# Summary

Spontaneous awakening trials (SAT) and spontaneous breathing trials (SBT) reduce the length of mechanical ventilation, thereby reducing the risk for developing ventilator-associated pneumonia (VAP). Since the guidelines were written in 2007, a groundbreaking article by Girard in 20081 showed that SAT and SBT protocols result in faster extubation time and earlier discharge date. Most recently in 2012, a review article focusing on the findings of 14 studies recommended that weaning should be considered as early as possible, and most importantly, that protocols for weaning from sedation and from ventilation should be paired in order to optimize outcomes (Luetz, 2012).2 In 2013, Mehta et al3 performed a randomized controlled trial to assess sedation with a protocol versus sedation with a protocol and a daily sedation vacation. The results did not support the use of an SAT, as there was no difference in time to extubation, the primary outcome. However, with the sedation vacation was a concomitant increase in the use of benzodiazepines.

***Note****: Literature supporting the guidelines is listed first, followed by reviews and meta-analyses and an annotated bibliography.*

## Society for Healthcare Epidemiology of America

*2014 – Strategies to prevent ventilator-associated pneumonia in acute care hospitals: 2014 update*4

* ***Recommends the interruption of sedation (SAT) and the assessment of readiness to extubate (SBT) once a day. The SAT and SBT should be paired.***

## American Thoracic Society

*2004 – Guidelines for the management of adults with hospital-acquired, ventilator-associated, and healthcare-associated pneumonia.*5

* ***Recommends use of daily interruption or lightening of sedation (SAT) to avoid constant heavy sedation and to facilitate and accelerate weaning.***
* ***Does not address SBT.***

## Centers for Disease Control and Prevention (CDC)

*2003 – CDC Guidelines for Preventing Health-Care-Associated Pneumonia: Evidence-based, clinical practice guidelines for the prevention of healthcare-associated pneumonia, including VAP.*6

