage. The implementation stage mainly involves the nurses, so they must be well trained and equipped with the skills and knowledge of the protocol before the start of the implementation of the new protocol. Training of the nursing staff is essential, which can be divided into theoretical and practical sessions by the research committee. The theoretical session includes the introduction, discussion on the importance, and the actual procedures in the guidelines. The practice session includes the demonstration, the details about the real innovation, and case demonstration. Teaching materials and handouts will be given to the staff, and a demonstration video will be provided and recommended to be saved in the ward computer so that the staff members can review the procedures and the guidelines. The ward staff can also consult the APN, WM in the ICU.

For the evaluation stage, the satisfaction survey (Appendix 12) will be given to the staff for feedback. The outcome evaluation includes the evaluation of the outcomes of the new protocol, particularly the duration of MV and the length of stay in ICU, and the occurrence of any complication, which can be detected by case physicians or medical officers.
**Administration support:**

Three clerks and two ward assistants work in the target ICU. The clerks prepare training materials, photocopy notes and questionnaires, and collect and manage assessment forms (Appendix 13). The ward assistants assist in the training workshops. For example, they can help nurse consultants by searching for training venues and setting up computers in conference rooms.

**Accessibility and Availability of Equipment and Facilities:**

No additional equipment is required because the new protocol only involves the weaning of mechanical ventilators and the usage of sedative medications.

**Availability of Evaluation Tools:**

The designated ICU uses the Clinical Information System (CIS) to record the duration of mechanical ventilator used, the total amount and the dosage of sedation used, and the day of extubation in each patient. Nonetheless, new evaluation tools, such as questionnaire (Appendix 12), are still necessary to collect the feedback of the staff after the implementation of the new protocol.

After review the above issues, we found that the new protocol will not interfere the staff routine and will not increase the workload of the frontline staff. After the introduction and the training of the staff, they can provide patient care and can titrate the sedative medications under the supervision of the committee.
members. The new protocol can be implemented in the local setting in the designated ICU.

3.3 Cost-Benefit Ratio:

Potential Risk of innovation:

Nurses require training prior to implementing the new protocol, sufficient time to apply the new assessment and treatment methods, and adequate competence level. In the initial time of implementation, they may experience uncertainties on the assessment and treatment plans, which may delay the delivery of treatments or may affect the sedation of patients. As a consequence, patients may be undersedated or oversedated. Undersedation causes adverse physiological responses, such as agitation and restlessness, which can trigger ventilator desynchronization and unintentional removal of lifesaving devices and catheters (Devlin, Fraser, Kanji, & Riker, 2001; Fraser, et al., 2000). Conversely, oversedation can lengthen the duration of ventilator use and cause difficulties in weaning; as a result, patients may suffer from various complications (Devlin, Fraser, Kanji, & Riker, 2001; Fraser, et al., 2000). Physicians can also experience uncertainties in the evaluation of patients’ mental status and therefore prompt them to order neurological diagnostic studies, which may be costly. With the help of clinical supervisors, this problem can be addressed.
**Potential benefit:**

The potential benefits of the new protocol are shorter MV use, reduced sedative medications, and reduced incidence of complications. The medical demands and expenses can also decrease. The standardized protocol provides a systematic approach in the delivery of the treatment, which reduces the differences in treatment plans among different colleagues. Therefore, it can facilitate the improvement of the quality of care.

**Detail of cost calculation:**

**Cost:**

The innovation is planned to be implemented for 11 months. Manpower and material costs related are discussed in the following sections:

**Medical equipment cost:**

Medical equipment, such as ventilators, syringe, syringe pumps, and cables are already available in the target ICU, thus no extra expense are expected.

**Manpower cost:**

The assessment of the patient and the adjustment of the sedative infusion are performed by the nurses in the ICU. The assessment requires nearly one minute for the evaluation of the SAS, and requires two minutes for the titration of the sedatives and analgesic medications. The patient assessment is conducted
seven times per day. Therefore, nursing staff will use 21 minutes daily and about 5,040 minutes for eight months (two months of pilot and six months of full implementation). By considering the basic salary of the staff members in the target ICU, which is point 19, the monthly cost with regard to manpower is approximately $1,940.4. In an eight-month implementation, the total cost for the manpower was estimated to be $15,523.2 (Appendix 6).

Training cost: the nursing staff will be officially sent to the training workshops, in which the theoretical and practical sessions each will be conducted for 30 minutes. A one-hour training session for each nurse costs $184.8. During the workshop, copies of the handouts which cost around two dollars each will be given to each staff. A total of 90 nurses are employed in the target ICU, so the total cost of the handouts is $180. Moreover, a copy of the protocol will be provided in each ICU bed, so another $48 will be spent. Therefore, the total cost of the eight-month sedation protocol will be $15,935.8 and are summarized in Appendix 7.

Benefit to patients: The target ICU has 24 beds, and according to the unpublished data in 2015, 1,007 patients (88% of the total admission) required MV. Nearly more than 90% of the MV patients used sedation. Thus, 906 ICU patients will benefit from the new protocol.
Benefit of the implementation of the innovation: in the target ICU, each bed costs HK $13,900. As previously mentioned, around 906 patients could benefit after the implementation of the innovation. According to the integrated studies, the duration of MV can be reduced by 2 to 3.1 days (Girard et al., 2008, Kress et al., 2000, Robinson et al., 2008, Schweickert et al., 2004). We can assume that if the duration of MV use is reduced for two days, the total cost of hospitalization will be $25,186,800.

Cost-benefit Ratio for the new protocol: The cost of implementation of the new protocol is calculated over its benefits. The cost-benefit ratio is 0.0006327. A value less than 1 indicates cost effectiveness, thus the daily interruption of sedation protocol for MV weaning is considered to be cost effective. (The details are shown in Table 2)

<table>
<thead>
<tr>
<th>Cost of implementation of the protocol</th>
<th>$15,935.8</th>
</tr>
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<tbody>
<tr>
<td>Cost of without implementation of protocol</td>
<td>$25186,800</td>
</tr>
<tr>
<td>Cost-benefit ratio</td>
<td>15,935.8/25186,800 = 0.0006327 (&lt;1)</td>
</tr>
</tbody>
</table>

Table 2: detail of cost-benefit ratio
3.4 Evidence-Based Practice Guideline:

The evidence-based guideline was developed based on the analysis and summaries from the systematic review discussed in chapter 2 (Appendix 8). Furthermore, the SIGN checklists were used to assess the levels of evidence and grades of recommendations of the new protocol (Scottish Intercollegiate Guidelines Network, 2012) (Appendix 9). In the integrated studies, one study had a grade of 1++ (Girard et al., 2008), and two studies each had a grade of 1+ (Kress et al., 2000; Mehta et al., 2012), and two studies each had a grade of 2+ (Robinson et al., 2008; Schweickert et al., 2004). The flow of daily sedation interruption protocol is shown in Appendix 16.
Chapter 4: Implementation Plan:

4.1 Communication plan:

The stakeholders must be identified because they can affect the implementation of the protocol (Pilot & Beck, 2010). For the daily sedation interruption protocol, the stakeholders in the ICUs can be categorized into three levels: the administrators, the managing staff, and the frontline staff.

For the administrators, they are the chief of service (COS), department operative manager (DOM), and nurse consultant (NC). Any new implemented protocol requires their permission because they have the authority to terminate new protocols considered to be unfeasible.

The manager level staff includes ward manager (WM), nursing specialists (NSs) and advanced practice nurses (APN). They are responsible for resources planning such as staff assignments. In addition, their seniority can facilitate the initiation of the pilot study and clinical supervision.

The operational staff includes all registered nurses and medical officers. The nurses incorporate the protocol into daily clinical practices, monitor the progress of the patients, and document their conditions. On the other hand, the protocol can affect the sedation and the conscious levels of the patients, which also involve the
assessment of the doctor. Thus, the ICU physicians will also be considered in the implementation of the protocol.