* ***Does not specifically address SAT and SBT, but supports weaning.***

|  |  |
| --- | --- |
| **Relevant Studies 1999–2015** | |
| **Study Type and Author** | **Results** *–* **Details in Annotated Bibliography** |
| Randomized Controlled Trial (RCT)  (Fan, 2015)7 | **PRO:** Randomized controlled trial (RCT) conducted in a neurological intensive care unit (NCU) in a tertiary care hospital. 144 patients requiring mechanical ventilation for more than 24 hours were randomized to protocol-directed (intervention) or physician-directed (control) group. The intervention group had shorter median weaning times and duration of mechanical ventilation than the control group. Protocol-directed weaning reduces weaning times, duration of mechanical ventilation, length of NCU stay, and NCU cost in neurological patients, and these effects are more significant in conscious patients than in unconscious patients. |
| Quasi-experimental Study  (Stollings, 2015)8 | **PRO:** Quasi-experimental, quality improvement study – implemented a pharmacist-driven spontaneous awakening trail (SAT) protocol that included process measures. Compared this to a protocol where pharmacists were not included. A pharmacist-driven protocol significantly improved process measure compliance, comparing the pre-intervention period to the post-intervention period. Results were sustained in the 8-month followup period. |
| Controlled Trial  (Klompas, 2015)9 | **PRO:** Controlled trial to assess whether daily coordinated SATs and spontaneous breathing trials (SBTs) might prevent ventilator-associated events (VAEs). 20 units in the Centers for Disease Control and Prevention Epicenters Program participated in the trial. 12 units implemented an opt-out protocol for nurses and respiratory therapists to perform paired daily SATs and SBTs. 8 units only conducted surveillance for VAEs. With significant increases in the performance of SATs and SBTs, there were significant decreases in duration of mechanical ventilation and hospital length of stay. |
| Prospective, Cohort, Before-After Study  ABCDE Versus Usual Care  (Balas, 2014)10 | **PRO:** Patients managed with the awakening and breathing coordination, delirium monitoring/management, and early exercise/mobility bundle spent 3 more days breathing without assistance, experienced less delirium, and were more likely to be mobilized during their intensive care unit (ICU) stay than patients treated with usual care. |
| RCT  Protocolized Sedation Versus Protocolized Sedation & Daily Sedation Interruption  (Mehta, 2012)3 | **CON:** Participants included 430 critically ill, mechanically ventilated adults in 16 tertiary care medical and surgical ICUs in Canada and the United States. 209 participants were randomized to the control arm and 214 to the intervention arm. There were no significant differences between the two groups on median time to extubation or duration of ICU stay. Daily interruption was associated with higher daily doses of midazolam and fentanyl and more daily boluses of benzodiazepines. |
| RCT  Pressure Support Versus Spontaneous Breathing  (Gnanapandithan, 2011)11 | **CON:** Study focused on adult patients requiring mechanical ventilation for more than 24 hours. Study findings show that weaning by gradual pressure support (PS) without an initial SBT was associated with better outcomes (in terms of higher weaning trial successes and shorter ICU stay) and trend towards quicker time to extubation than weaning by PS supported with SBTs. |
| National Nursing Survey  (Guttormson, 2010)12 | **PRO:** Survey focused on members of the American Association of Critical Care Nurses. Findings showed that positive nursing attitudes toward the effectiveness of sedation in relieving the discomfort of mechanical ventilation had a moderate positive correlation with sedation practices and intent to administer sedation to all mechanical ventilated patients. |
| Survey of SCCM  (Tanios, 2009)13 | **PRO:** Survey focused on 12,994 physician, nurse, and pharmacist members of Society of Critical Care Medicine. Findings showed that nurse attitudes toward the efficacy of sedation for mechanically ventilated patients was positively correlated with nurses’ report of the sedation practice. |
| Randomized Trial  SAT with SBT Versus Standard of Care and SBT  (Girard, 2008)1 | **PRO:** Study focused on adult mechanically ventilated patients in the intensive care unit who required ventilation for 12 hours or more. Findings show that a paired sedation and weaning protocol consisting of daily SATs plus SBTs were better at reducing length of mechanical ventilation, length of stay, and 1 year mortality. |
| Quasi- Experimental  Nurse-Implemented Sedation Intervention  (Quenot, 2007)14 | **PRO:** Study focused on 423 adult patients requiring mechanical ventilation for at least 48 hours and infused with midazolam or propofol. Study findings showed that a nurse-implemented sedation protocol decreased the rate of ventilator-associated pneumonia (VAP) and duration of mechanical ventilation. |
| Quasi-Experimental Study  (Resar, 2005)15 | **PRO**: This study did not specifically focus on weaning or sedation vacation, but the implementation of the Institute for Healthcare Improvement ventilation bundle. Findings showed that adherence to the bundle led to a significant reduction of VAP. One of the items in the ventilator bundle was use of a sedation vacation protocol. |
| Ventilator Management Protocol Versus Control  (Marelich, 2000)16 | **PRO**: This article did not focus on sedation vacation intervention, but the use of ventilator management protocol, including twice-daily SBTs. |
| Sedation Interruption Versus Control  (Kress, 2000)17 | **PRO**: Study focused on adult medical patients requiring mechanical ventilation who were receiving continuous infusion of sedative drugs. Findings showed that daily interruption of sedative drug infusions decreased the duration of mechanical ventilation and the length of stay in the ICU. |
| Protocol-Directed Versus Non-Protocol  (Brook, 1999)18 | **PRO**: Study focused on adult patients who were admitted into the medical ICU. Findings showed that the use of protocol-directed sedation could reduce the mechanical ventilation, length of stay, and need for tracheostomy among critically ill patients with acute respiratory failure. |

|  |  |
| --- | --- |
| **Reviews and Meta-Analyses** | |
| **Study Type and Author** | **Results - Details in Annotated Bibliography** |
| Guidelines for PAD Management  (Barr, 2013)19 | These guidelines provide a roadmap for developing integrated, evidence-based, and patient-centered protocols for preventing and treating pain, agitation, and delirium in critically ill patients. The use of SATs or light sedation and SBTs are supported by these guidelines. |
| Review  (Luetz, 2012)2 | Reviewed the findings of 14 articles to recommend that weaning should be considered as early as possible; a daily screening for readiness to wean should be implemented; and a weaning protocol including an SBT should be used. |
| Clinical Review  (Patel, 2012)20 | Review states that sedation and analgesia are important components of care of the mechanically ventilated patient in the ICU. Objective assessments of pain, sedation, and agitation have been validated for use in the ICU for assessment and titration of medications. An evidence-based strategy for administering these drugs can lead to improvements in short- and long-term outcomes of the mechanically ventilated patient. |
| Systematic Review  (Blackwood, 2011)21 | Review focused on 11 RCTs that evaluated the effect of weaning protocols on the duration of mechanical ventilation in 1,971 critically ill patients in ICUs. Study findings showed that weaning protocol was associated with significant reduction for duration of mechanical ventilation, length of weaning, and length of stay in the ICU. |

## Annotated Bibliography

1. Girard TD, Kress JP, Fuchs BD, et al. Efficacy and safety of a paired sedation and ventilator weaning protocol for mechanically ventilated patients in intensive care (awakening and breathing controlled trial): A randomized controlled trial. Lancet. 2008 Jan;371(9607):126-34. PMID: 18191664.

**PRO:** Study focused on adult mechanically ventilated patients in the intensive care unit who required ventilation for 12 hours or more. Patients were randomized to management with a daily SAT followed by an SBT (n=168) or with sedation per usual care plus a daily SBT (n=168). **Patients in the intervention group spent more days breathing without assistance during the study period than did those is the control group (14.7 days vs 11.6 days; mean difference 3.1 days, 95% Ci 0.7 to 5.6: p=0.02. Intervention group patients were discharged from the ICU earlier (median time in the ICU 9.1 days vs 12.9 days; p=0.01) as well as from the hospital (median time in the hospital 14.9 days vs 19.2 days; p=0.04). At any instant during the year after enrollment, patients in the intervention group were less likely to die than were patients in the control group (HR 0.68, 95% CI 0.50 to 0.92; p-0.01). For every seven patients treated with the intervention, one life was saved (number needed to treat was 7.4, 95% CI 4.2 to 35.5).** Findings show that a paired sedation and weaning protocol consisting of daily spontaneous awakening trials (SATs) plus spontaneous breathing trials (SBTs) were better at reducing length of mechanical ventilation, length of stay and one year mortality.

2. Luetz A, Goldman A, Weber-Castens S, et al. Weaning from mechanical ventilation and sedation. Curr Opin Infect Dis. 2012 Apr;25(2):164-9. PMID: 22246460.

**PRO:** Literature review. Article focused on the findings of 14 articles to recommend that weaning should be considered as early as possible; a daily screening for readiness to wean should be implemented; and a weaning protocol including an SBT should be used.

3. Mehta S, Burry L, Cook D, et al. Daily sedation interruption in mechanically ventilated critically ill patients cared for with a sedation protocol: A randomized controlled trial. JAMA. 2012 Nov;308(19):1985-92. PMID: 23180503.

**CON:** Randomized controlled trial (RCT) of 430 critically ill, mechanically ventilated adults in 16 tertiary care medical and surgical intensive care units (ICUs) in the United States and Canada. Patients were randomized to protocolized sedation or protocolized sedation plus daily sedation interruption. **Results: Median time to successful extubation was 7 days in both the interruption and control groups (median [interquartile range (IQR)], 7 [4–13] vs. 7 [3–12]; interruption group hazard ratio, 1.08; 95% confidence interval [CI], 0.86–1.35; p=0.52). Duration of intensive care unit [ICU] stay (median [IQR], 10 [5–17] days vs. 10 [6–20] days; p=0.36) and hospital stay (median [IQR], 20 [10–36] days vs. 20 [10–48] days; p=0.42) did not differ between the daily interruption and control groups, respectively. Daily interruption was associated with higher mean daily doses of midazolam (102 mg/d vs. 82 mg/d; p=0.04) and fentanyl (median [IQR], 550 [50–1850] vs. 260 [0–1400]; p=0.001) and more daily boluses of benzodiazepines (mean, 0.253 vs. 0.177; p=0.007) and opiates (mean, 2.18 vs. 1.79; p=0.001). Unintentional endotracheal tube removal occurred in 10 of 214 (4.7%) versus 12 of 207 patients (5.8%) in the interruption and control groups, respectively (relative risk [RR], 0.82; 95% CI, 0.36–1.84; p=0.64). Rates of delirium were not significantly different between groups (53.3% vs. 54.1%; RR, 0.98; 95% CI, 0.82–1.17; p=0.83). Nurse workload was greater in the interruption group (visual analog scale score, 4.22 vs. 3.80; mean difference, 0.41; 95% CI, 0.17–0.66; p=0.001).** Patients managed with protocolized sedation and a daily sedation interruption did not have any significant differences in duration of mechanical ventilation or length of ICU stay. However, as stated above, the use of midazolam, fentanyl, benzodiazepines, and opioids increased in the patients with daily sedation interruption.