The person in charge of the Pharmacy Department is also considered a stakeholder because he or she supplies the sedation medications. The person in charge of the Pharmacy Department monitors the usage of sedation to prevent excess or shortage. The Pharmacy Department can act as the gatekeeper to prevent wrong prescriptions and dilution protocol. The flow of communication with the stakeholders is shown in Appendix 14.

**Communication process with stakeholders:**

A good communication plan between different stakeholders is necessary to effectively implement the guideline.

**Initial the change:**

Approval must be obtained from the administrators in Phase 1. This requires one week because both the COS and the DOM are the highest authorities among the doctors and nurses in the ICU department. They have the authority to allow changes in the clinical practice within the department. The cooperation between the physicians and the nurses is essential for the successful change in practice. Moreover, they can approve the financial support for the new protocol.
The patients with oversedated conditions and the positive outcomes of the new practice will be discussed to the COS and DOM. After the approval of the administrator is obtained, another one week will be used for the formal meeting with the managing staff. Apart from the importance of using sedation protocol for the MV patients, we will discuss and analyze the resources needed, manpower, and estimated expenses during the formal meeting.

After the agreement has been established with the managerial level staff, the project will proceed to Phase 3. The NC will be invited to be the project director. Three APNs and five RNs will be assigned by the NC to a working committee. A seminar will be held to introduce the background and the significance of the new guideline. After the seminar, two formal meetings will be held by the NC for project planning, including equipment and resources preparation and staff training prior to the pilot study. The meetings may require two weeks.

In Phase 4 (5-6 weeks), the working group members commence the staff training and guideline promotion. The new innovation will be disseminated to the remaining stakeholders via email through the hospital authority intranet (HA webmail), to present the general picture of the new guideline protocol before the training workshops.
**Guiding the change:**

All the frontline nurses will have official release (30 minutes) to attend the training workshop to learn the proper technique on the patient agitation assessment using SAS. The workshop will include powerpoint presentations and video demonstration. Handouts will also be given to the nurses and will be uploaded to the ICU web site for them to revise. The working group members will also serve as guides and trainer to provide assistance during the implementation period especially at the beginning of the project. This can have a positive influence on other frontline staff.

Furthermore, they are encouraged to provide feedback or ask for assistance in case of any problems, which will be recorded and then reviewed in bi-weekly meetings. Any update or improvement in the sedation protocol will be posted on the staff notice board and will be sent via webmail to notify the operational staff.

**Sustain the change:**

Ward culture and individual behavior of the frontline staff are the most difficult to control. For the ward culture, DOM, NC, WM, and APN will be the guides during the implementation of the protocol. Their seniority and authority could persuade the frontline staff to adopt the guideline. Moreover, prompt
assistance and a clear and concise clinical guideline are crucial when the frontline staff needs assistance.

In phase 5, a pilot study (2 months) will be conducted in the ward, in which the working group is responsible for the progress monitoring. They are also responsible in the evaluation (Phase 6) of the pilot study after its conclusion. The plan of the refined protocol and the evaluation report will be presented to administrator.

The implementation of the refined protocol (Phase 7) require around six months. The final evaluation (Phase 8) will require one month and the subsequent report will be submitted and presented to the administrator.

**4.2 Pilot Study Plan:**

**Objective:**

The pilot study must be conducted to explore any weakness and limitation before the implementation. The pilot evaluation could also be used to examine the adequacy of the training workshops, the feasibility of the project, and the evaluation plan to refine the clinical guideline based on the pilot result. The pilot study will be conducted in the designated ICU.
**Target population and recruitment:**

The targets of the study are the critically ill patients who are eighteen years old or older and require MV for more than 24 hours in the local ICU setting. A number of 80 ICU patients with MV is an affordable sample size in the pilot study. These patients will be recruited through convenience-sampling method.

**Time frame:**

The pilot study will be initiated in Phase 5, which will be conducted for two months. According to the annual admission rate of MV patients from the local ICU (1007 per year), collection of preset sample size will require one month and the preparation of the evaluation report of the project team will require two weeks. The report will be presented to the administrator and will be used to refine the clinical guideline.

**Outcome measurement & Data collection:**

After the training workshops (Phase 4), a nurse satisfaction survey (Appendix 12) will be given to each participant to collect his or her opinion on the sedation protocol.

During the pilot study, APN of the committee group will be informed when an eligible case satisfied our inclusive criteria. They will then perform an on-site
assessment to ensure the competency and compliance of the frontline staff. Their skills in the patient agitation assessment will be evaluated using the designed form (Appendix 15). Any issue will be recorded for further modification of the protocol.

After the sedation of a patient is interrupted in the morning shift, the nurse in charge will assess the wakefulness of the patient hourly using the SAS until the patient becomes awake, the patient can perform at least three of the following on request: eye opening, tracking, hand squeezing, and toe moving. The sedation infusions can be restarted with half of the previous rates or titrated based if necessary in case the patient is agitated. The scale scores and the sedation titration records will be documented in the ICU Clinical Information System (CIS). The number days of extubation will be recorded. In case the sedation interruption cannot be performed, the reason for the failure must be documented. All gathered data will be used for analysis, so that the evaluation of the pilot study can be used to improve the plan of the actual implementation.

**Result analysis and evaluation:**

The evaluation session will require two weeks, during which the working group will collect and encode the collected data. Apart from the study result, any limitations or weakness identified during sampling, the application of the guideline,
and data collection will be discussed in the regular formal meetings arranged by the NC. The working group members could express their opinions and can state the problems they encountered in the formal meetings. The NC will be responsible for data analysis and for the refinement of the clinical protocol. All the records of the meeting, problems encountered, and refined protocol will be documented into written word files and will be presented to the department administrator for their final approval.

4.3 Evaluation Plan:

The evaluation plan aims to assess the effectiveness of the proposed protocol. The outcomes can be divided into three domains, namely, patients, nurses, and organizational outcomes.

Patient outcome:

The innovation aims to facilitate the weaning of the MV of critically ill patients in ICUs; therefore, MV duration can be considered as the primary outcome. The length of stay (LOS) in ICUs, which is highly correlated with the duration of MV, can be regarded as the secondary outcome. In early weaning of MV, the risk of complications, such as VAP, will decrease and the LOS in ICU will also be reduced. Another outcome will be the incidence of the self extubation. It is an indicator of an
adverse effect of the new innovation, which can reflect the competencies of the frontline nurses in the titration of the sedation. Thus, the preventive strategies can be developed based on the monitoring of this adverse event.

**Nursing staff outcomes:**

For the nurses, the training workshops will be provided. The success of the training workshop and the adequacy of staff training can be evaluated through the level of perception and satisfaction of nurses. The staff compliance rate and competence can also be used to assess the outcome. The perception that the protocol is easy to implement can increase their acceptance of the new protocol and facilitate the new culture of daily sedation interruption for the MV patients in ICU. Therefore, the level of easiness of the adopted protocol is highly correlated to the staff compliance rate.

**Organizational outcome:**

For the organizational aspect, the balance between the financial cost and the benefit (quality of care) of the new practice is the main outcome. Considering the budget cut implemented by the hospital authority and the rising health care expenditures, and the high expectation of the public on health care services, the protocol of early sedation interruption can reduce the duration of MV, the incidence
of complications, and the LOS in ICU, which can reduce the cost in healthcare and also promote the quality of care in the patients.

**Nature and sample size of the target subjects:**

**Patient’s nature:**

All target patients must be 18 years old or older and must be newly admitted to the ICU with mechanical ventilator for more than 12 hours. These are the same criteria as those mentioned in the selected eligible studies. These criteria were selected to maintain the consistency of the study and to examine the effectiveness and feasibility of the proposed protocol. Apart from pregnant patients and those who have any neurological issue or history of cardiac arrest, no specific demographic parameter will be used in the selection of subjects for the project.

**Sample size plan:**

Convenience sampling will be used for patient recruitment in this study, and our project members will follow up the selected patients until they are discharged from the ICU. The sample size is calculated by using G power version 3.1 statistical program. As reported by the eligible studies, 2 days to 3.1 days were reduced in the duration of MV after the proposed protocol is implemented (Girard et al., 2008; Kress et al., 2000; Schweickert et al., 2004; Robinson et al., 2008). The effect size
from these studies ranges from 25% to 62.5%, with a median effect size of 44%.

From the local unpublished database, the mean duration of MV is 10.6 days. Considering 80% power and 5% significance level, we should obtain 130 samples to achieve a difference of 4.6 days in MV duration. With the 20% possible attrition rate, the actual sample size should be approximately 156. The previous department data showed that the annual admission rate of MV patients is 1007. Therefore, six-month is reasonable for the actual implementation.

**Timing and frequency of the evaluation:**

Before the implementation of the protocol, training workshops will be provided to the frontline staff to enhance their knowledge. They will be then asked to complete the satisfactory questionnaire (Appendix 12) to examine their level of perception and to obtain their suggestions.

During the actual implementation, the project member will monitor the compliance rate of the frontline staff in each shift. Furthermore, their competence on the assessment of the patient sedation level and on the titration of sedations will also be evaluated by the project team.

Regarding the patients, the agitation level of the recruited patients will be assessed using SAS (Appendix 10) and routinely by the case in-charge. The
sedation titration rate and the start time and the stop time of the sedation interruption will also be recorded. The primary (the duration of MV) and secondary outcome (the ICU length of stay & the incidence of self-extubation) will be recorded in the CIS. All these data will be collected and analyzed during the evaluation period for one month.

With regard to the department, the balance between the costs and the benefits of the proposed protocol will be evaluated after the end of the study. All the material costs and the invoice of the nonmaterial costs will be collected and calculated by the project team members.

**Data analysis:**

For the collected data, the demographic data of the recruited patients will be described through descriptive statistics and will be represented as percentages values (mean ± standard deviation). Chi-square tests will be used for the comparison of the categorical variables between the control and experiment groups.

For continuous variables, an independent simple t-test will be used, which will be two-tailed and will be considered as statistically significant at \( p \leq 0.05 \). The confidence interval (CI) is 95%.

For qualitative data including the expense of materials, opinions, feedback
and comments received from the administrators or from frontline staff will be present in written format in the evaluation report.

4.3 Basis of the Effectiveness of the Protocol:

The proposed protocol can be regarded as effective when the identified outcomes meet these criteria. For outcomes from the patients, the duration of MV and the incidence of self extubation must be reduced after the protocol implementation. For the ICU nurses, over 80% of the frontline nurses must express satisfaction on the new guideline. Moreover, the compliance rate of frontline staff must reach over 90%. To the ICU department, the length of ICU stay must decrease after guideline implementation and the total cost of the guideline implementation must be within our estimated budget.
**Conclusion:**

The proposed protocol involving daily sedation interruption is practical and cost effective. This protocol can be implemented to reduce MV duration and can be readily performed by nurses in ICUs. However, thorough and careful implementation and evaluation plans must be developed before the proposed protocol is completely implemented to determine its weaknesses and to evaluate its feasibility. Thus, the proposed protocol can be efficiently implemented.
Reference:


Mehta, S., Burry, L., Cook, D., Fergusson, D., Steinberg, M., Granton, J., Meade,


Riker, R.R., Picard, J.T., & Fraser, G.L. (1999). Prospective evaluation of the
Sedation-Agitation Scale for adult critically ill patients. Critical Care Medicine, 27, 1325–1329


Tembo, A. C., Higgins, I., & Parker, V. (2014). The Experience of Communication Difficulties in Critically Ill Patients in and Beyond Intensive Care: Findings
from a Larger Phenomenological Study. Intensive Critical Care Nursing. doi:

10.1016/j.iccn.2014.10.004

Weinert, C. R., & Calvin, A. D. (2007). Epidemiology of sedation and sedation adequacy for mechanically ventilated patients in a medical and surgical intensive care unit. Critical Care Medicine, 35(2), 393-401. doi:

10.1097/01.ccm.0000254339.18639.1d
### Appendix 1: Database Searching

<table>
<thead>
<tr>
<th>MeSH term</th>
<th>PubMed</th>
<th>CINAHL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Mechanically ventilator</td>
<td>6506</td>
<td>831</td>
</tr>
<tr>
<td>2. Daily sedation interruption/Daily interruption of sedatives</td>
<td>145</td>
<td>11</td>
</tr>
<tr>
<td>3. Critically ill</td>
<td>53566</td>
<td>2149</td>
</tr>
<tr>
<td>Combined 1,2,3</td>
<td>51</td>
<td>8</td>
</tr>
<tr>
<td>Duplicated articles</td>
<td>0</td>
<td>3*</td>
</tr>
</tbody>
</table>

* Articles were duplicated with searched articles in PubMed database.
## Appendix 2: Table of Evidence

<table>
<thead>
<tr>
<th>Bibliographic citation/ Design</th>
<th>Sample characteristics</th>
<th>Level of evidence</th>
<th>Intervention</th>
<th>Comparison</th>
<th>Outcome measures</th>
<th>Effect size (IG vs CG)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Girard et al (2008)/ RCT/ USA</td>
<td>Medical ICU All mechanically-ventilated patients receiving continuous infusion of sedatives 12 hours after ICU admission Age(years): 60 vs 64 Sex: female: 77(46%) vs 83(49%)</td>
<td>1++</td>
<td>daily interruption of sedatives with spontaneous breathing trials (SBTs) (n=167)</td>
<td>Sedation per usual care + daily spontaneous breathing (SBTs) trials (n=168)</td>
<td>(1) Primary outcome: time breathing without MV (Days) (2) Secondary outcomes: (a) ICU LOS (Days) (b) hospital LOS (Days) (c) self-extubation (no) (d) 1 year mortality rate (e) duration of brain dysfunction (f) coma (days) (g) delirium (days) (h) tracheostomy</td>
<td>(1) 14.7 vs 11.6 (P=0.02) (2a) median 9.1 vs 12.9 (P=0.01) (2b) 14.9 vs 19.2 (P=0.04) (2c) 16 vs 6 (P=0.03) (2d) 74 (44%) vs 97 (58%) (P=0.01) (2e) 2 vs 3 (P=0.002) (2f) 2 vs 2 (P=0.5) (2g) 16 (10%) vs 6 (4%) (2h) 21 (13%) vs 34 (20%) (P=0.06)</td>
</tr>
<tr>
<td>Kress et al (2000)/ RCT/ Chicago</td>
<td>Medical intensive care unit All mechanically-ventilated patients receiving continuous infusion of sedatives 48 hours after ICU admission</td>
<td>1+</td>
<td>daily interruption of infusion of sedatives (n=68)</td>
<td>Continuous infusion of sedatives with interruption only at the discretion of the intensive care unit team (n=60)</td>
<td>Primary outcome: (1) duration of MV(Days) Secondary outcomes: (2) (a) ICU LOS (median, Days) (b) hospital LOS (median, Days):</td>
<td>(1) 4.9 vs 7.3 (P=0.004) (2) (a) Median: 6.4 vs 9.9 (P=0.02) (b) Median: 13.3 vs 16.9 (P=0.19)</td>
</tr>
</tbody>
</table>
| Mehta et al (2012) / RCT/Canada | 1+ | Protocolized sedation and Daily interruption of continuous benzodiazepine and opioid infusion (n=214) | Protocolized sedation (n=209) | Primary outcome:  
(A) Days to successful extubation, median (days)  
Secondary outcome:  
(1) ICU mortality (%)  
(2) Hospital mortality (%)  
(3) ICU LOS (days), median  
(4) Hospital LOS (days)  
(5) Incidence of delirium (%)  
(6) unintentional device removal, number, %  
(a) Gastric tube  
(b) Endotracheal tube | (A) 7 vs 7 (P=0.52)  
(hazard Ratio: 1.08  
(1) 50 (23.4%) vs 52 (24.9%)  
(P=0.72)  
(2) 63 (29.6%) vs 63 (30.1%)  
(P=0.89)  
(3) 10 vs 10 (P=0.36)  
mean difference: -3.17  
(4) 20 vs 20 (P=0.42)  
mean difference: -8.2  
(5) 113 (53.3%) vs 113 (54.1%)  
(P=0.83)  
(6a) 18(8.5%) vs 29(13.9%)  
(P=0.08)  
(6b) 10 (4.7%) vs 12 (5.8%) | (c) no of patients underwent diagnostic testing to assess changes in mental status (%)  
(d) Complications such as self extubation, removal of CVC (%)  
(e) total dose of midazolam (mg)  
(f) total dose of morphine (mg)  
(g) Mortality rate (%)  
(c) 9 vs 27 (P=0.02)  
(d) 4 vs 7 (P=0.88)  
(e) 229.8 vs 425.5 (P=0.05)  
(f) 205 vs 481 (P=0.009)  
(g) 36 vs 46.7 (P=0.25) |
| Age (median): I vs C: 57 vs 61  
Sex (no) male vs female: I: 34 vs 34  
C: 26 vs 34 |  
(c) | | | |