4. Klompas M, Branson R, Eichenwald EC, et al. Strategies to prevent ventilator-associated pneumonia in acute care hospitals: 2014 update. Infect Control Hosp Epidemiol. 2014 Aug;35(8):915-36. PMID: 25026607.

5. American Thoracic Society, Infectious Diseases Society of America. Guidelines for the management of adults with hospital-acquired, ventilator-associated, and healthcare-associated pneumonia. Am J Respir Crit Care Med. 2005Feb;171(4):388-416. PMID: 21481251.

6. Tablan OC, Anderson LJ, Besser R, et al. Guidelines for preventing healthcare-associated pneumonia, 2003: Recommendations of CDC and the Healthcare Infection Control Practices Advisory Committee. MMWR Recomm Rep. 2004 Mar;53:1-36. PMID: 15048056.

7. Fan L, Su Y, Elmadhoun OA, et al. Protocol-directed weaning from mechanical ventilation in neurological patients: A randomised controlled trial and subgroup analyses based on consciousness. Neurol Res. 2015 Nov;37(11):1006-14. PMID: 26311500.

**PRO:** RCT conducted in a neurological intensive care unit (NCU) in a tertiary care hospital. 144 patients requiring mechanical ventilation for more than 24 hours were randomized to protocol-directed (intervention, n=71) or physician-directed (control, n=73) group. **The intervention group displayed a significantly shorter median weaning time than the control group (2.00 vs 5.07 days, p<0.05). The median duration of mechanical ventilation tended to be shorter in the intervention group (10.8 vs 14.2 days, p=0.106). The median length of NCU stay was 19.0 and 26.1 days in the intervention and control groups, respectively (p=0.063). The median NCU cost was 9.26 X 10(4) and 12.24 X 10(4) Yen in the intervention and control groups, respectively (p=0.059). The unsuccessful weaning, ventilator-associated pneumonia (VAP) and mortality rates were similar between the groups. Among conscious patients, the median weaning time (2.00 vs 7.00 days, p=0.05) and the median duration of mechanical ventilation (8.8 vs 18.0 days, p=0.017) were significantly reduced in the intervention group. Among unconscious patients, the intervention group displayed a reduced median weaning time (1.00 vs 3.10 days, p=<0.05), but not median duration of mechanical ventilation (11.6 vs 11.1 days, p=0.702) compared to the control group.** Protocol-directed weaning reduces weaning times, duration of mechanical ventilation, length of NCU stay and NCU cost in neurological patients, and effects are more significant in conscious patients than in unconscious patients.

8. Stollings JL, Foss JJ, Ely EW, et al. Pharmacist leadership in ICU quality improvement: Coordinating spontaneous awakening and breathing trials. Ann Pharmacother. 2015 Aug;49(8):883-91. PMID: 25907528.