- Critically ill adults required mechanical ventilation and were expected to need mechanical ventilation at least 48 hours after enrollment in ICU  
- Median age = 57 (46-70) vs 60 (49-70)  
- Female: 93 (43.5%) vs 92 (44%)
<p>| Schwieckert et al (2004)/ Blinded retrospective | -medical ICU - patient with mechanical ventilation and continuous infusion of (n=66) | 2+ | Daily interruption of sedative infusion (n=66) | Sedation as directed by the ICU doctor (n=60) | Primary outcome: (a) Mortality rate (%) (b) duration of MV(days) (c) ICU LOS (days) | (a) 36.3 vs 46.7 (P=0.16) (b) 4.8 (2.4-8.0) vs 7.3 (3.4-16.1) (P=0.003) (c) 6.2 (3.9-11.3) vs 9.9 (4.7-17.9) | (c) urinary catheter (d) central venous or artery catheter (7) Reintubation within 48 hours, numbers (%) (8) Tracheostomy rates (%) (9) clinical workload of (a)nurses (b)respiratory therapist (Visual analog scale VAS), mean (10) use of sedation (a) mean daily dose (mg/d) and number of boluses per day of benzodiazepine (b) daily opioid doses(ug/d), number of boluses per day of fentanyl (P=0.64) (6c) 6 (2.8%) vs 12 (6.2%) (P=0.09) (6d) 17 (8%) vs 10 (4.8%) (P=0.18) (7) 12 (5.6%) vs 16 (7.7%) (P=0.39) (8) 49 (23.2%) vs 54 (26.3%) (P=0.46)(9a) 4.22 vs 3.8, 95% CI, mean difference:0.41 (P=0.001) (9b) 3.69 vs 3.61, mean difference: 0.08 (P=0.57) (10a): 102 vs 82mg/d, Mean: 8 (IQR:0-86) vs 0 (IQR:0-50) Mean difference: 19.23 (P=0.04), Mean: 0.253 vs 0.177, Mean difference: 0.077 (0.020 to 0.134) (P=0.007) (10b): 1780 vs 1070ug/d mean difference: 709.3 (P&lt;0.001) Mean:2.18 vs 1.79 mean difference: 0.395 (P&lt;0.001) |</p>
<table>
<thead>
<tr>
<th>Chart review/Chicago</th>
<th>Sedative drugs</th>
<th>(d) Length of stay in hospital (days)</th>
<th>Secondary outcomes:</th>
<th>(P=0.01)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (year): 55.5 (41-71) vs 61 (40-73.5) (P=0.59)</td>
<td>Gender (number): (P=0.69)</td>
<td>Secondary outcomes: 7 complications occur:</td>
<td>Intervention group vs control group (no)</td>
<td>(d) 13.3 (7.3-20.5) vs 16.9 (8.5-26.6) (P=0.15)</td>
</tr>
<tr>
<td>(I) Male: female = 32 vs 34</td>
<td>(B) Male: female = 6 vs 34</td>
<td>(1) Ventilator associated pneumonia</td>
<td>(1) 2 vs 5</td>
<td></td>
</tr>
<tr>
<td>Gender (number):</td>
<td></td>
<td>(2) Upper GI hemorrhage</td>
<td>(2) 5 vs 4</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(3) Bacteremia</td>
<td>(3) 4 vs 7</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(4) Barotrauma</td>
<td>(4) 0 vs 3</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(5) Venous thromboembolism</td>
<td>(5) 2 vs 5</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(6) Cholestasis</td>
<td>(6) 0 vs 1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(7) Sinusitis</td>
<td>(7) 0 vs 1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total number: 13 vs 26</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Robinson et al (2008)/Retrospective review (compared between 6 months in 2004 and same period in 2006)</th>
<th>USA Surgical ICU</th>
<th>Implementation of an Analgesia-Delirium-Sedation (ADS) protocol (n=58)</th>
<th>Continuous sedation (n=61)</th>
<th>Primary outcome:</th>
</tr>
</thead>
<tbody>
<tr>
<td>- The trauma patients with mechanical ventilator and were expected to need mechanical ventilation</td>
<td>- Age, median (yrs) 37 vs 35</td>
<td></td>
<td></td>
<td>(1) 1.2 vs 3.2 (P=0.027)</td>
</tr>
<tr>
<td>- Sex: Male: 47 vs 50</td>
<td>- Female: 11 vs 11</td>
<td></td>
<td></td>
<td>(2) 26.4 vs 22.8 (P=0.007)</td>
</tr>
<tr>
<td>30 (50%) Female</td>
<td></td>
<td></td>
<td></td>
<td>(3) 4.1 vs 5.9 (P=0.21)</td>
</tr>
<tr>
<td>2+</td>
<td></td>
<td></td>
<td></td>
<td>(4) 12 vs 18 (P=0.036)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(5) 1641 vs 2465 (P&lt;0.001)</td>
</tr>
<tr>
<td>(mg)</td>
<td>(6) Propofol use per patient (mg)</td>
<td>(6) 10057 vs 19232 (P=0.01)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Appendix 3: Level of Evidence

(Scottish Intercollegiate Guidelines Network, 2014)

<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. 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>
## Methodology Checklist 2: Controlled Trials


### Guideline topic: 

<table>
<thead>
<tr>
<th>Key Question No:</th>
</tr>
</thead>
</table>

### Before completing this checklist, consider:

1. Is the paper a **randomised controlled trial** or a **controlled clinical trial**? If in doubt, check the study design algorithm available from SIGN and make sure you have the correct checklist. If it is a **controlled clinical trial** questions 1.2, 1.3, and 1.4 are not relevant, and the study cannot be rated higher than 1+.

2. Is the paper relevant to key question? Analyse using PICO (Patient or Population Intervention Comparison Outcome). IF NO REJECT (give reason below). IF YES complete the checklist.

### Section 1: Internal validity

**In a well conducted RCT study...**

<table>
<thead>
<tr>
<th>Does this study do it?</th>
</tr>
</thead>
</table>

1.1 The study addresses an appropriate and clearly focused question. Yes ✅
<table>
<thead>
<tr>
<th></th>
<th>The assignment of subjects to treatment groups is randomised.</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Randomization was done by computer allocation</td>
<td></td>
</tr>
<tr>
<td>1.3</td>
<td>An adequate concealment method is used.</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>The randomized sequence number was enclosed in a consecutively numbered, sealed, opaque envelop</td>
<td></td>
</tr>
<tr>
<td>1.4</td>
<td>The design keeps subjects and investigators ‘blind’ about treatment allocation.</td>
<td>No</td>
</tr>
<tr>
<td>1.5</td>
<td>The treatment and control groups are similar at the start of the trial.</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>No statistical difference of the eligible patients within either group. All demographic data of enrolled patients in each group were similar</td>
<td></td>
</tr>
<tr>
<td>1.6</td>
<td>The only difference between groups is the treatment under investigation.</td>
<td>Yes</td>
</tr>
<tr>
<td>1.7</td>
<td>All relevant outcomes are measured in a standard, valid and reliable way.</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>The duration of mechanical ventilation was collected and Richmond Agitation-Sedation Scale was used to measure the sedation level of the patients</td>
<td></td>
</tr>
<tr>
<td>1.8</td>
<td>What percentage of the individuals or clusters recruited into each treatment arm of the study dropped out before the study was completed?</td>
<td>IG: 0.59%  CG: 1.19%</td>
</tr>
<tr>
<td>1.9</td>
<td>All the subjects are analysed in the groups to which they were randomly allocated (often referred to as intention to treat analysis).</td>
<td>Yes</td>
</tr>
<tr>
<td>1.10</td>
<td>Where the study is carried out at more than one site, results are comparable for all sites.</td>
<td>Yes</td>
</tr>
<tr>
<td>-------</td>
<td>--------------------------------------------------------------------------------------------</td>
<td>-----</td>
</tr>
<tr>
<td></td>
<td>The participants at four large medical centers (Nashville, Chicago, Philadelphia) in USA.</td>
<td></td>
</tr>
</tbody>
</table>

**SECTION 2: OVERALL ASSESSMENT OF THE STUDY**

2.1  
*How well was the study done to minimise bias?*

| Code as follows: | High quality (+++) |

2.2  
Taking into account clinical considerations, your evaluation of the methodology used, and the statistical power of the study, are you certain that the overall effect is due to the study intervention?

| YES | Except the blinding method has not been mentioned, this study was conducted in a systematic way |

2.3  
Are the results of this study directly applicable to the patient group targeted by this guideline?

| Yes |

2.4  
**Notes.** Summarise the authors’ conclusions. Add any comments on your own assessment of the study, and the extent to which it answers your question and mention any areas of uncertainty raised above.

| This study supported that the daily interruption of sedation could reduce the duration of MV, ICU and hospital length of stay as well as self extubation. |
Methodology Checklist 2: Controlled Trials

Study identification  
*Include author, title, year of publication, journal title, pages*


Guideline topic:  
Key Question No:  
Reviewer:

**Before** completing this checklist, consider:

1. **Is the paper a randomised controlled trial** or a controlled clinical trial? If in doubt, check the study design algorithm available from SIGN and make sure you have the correct checklist. If it is a controlled clinical trial questions 1.2, 1.3, and 1.4 are not relevant, and the study cannot be rated higher than 1+

2. **Is the paper relevant to key question? Analyse using PICO (Patient or Population Intervention Comparison Outcome). IF NO REJECT (give reason below). IF YES complete the checklist.**

Reason for rejection:  
1. Paper not relevant to key question □  
2. Other reason □  
    (please specify):

## Section 1: Internal validity

In a well conducted RCT study…

<table>
<thead>
<tr>
<th>Does this study do it?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1.1</strong> The study addresses an appropriate and clearly focused question.</td>
</tr>
<tr>
<td><strong>1.2</strong> The assignment of subjects to treatment groups is randomised.</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>1.3</td>
</tr>
<tr>
<td>1.4</td>
</tr>
<tr>
<td>1.5</td>
</tr>
<tr>
<td>1.6</td>
</tr>
<tr>
<td>1.7</td>
</tr>
</tbody>
</table>
| 1.8 | What percentage of the individuals or clusters recruited into each treatment arm of the study dropped out before the study was completed? | IG: 9.3%  
CG: 20% | |
| 1.9 | All the subjects are analysed in the groups to which they were randomly allocated (often referred to as intention to treat analysis). | Yes | |
| 1.10 | Where the study is carried out at more than one site, results are comparable for all sites. | No | This study was conducted in the medical ICU in Chicago |

**SECTION 2: OVERALL ASSESSMENT OF THE STUDY**
### 2.1

*How well was the study done to minimise bias?*

Code as follows:

<table>
<thead>
<tr>
<th>Acceptable (+)</th>
</tr>
</thead>
</table>

### 2.2

Taking into account clinical considerations, your evaluation of the methodology used, and the statistical power of the study, are you certain that the overall effect is due to the study intervention?

| yes |

### 2.3

Are the results of this study directly applicable to the patient group targeted by this guideline?

| yes |

### 2.4

**Notes.** Summarise the authors’ conclusions. Add any comments on your own assessment of the study, and the extent to which it answers your question and mention any areas of uncertainty raised above.

This study showed that the daily interruption of sedation could reduce the duration of MV, ICU length of stay and less diagnostic test for the critically ill patients.
Methodology Checklist 2: Controlled Trials

Study identification  
(Include author, title, year of publication, journal title, pages)

Guideline topic:  
Key Question No:  
Reviewer:

Before completing this checklist, consider:

1. Is the paper a randomised controlled trial or a controlled clinical trial? If in doubt, check the study design algorithm available from SIGN and make sure you have the correct checklist. If it is a controlled clinical trial questions 1.2, 1.3, and 1.4 are not relevant, and the study cannot be rated higher than 1+

2. Is the paper relevant to key question? Analyse using PICO (Patient or Population Intervention Comparison Outcome). IF NO REJECT (give reason below). IF YES complete the checklist.

Reason for rejection: 1. Paper not relevant to key question 2. Other reason (please specify):

Section 1:  Internal validity

In a well conducted RCT study...

<table>
<thead>
<tr>
<th>Does this study do it?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1 The study addresses an appropriate and clearly focused question.</td>
</tr>
<tr>
<td>1.2 The assignment of subjects to treatment groups is randomised.</td>
</tr>
<tr>
<td>1.3 An adequate concealment method is used.</td>
</tr>
</tbody>
</table>

Randomization was done by computer allocation
<table>
<thead>
<tr>
<th></th>
<th>Statement</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.4</td>
<td>The design keeps subjects and investigators 'blind' about treatment allocation.</td>
<td>Can't say</td>
</tr>
<tr>
<td>1.5</td>
<td>The treatment and control groups are similar at the start of the trial.</td>
<td>Yes</td>
</tr>
<tr>
<td>1.6</td>
<td>The only difference between groups is the treatment under investigation.</td>
<td>Yes</td>
</tr>
<tr>
<td>1.7</td>
<td>All relevant outcomes are measured in a standard, valid and reliable way.</td>
<td>Yes</td>
</tr>
</tbody>
</table>
| 1.8 | What percentage of the individuals or clusters recruited into each treatment arm of the study dropped out before the study was completed? | IG: 1.8%  
CG: 1.4 |
| 1.9 | All the subjects are analysed in the groups to which they were randomly allocated (often referred to as intention to treat analysis). | Yes    |
| 1.10| Where the study is carried out at more than one site, results are comparable for all sites. | Yes    | The participants were recruited in Canada and US centers. |

**SECTION 2: OVERALL ASSESSMENT OF THE STUDY**

<table>
<thead>
<tr>
<th>2.1</th>
<th><em>How well was the study done to minimise bias?</em></th>
<th>Acceptable (+)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Code as follows:</td>
<td></td>
</tr>
<tr>
<td>Question</td>
<td>Answer</td>
<td></td>
</tr>
<tr>
<td>-------------------------------------------------------------------------</td>
<td>--------</td>
<td></td>
</tr>
<tr>
<td>Taking into account clinical considerations, your evaluation of the methodology used, and the statistical power of the study, are you certain that the overall effect is due to the study intervention?</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Except the concealment and blinding method has not been mentioned, this study was conducted in a systematic way.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are the results of this study directly applicable to the patient group targeted by this guideline?</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Notes. Summarise the authors' conclusions. Add any comments on your own assessment of the study, and the extent to which it answers your question and mention any areas of uncertainty raised above.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The result showed that there is no difference between the intervention and control, and it does not support the result we hypothesis. One of the reason is that the control is already targeted light sedation which is lightly superior to “user care”.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix 5: SIGN checklists for Cohort studies

Methodology Checklist 3: Cohort studies

<table>
<thead>
<tr>
<th>Study identification</th>
<th>Guideline topic:</th>
<th>Key Question No:</th>
<th>Reviewer:</th>
</tr>
</thead>
</table>

Before completing this checklist, consider:

1. Is the paper really a cohort study? If in doubt, check the study design algorithm available from SIGN and make sure you have the correct checklist.