**PRO:** Quasi-experimental, quality improvement study – implemented a pharmacist-driven SAT protocol that included process measures. Compared this to a protocol where pharmacists were not included. **SAT safety screens were performed on only 20 percent of pre-quality improvement (QI) patient-days versus 97 percent of during-QI patient-days (p<0.001) and 100% of post-QI patient-days (p=0.25). The rates of passing the SAT safety screen in pre-QI and during-QI periods were 63 percent versus 78 percent (p=0.03) and 81 percent in the post-QI period (p=0.86). The rates of SATs among eligible patients on continuous infusions were only 53 percent in the pre-QI versus 85 percent in the during-QI (p=0.0001) and 87percent in the post-QI (p=1.0) periods.** A pharmacist-driven awakening and breathing coordination protocol significantly improved process measure compliance, comparing the pre-intervention rates of screening, performing and coordinating SAT and SBTs. Results were sustained in the 8-month followup period.

9. Klompas M, Anderson D, Trick W, et al. The preventability of ventilator-associated events. The CDC prevention epicenters wake up and breathe collaborative. Am J Respir Crit Care Med. 2015 Feb;191(3):292-301. PMID: 25369558.

**PRO:** Controlled trial to assess whether daily coordinated SATs and SBTs might prevent ventilator-associated events (VAEs). 20 units in the Centers for Disease Control and Prevention Epicenters Program participated in the trial. 12 units implemented an opt-out protocol for nurses and respiratory therapists to perform paired daily SATs and SBTs. **8 units only conducted surveillance for VAEs. 5,164 consecutive episodes of mechanical ventilation were tracked; 3,425 in intervention units and 1,739 in control units. Within collaborative units, significant increases in SATs, SBTs, and percentage of SBTs performed without sedation were mirrored by significant decreases in duration of mechanical ventilation and hospital length-of-stay. There was no change in VAE risk per ventilator day but significant decreases in VAE per episode of mechanical ventilation (odds ratio [OR], 0.63; 95% CI 0.42 to 0.97) and infection-related ventilator-associated complications (OR, 0.35; 95% CI 0.17 to 0.71) but not pneumonias (OR, 0.51; 95% CI 0.19 to 1.3).** Within control units, there were no significant changes in SAT, SBT, or VAE rates. With significant increases in the performance of SATs and SBTs, there were significant decreases in duration of mechanical ventilation and hospital length of stay.

10. Balas MC, Vasilevskis EE, Olsen KM, et al. Effectiveness and safety of the awakening and breathing coordination, delirium monitoring/management, and early exercise/mobility bundle. Crit Care Med. 2014 May;42(5):1024-36. PMID: 24394627.

**PRO:** This was an 18-month, prospective cohort, before and after study in five adult intensive care units, one step-down unit and one oncology/hematology/special care unit. A total of 296 patients (146 pre-bundle and 150 post-bundle) were enrolled, and 187 of these were mechanically ventilated. For the mechanically ventilated patients, outcomes included the association of bundle implementation and ventilator-free days. **Patients in the post-implementation period spent 3 more days breathing without mechanical assistance than did those in the pre-implementation period (median [IQR], 24 [7–26] vs 21 [0–25]; p=0.04). After adjusting for age, sex, severity of illness, comorbidity, and mechanical ventilation status, patients managed with the Awakening and Breathing Coordination, Delirium Monitoring/Management, and Early Exercise/Mobility bundle experienced a near halving of the odds of delirium (OR, 0.55; 95% CI, 0.33 to 0.93; p=0.03) and increased odds of mobilizing out of bed at least once during an intensive care unit stay (odds ratio, 2.11; 95% CI, 1.29 to 3.45; p=0.003).** Critically ill patients managed with the Awakening and Breathing Coordination, Delirium Monitoring/Management, and Early Exercise/Mobility bundle spent 3 more days breathing without assistance, experienced less delirium, and were more likely to be mobilized during their intensive care unit stay than patients treated with usual care.

11. Gnanapandithan K, Agarwal RA, Aggarwal AN, et al. Weaning by gradual pressure support (PS) reduction without an initial spontaneous breathing trial (SBT) versus PS-supported SBT; a pilot study. Rev. Port Penumol. 2011Nov-Dec;17(6):244-52. PMID: 21908162.