2. Is the paper relevant to key question? Analyse using PICO (Patient or Population Intervention Comparison Outcome). IF NO REJECT (give reason below). IF YES complete the checklist.

Reason for rejection: 1. Paper not relevant to key question □ 2. Other reason □ (please specify):

Please note that a retrospective study (ie a database or chart study) cannot be rated higher than +.

Section 1: Internal validity

<table>
<thead>
<tr>
<th>In a well conducted cohort study:</th>
<th>Does this study do it?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1 The study addresses an appropriate and clearly focused question.</td>
<td>Yes □</td>
</tr>
</tbody>
</table>

SELECTION OF SUBJECTS

| 1.2 The two groups being studied are selected from source populations that are comparable in all respects other than the factor under investigation. | Yes □ |
| The characteristics of the eligible patients in either group were selected are summarized |
| 1.3 | The study indicates how many of the people asked to take part did so, in each of the groups being studied.iii | Does not apply ■
As this is not prospective study |
| 1.4 | The likelihood that some eligible subjects might have the outcome at the time of enrolment is assessed and taken into account in the analysis.iv | Can’t say ■ |
| 1.5 | What percentage of individuals or clusters recruited into each arm of the study dropped out before the study was completed?v | Does not apply ■
As this is not prospective study |
| 1.6 | *Comparison is made between full participants and those lost to follow up, by exposure status.*vi | Does not apply ■
As this is not prospective study |

**ASSESSMENT**

| 1.7 | The outcomes are clearly defined.vii | Yes ■
Where endpoints or outcomes are clearly specified and used in the analysis. |
| 1.8 | The assessment of outcome is made blind to exposure status. If the study is retrospective this may not be applicable.viii | Yes ■
The data-base was reviewed by investigators blinded to each patients’ assignment |
| 1.9 | Where blinding was not possible, there is some recognition that knowledge of exposure status could have influenced the assessment of outcome.ix | Yes ■
The data-base was reviewed by investigators blinded to each patients’ assignment |
| 1.10 | The method of assessment of exposure is reliable.x | Can’t say ■ |
| 1.11 | Evidence from other sources is used to demonstrate that the method of outcome assessment is valid and reliable.\textsuperscript{xi} | Yes \textsuperscript{■} | The primary outcome measure was identified and used in the analysis (the duration of MV) |
| 1.12 | Exposure level or prognostic factor is assessed more than once.\textsuperscript{xii} | Does not apply \textsuperscript{■} | As it is retrospective chart review, not prospective |

### CONFOUNDING

| 1.13 | The main potential confounders are identified and taken into account in the design and analysis.\textsuperscript{xiii} | Can’t say \textsuperscript{■} |

### STATISTICAL ANALYSIS

| 1.14 | Have confidence intervals been provided?\textsuperscript{xiv} | No \textsuperscript{■} |

### SECTION 2: OVERALL ASSESSMENT OF THE STUDY

| 2.1 | How well was the study done to minimise the risk of bias or confounding?\textsuperscript{xv} | Acceptable (+) \textsuperscript{■} |
| 2.2 | Taking into account clinical considerations, your evaluation of the methodology used, and the statistical power of the study, do you think there is clear evidence of an association between exposure and outcome? | Yes \textsuperscript{■} |
| 2.3 | Are the results of this study directly applicable to the patient group targeted in this guideline? | Yes \textsuperscript{■} |

### Notes.

Summarise the authors’ conclusions. Add any comments on your own assessment of the study, and the extent to which it answers your question and mention any areas of uncertainty raised above.

**Although the sample size is relatively small from the single –centre investigation, these improved outcomes are likely the result of reduced duration of mechanical ventilation and length of stay in the ICU**
Methodology Checklist 3: Cohort studies

Study identification  (Include author, title, year of publication, journal title, pages)

Guideline topic:  |  Key Question No:  |  Reviewer:
--- | --- | ---

**Before** completing this checklist, consider:

1. Is the paper really a cohort study? If in doubt, check the study design algorithm available from SIGN and make sure you have the correct checklist.
2. Is the paper relevant to key question? Analyse using PICO (Patient or Population Intervention Comparison Outcome). IF NO REJECT (give reason below). IF YES complete the checklist..

Reason for rejection: 1. Paper not relevant to key question □ 2. Other reason □ (please specify):

Please note that a retrospective study (ie a database or chart study) cannot be rated higher than +.

**Section 1:  Internal validity**

**In a well conducted cohort study:**

<table>
<thead>
<tr>
<th></th>
<th>Does this study do it?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>The study addresses an appropriate and clearly focused question.xvi</td>
</tr>
</tbody>
</table>

**SELECTION OF SUBJECTS**

<table>
<thead>
<tr>
<th></th>
<th>Does this study do it?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.2</td>
<td>The two groups being studied are selected from source populations that are comparable in all respects other than the factor under investigation.xvii</td>
</tr>
<tr>
<td></td>
<td>The characteristics of the eligible patients in either group were selected were summarised</td>
</tr>
<tr>
<td>1.3</td>
<td>The study indicates how many of the people asked to take part did so, in each of the groups being studied.xviii</td>
</tr>
<tr>
<td></td>
<td>As it is retrospective chart review, not prospective</td>
</tr>
<tr>
<td>1.4</td>
<td>The likelihood that some eligible subjects might have the outcome at the time of enrolment is assessed and taken into account in the analysis. ( ^{xix} )</td>
</tr>
</tbody>
</table>
| 1.5 | What percentage of individuals or clusters recruited into each arm of the study dropped out before the study was completed. \( ^{xx} \) | Does not apply □  
As it is retrospective chart review, not prospective |
| 1.6 | *Comparison is made between full participants and those lost to follow up, by exposure status.* \( ^{xxi} \) | Does not apply □  
As it is retrospective chart review, not prospective |

### ASSESSMENT

| 1.7 | The outcomes are clearly defined. \( ^{xii} \) | Yes □  
The endpoints or outcomes are clearly specified and used in the analysis. |
| 1.8 | The assessment of outcome is made blind to exposure status. If the study is retrospective this may not be applicable. \( ^{xiii} \) | Does not apply □  
As it is retrospective chart review, not prospective |
| 1.9 | Where blinding was not possible, there is some recognition that knowledge of exposure status could have influenced the assessment of outcome. \( ^{xiv} \) | Can’t say □ |
| 1.10 | The method of assessment of exposure is reliable. \( ^{xxv} \) | Can’t say □ |
| 1.11 | Evidence from other sources is used to demonstrate that the method of outcome assessment is valid and reliable. \(^{xxvi}\) | Yes □  
The primary outcome measure was identified and used in the analysis (the duration of MV) |
| 1.12 | Exposure level or prognostic factor is assessed more than once. \(^{xxvii}\) | Does not apply □  
As it is retrospective chart review, not prospective |

### CONFOUNDING

| 1.13 | The main potential confounders are identified and taken into account in the design and analysis. \(^{xxviii}\) | Yes □ |

### STATISTICAL ANALYSIS

| 1.14 | Have confidence intervals been provided? \(^{xxix}\) | Yes □ |

### SECTION 2: OVERALL ASSESSMENT OF THE STUDY

| 2.1 | How well was the study done to minimise the risk of bias or confounding? \(^{xxx}\) | Acceptable (+) □ |
| 2.2 | Taking into account clinical considerations, your evaluation of the methodology used, and the statistical power of the study, do you think there is clear evidence of an association between exposure and outcome? | Yes □ |
| 2.3 | Are the results of this study directly applicable to the patient group targeted in this guideline? | Yes □ |

| 2.4 | Notes. Summarise the authors’ conclusions. Add any comments on your own assessment of the study, and the extent to which it answers your question and mention any areas of uncertainty raised above. | The use of agitation-delirium-sedation protocol is feasible, patient focused can significantly reduce the duration of mechanical ventilation and length of hospital stay of the critically ill trauma patients. |
Appendix 6: Table of estimated manpower cost

<table>
<thead>
<tr>
<th>Manpower cost</th>
<th>Items</th>
<th>Prices (HK$)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Time for GCS assessment and sedation/analygesic titration</td>
<td>(Daily) $(1+2) \times 7 = 21$ minutes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Monthly) $21 \times 30 = 630$ minutes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(8 monthly) $630 \times 8 = 5040$ minutes</td>
</tr>
<tr>
<td></td>
<td>Weekly nursing working hours: 44 hours</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Nursing basic salary at point 19 (per minute)</td>
<td>$32560 / (4 \times 44 \times 60) \approx 3.08$</td>
</tr>
</tbody>
</table>
### Appendix 7: Table of cost of implementation of innovation

<table>
<thead>
<tr>
<th>Items</th>
<th>Price (HK)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total cost of nursing time for the protocol (8 months)</td>
<td>5040 X 3.08 = $15,523</td>
</tr>
<tr>
<td>Training session: 60 minutes</td>
<td></td>
</tr>
<tr>
<td>The training attendance cost by nursed</td>
<td>$3.08 X 60 = $184.8</td>
</tr>
<tr>
<td>Training handout</td>
<td>$2 X 90 = $180</td>
</tr>
<tr>
<td>Copy of protocol</td>
<td>$2 X 24 = $48</td>
</tr>
<tr>
<td>Total cost</td>
<td>$15935.8</td>
</tr>
</tbody>
</table>
Appendix 8: Evidence-based Protocol:

“Evidence-based sedation interruption protocol for weaning MV of critically ill patients”.

**Background**

A mechanical ventilator can be used as a lifesaving equipment when patients suffer from respiratory arrest or become deteriorated to maintain their airways and support their respiratory systems (Esteban et al., 2002). During intubation, most of the patients experience pain, anxiety, and discomfort (Tembo, Higgins, & Parker, 2014). Sedation is among the treatment methods used to maintain the calmness of patients and to minimize their fears (Jacobi et al., 2002).

After a patient is no longer under critical condition or is cured, the early weaning of a mechanical ventilator is the target outcome because prolonged or improper sedation can cause several side effects. Thus, health professionals must understand the complications of improper sedation and implement a guideline that can maintain the consciousness of patients and facilitate the weaning of ventilators.

**Goal**

To facilitate the weaning of a mechanical ventilator and to promote the appropriate usage of sedatives
To standardize patient agitation assessment and weaning guidelines.

**Target user**

All nurses in target ICU

**Target population**

Adult patients aged 18 years and above, confined in ICUs, subjected to a mechanical ventilator for at least 12 h, and requiring sedative medication.

**Exclusion population**

Targets are pregnant patients, patients in moribund state, and patients with profound neurological deficits or who were admitted after cardiopulmonary arrest.

Targets were transferred from other departments where sedatives were administered, subjected to continuous MV for 2 weeks or longer, or removed from life support.

**Guideline**

**Recommendation 1**

Daily interruption of sedation is a practical, and cost-effective intervention that can be readily performed by nurses caring for patients in the ICUs. [Grade B]

- Nursing colleagues are authorized to titrate the sedation infusion within the prescribed range on the basis of a patient’s condition. (Girard et al., 2008) [1+] (Kress et al., 2000) [1+] (Mehta et al., 2012) [1+] (Robinson et al., 2008) [2+] (Schweickert et al., 2004) [2+]
**Recommendation 2**

Half of the previous sedation rates should be obtained if patients are agitated or self-titration of sedation by nursing staff is based on the clinical assessment during sedation interruption and individual patients’ responses to sedation therapy. [Grade B]

- Discomfort and pain may cause restlessness among patients and increase the risk of unintentional device removal. Sedation can also affect the vital signs and conditions of patients (Girard et al., 2008) [1++] (Kress et al., 2000) [1+] (Mehta et al., 2012) [1+] (Robinson et al., 2008) [2+] (Schweickert et al., 2004) [2+]

**Recommendation 3**

Sedation interruption protocol should be terminated when patients exhibit any abnormality, manifest unstable conditions, or become agitated. [Grade B]

- Sedation interruption should be withheld when patients are emotionally unstable and demonstrating a violent behavior during the process. Daily sedation interruption must be terminated and physicians must be informed for assessment when a patient’s condition deteriorates or cardiac abnormalities, such as severe tachycardia, bradycardia, hypotension, and cardiac arrest, develop. (Girard et al., 2008) [1++] (Kress et al., 2000) [1+] (Mehta et al., 2012) [1+] (Robinson et al., 2008) [2+] (Schweickert et al., 2004) [2+]
Recommendation 4

The innovation should be conducted without interfering ward routines, such as physician rounds or visiting hours. [Grade B]

- Sedation interruption should be initially performed in the morning and before the morning round of doctors to allow nurses to inform them of any emergency or abnormality.

(Girard et al., 2008) [1++]

Recommendation 5

A target sedation level should be set to keep patients calm and conscious [Grad B]

- Promoting patients’ comfort can facilitate the synchronization and weaning of ventilator.

(Girard et al., 2008) [1++] (Mehta et al., 2012) [1+].

Recommendation 6

Sedation agitation level should be monitored by using SAS and conscious level should be determined on the basis of at least three of the following four actions: opening the eyes in response to sound, using the eyes to follow an investigator’s instructions, squeezing a hand upon request, and sticking out the tongue upon request. These procedures should be performed hourly until the end of the protocol. [Grade B]

- The sedation agitation level and conscious level of the patients during sedation interruption should be assessed frequently to detect any occurrence of safety problems and
abnormalities, such as unintentional device removal. Thus, nurses can implement immediate actions, especially during emergencies. (Kress et al., 2000) [1+] (Girard et al., 2008) [1++] (Mehta et al., 2012) [1+]
## Appendix 9: SIGN grades of recommendation

(Scottish Intercollegiate Guidelines Network, 2014)

<table>
<thead>
<tr>
<th>Grade</th>
<th>Recommendation</th>
</tr>
</thead>
</table>
| A     | 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 |
| B     | 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+ |
| C     | 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++ |
| D     | Evidence level 3 or 4  
       | Or  
       | Extrapolated evidence from studies rated as 2+ |
### Appendix 10: Sedation-Agitation Scale (SAS)