**CON:** RCT. Study focused on 120 adult patients requiring mechanically ventilation for more than 24 hours to evaluate the effectiveness of weaning by gradual pressure support (PS) without initial SBT versus PS-supported SBT. Findings showed that weaning by gradual reduction of PS without an SBT was associated with better outcomes in terms of higher weaning trial successes, shorter ICU stay and trend toward quicker time to extubation than weaning by PS supported with SBTs. The median duration of ventilation prior to weaning was 80.2 (50.5–175.6) hours. **The baseline characteristics were similar in the two groups except the PaO(2)/FiO(2) ratio, which was significantly higher in the SBT group. The rates of successful weaning trial (89.7% vs. 69.4%) were significantly higher in the PS group. The median duration of weaning (66 hours vs 81.5 hours, p=0.05) and the median duration of ICU stay (8 days vs. 9.4 days, p=0.027) was lower in the PS group.**

12. Guttormson J,Chlan L, Weinert C, et al. Factors influencing nurse sedation practices with mechanically ventilated patients: A U.S national survey. Intensive Crit.Care Nurs. 2010 Feb;26(1):44-50. PMID: 19945879.

**PRO:** Study surveyed 423 members of the American Association of Critical Care Nurses to describe factors that influence nurse sedation administration to mechanically ventilated patients and to identify individual or workplace characteristic that impact sedation practices. **Self-reported sedation administration subscale scores were higher (stronger agreement with positive statements and stronger disagreement with negative statements) for respondents using a sedation assessment scale (median: 3.67, IQR: 3.33–3.89) than those without (median: 3.56, IQR: 3.33–3.79); z(407)=-2.565, p=0.01). Respondents that utilized a sedation scale indicated stronger agreement that three items indicated under sedation: reaching for endotracheal tube or lines, tachypnea, and ventilator dysynchrony. The majority of nurse respondents felt that sedation was necessary for patients’ comfort and characterized mechanical ventilation as uncomfortable and stressful. The attitudes influence nurses' self-reported sedation administration.**

13. Tanios M, de Wit M, Epstein S, et al. Perceived barriers to the use of sedation protocols and daily sedation interruption: A multidisciplinary survey. Journal Critical Care. 2009 Mar;24(1):66-73. PMID: 19272541.

**PRO:** Study focused on surveying 916 physician, nurse, and pharmacist members of the Society of Critical Care Medicine. The goal was to determine current use of sedation protocols and daily sedation interruption (DIS), along with the perceived barriers to each. Of 64 percent having sedation protocol, 78 percent used it for more than 50 percent of ventilated patients. Reasons for lack of protocol use include no physician order (35%), lack of nursing support (11%), and fear of oversedation (7%). DSI was used by only 40 percent. Barriers to DIS included lack of nursing acceptance (22%), concern about risk of patient-initiated device removal (19%), and inducement of either respiratory compromise (26%) or patient discomfort (13%). Clinicians who prefer propofol were more likely to use DIS than those who prefer benzodiazepines.

14. Quenot J, Ladoire S, Devoucoux F, et al. Effect of a nurse-implemented sedation protocol on the incidence of ventilator-associated pneumonia. Crit Care Med. 2007 Sep;35(9):2031-6. PMID: 17855817.

**PRO:** Study focused on 423 adult patients requiring mechanical ventilation for at least 48 hours and infusion with either midazolam or propofol**. The incidence of ventilator-associated pneumonia VAP was significantly lower in the nurse-implemented protocol (NIP) group compared with the control group (6% and 15%, respectively, p=0.005). By univariate analysis (log-rank test), only use of a NIP was significantly associated with a decrease of incidence of VAP (p<0.01). Additionally, NIP was found to be independently associated with a lower incidence of VAP after adjustment on Simplified Acute Physiology Score II in the multivariate Cox proportional hazards model (hazard rate, 0.81; 95% CI, 0.62 to 0.95; p=0.03). The median duration of mechanical ventilation was significantly shorter in the NIP (4.2 days; IQR, 2.1–9.5) compared with the control group (8 days; IQR, 2.2–22.0; p=0.001), representing a 52 percent relative reduction.** Nurses used dosage table to administer medication by weight for initial and adjustment of sedatives. Level of sedation was determined using Cambridge score used to assess consciousness levels every 3 hours.