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>Dangerous agitation</td>
<td>Pulling at endotracheal tube (ETT), trying to remove catheters, climbing over bedrail, striking at staff, thrashing side-to-side</td>
</tr>
<tr>
<td>6</td>
<td>Very agitated</td>
<td>Does not calm despite frequent verbal reminding of limits, require physical restraints, biting ETT</td>
</tr>
<tr>
<td>5</td>
<td>Agitated</td>
<td>Anxious or mildly agitated, attempting to sit up, clams down to verbal instructions</td>
</tr>
<tr>
<td>4</td>
<td>Calm &amp; cooperative</td>
<td>Calm, awakens easily, follows commands</td>
</tr>
<tr>
<td>3</td>
<td>Sedated</td>
<td>Difficult to arouse, awakens to verb stimuli or gentle shaking but drifts off again, follow simple commands</td>
</tr>
<tr>
<td>2</td>
<td>Very sedated</td>
<td>Aroused to physical stimuli but does not communicate or follow commands, may move spontaneously</td>
</tr>
<tr>
<td>1</td>
<td>Unarousable</td>
<td>Minimal or no response to noxious stimuli, does not communicate or follow commands</td>
</tr>
</tbody>
</table>
## Appendix II: Project timeline

<table>
<thead>
<tr>
<th>Task</th>
<th>Organizer(s)</th>
<th>Target(s)</th>
<th>Months</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Phase 1</strong></td>
<td></td>
<td></td>
<td>1-11</td>
</tr>
<tr>
<td>Approvals seeking</td>
<td>Author</td>
<td>COS/DOM/NC</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>WEEK 1*</td>
</tr>
<tr>
<td><strong>Phase 2</strong></td>
<td></td>
<td></td>
<td>1-11</td>
</tr>
<tr>
<td>Approvals seeking</td>
<td>Author</td>
<td>WM/NS/APN</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>WEEK 2*</td>
</tr>
<tr>
<td><strong>Phase 3</strong></td>
<td></td>
<td></td>
<td>1-11</td>
</tr>
<tr>
<td>Project director &amp; working groups recruitment</td>
<td>NC</td>
<td>3 APN/5 RN</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>WEEK 3-4*</td>
</tr>
<tr>
<td><strong>Phase 4</strong></td>
<td></td>
<td></td>
<td>1-11</td>
</tr>
<tr>
<td>Staff training &amp; guideline promotion</td>
<td>Members of project team</td>
<td>All nursing staff</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>WEEK 5-6*</td>
</tr>
<tr>
<td><strong>Phase 5</strong></td>
<td></td>
<td></td>
<td>1-11</td>
</tr>
<tr>
<td>Pilot study implementation</td>
<td>Members of project team</td>
<td>All nursing staff &amp; recruited patients</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>WEEK 7-14*</td>
</tr>
<tr>
<td><strong>Phase 6</strong></td>
<td></td>
<td></td>
<td>1-11</td>
</tr>
<tr>
<td>Pilot study review &amp; report</td>
<td>Members of project team</td>
<td>COS/DOM/NC/WM/NS/APN</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>WEEK 15-16*</td>
</tr>
<tr>
<td><strong>Phase 7</strong></td>
<td></td>
<td></td>
<td>1-11</td>
</tr>
<tr>
<td>Full implementation</td>
<td>All staff in ICU</td>
<td>All nursing staff &amp; recruited patients</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>WEEK 17-41*</td>
</tr>
<tr>
<td><strong>Phase 8</strong></td>
<td></td>
<td></td>
<td>1-11</td>
</tr>
<tr>
<td>Final evaluation</td>
<td>Members of project team</td>
<td>COS/DOM/NC/WM/NS/APN</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>WEEK 42-45*</td>
</tr>
</tbody>
</table>
**Appendix 12: Nurse satisfaction survey**

XXX hospital  
Department of Intensive Care Unit

Nurse satisfaction survey for the new-implemented daily sedation interruption protocol

- To evaluate the effectiveness of the new-implemented daily sedation interruption protocol to patients with mechanical ventilators in ICU, your feedbacks are valuable to us
- Please circle the appropriate number to describe your level of satisfaction towards the guideline
- Please fill the following blanks:
  - Year of experience in ICU: __________ - Rank: __________

<table>
<thead>
<tr>
<th>Items</th>
<th>Highly Disagree</th>
<th>Slightly Disagree</th>
<th>Neutral</th>
<th>Slightly Agree</th>
<th>Highly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The Instruction of the protocol is clear</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>The content of presentation and demonstration are clear and easy to understand</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>The protocol is easy to follow and can be incorporated into the daily routine</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>The protocol will cause extra workload</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>The protocol is useful to improve the nursing care to patients</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

**Overall**

<table>
<thead>
<tr>
<th>Items</th>
<th>Highly Disagree</th>
<th>Slightly Disagree</th>
<th>Neutral</th>
<th>Slightly Agree</th>
<th>Highly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>The duration of the training session is right</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>7</td>
<td>The training session is useful to promote the competency</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>8</td>
<td>I have confidence to demonstrate the protocol</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>9</td>
<td>In general, I am satisfied with the proposed guideline</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>10</td>
<td>Instructors are expertise in the related field</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

11 Other comments:
Appendix 13: Assessment form for the daily sedation interruption

*Nurse(s) should fill this form immediately after the starting of the daily sedation protocol
*Patient assessment should be performed at least every one hour
*SAS: Sedation Agitation Scale (1-7), NA: Not Applicable
* Conscious level: write the belonging numbers into the box if patient could follow at least 3 of the choices
1. Eye opening/closure 2. Tracking 3. Upper limbs movement 4. Lower limbs movement (the number could be repeat)
*Please return this form to the collection box once the case is extubated

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>SAS score</th>
<th>Conscious level</th>
<th>Restart sedation at dosage (ml/hr) (yes/no)</th>
<th>Remarks</th>
<th>Signature</th>
</tr>
</thead>
<tbody>
<tr>
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</table>
Appendix 14: Flow of communication with the stakeholders

Author

Pharmacy Department

COS

ICU Physicians

DOM

NS/APN

NC

APN (working group)

RN
### Appendix 15: Audit form for protocol of daily sedation interruption

* To test the compliance & competence of sedation protocol
* Please “Circle” for the following statements
* NA: not applicable; O: observation; R: CIS record; Yes (Y) or No (N)

- Year of experience in ICU: _____________
- Rank: _____________

<table>
<thead>
<tr>
<th>Items</th>
<th>Source of information</th>
<th>Yes(Y)/ No(N)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Assessment</strong></td>
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<tr>
<td>Assessment of vital signs before the sedation interruption</td>
<td>NA/ O/ R</td>
<td>Y/ N</td>
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<tr>
<td>Assessment of the patient’s agitation level with SAS and conscious level</td>
<td>NA/ O/ R</td>
<td>Y/ N</td>
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<tr>
<td>Assessment of vital signs after the sedation interruption</td>
<td>NA/ O/ R</td>
<td>Y/ N</td>
<td></td>
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<tr>
<td>Find the underlying cause if patient not fit to proceed sedation interruption</td>
<td>NA/ O/ R</td>
<td>Y/ N</td>
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<tr>
<td><strong>Preparation of sedation</strong></td>
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<tr>
<td>Counter check the doctor’s prescription of the sedation</td>
<td>NA/ O/ R</td>
<td>Y/ N</td>
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<tr>
<td>Correct dilution of the sedation</td>
<td>NA/ O/ R</td>
<td>Y/ N</td>
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<tr>
<td><strong>Intervention</strong></td>
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<tr>
<td>Terminate the protocol and treat the possible causes (any treatments)</td>
<td>NA/ O/ R</td>
<td>Y/ N</td>
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<td>Correct restart and titration of sedative infusion</td>
<td>NA/ O/ R</td>
<td>Y/ N</td>
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<tr>
<td><strong>Evaluation</strong></td>
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<tr>
<td>Perform the continuous assessment of patient agitation and conscious level</td>
<td>NA/ O/ R</td>
<td>Y/ N</td>
<td></td>
</tr>
<tr>
<td><strong>Documentation</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Document the intervention; (any accidents/ adverse events)</td>
<td>NA/ O/ R</td>
<td>Y/ N</td>
<td></td>
</tr>
</tbody>
</table>

The name of auditor: __________
The rank of auditor: __________
The signature of auditor: __________
Appendix 16: Daily sedation interruption protocol