15. Resar R, Pronovost P, Haraden C, et al. Using a bundle approach to improve ventilator care processes and reduce ventilator-associated pneumonia. Jt Comm J Qual Patient Saf. 2005 May;31(5):243-48. PID: 159660014.

**PRO:** Systematic review. This review did not specifically address a sedation vacation protocol, but reviewed the use of the Institute for Healthcare Improvement ventilator bundle. Review focused on 21 teaching hospitals, 40 community hospitals that were made up of 44 medical 12 surgical ICUs and 12 surgical ICUs. Data from 35 units showed a decrease in VAP rates with increased adherence to ventilator bundle. One of four bundle items was the use of a sedation vacation protocol.

16. Marelich GP, Murin S, Battistella F, et al. Protocol weaning of mechanical ventilation in medical and surgical patients by respiratory care practitioners and nurses: Effect on weaning time and incidence of ventilator-associated pneumonia. Chest. 2000 Aug;118(2):459-67. PMID: 10936141.

**PRO:** Ventilator management protocol (VMP) versus control. This article did not focus on sedation vacation intervention, but the use of VMP that used spontaneous breathing trials. Study findings were based on 335 patients from the medical and surgical intensive care units that required mechanical ventilation. **The duration of mechanical ventilation for patients was decreased from a median of 124 hours for the control group to 68 hours in the VMP group (p=0.0001).**

17. Kress J, Pohlman A, O'Connor M, et al. Daily interruption of sedative infusion in critically ill undergoing mechanical ventilation. N Engl J Med. 2000 May;342(20):1471-7. PMID: 10816184.

**PRO:** Sedation interruption versus control. Study focused on 128 adult patients who were receiving mechanical ventilation and continuous infusions of sedative drugs in a medical ICU. In the intervention group, the sedative infusions were interrupted until the patients were awake, on a daily basis; in the control group, the infusions were interrupted only at the discretion of the clinicians in the intensive care unit. **The median duration of mechanical ventilation was 4.9 days in the intervention group, as compared with 7.3 days in the control group (p=0.004), and the median length of stay in the ICU was 6.4 days compared with 9.9 days, respectively (p=0.02). The study group also required less neurological workup to evaluate mental status changes (9% vs. 27% [p<0.02]).** Findings show that daily interruption of sedative drug infusions decreased the duration of mechanical ventilation and the length of stay in the intensive care unit.

18. Brook AD, Ahrens TS, Schaiff R, et al. Effect of a nursing-implemented sedation protocol on the duration of mechanical ventilation. Crit Care Med. 1999 Dec;27(12):2609-15. PMID: 10628598.

**PRO:** Protocol-directed versus non–protocol-directed sedation. Study was focused on 321 adult patients who were admitted into the medical ICU. **The median duration of mechanical ventilation was 55.9 hours (95% CI, 41.0 to 90.0 hours) for patients managed with protocol-directed sedation and 117.0 hours (95% CI, 96.0 to 155.6 hours) for patients receiving non–protocol-directed sedation. Kaplan-Meier analysis demonstrated that patients in the protocol-directed sedation group had statistically shorter durations of mechanical ventilation than patients in the non–protocol-directed sedation group (chi-square=7.00, p=0.008, log rank test; chi-square=8.54, p=0.004, Wilcoxon's test; chi-square=9.18, p=0.003, -2 log test). Lengths of stay in the intensive care unit (5.7 ± 5.9 days vs. 7.5 ± 6.5 days; p=0.013) and hospital (14.0 ± 17.3 days vs. 19.9 ± 24.2 days; p<0.001) were also significantly shorter among patients in the protocol-directed sedation group. Among the 132 patients (41.1%) receiving continuous intravenous sedation, those in the protocol-directed sedation group (n=66) had a significantly shorter duration of continuous intravenous sedation than those in the non–protocol-directed sedation group (n=66) (3.5 ± 4.0 days vs. 5.6 ± 6.4 days; p=0.003). Patients in the protocol-directed sedation group also had a significantly lower tracheostomy rate compared with patients in the non–protocol-directed sedation group (10 of 162 patients [6.2%] vs. 21 of 159 patients [13.2%], p=0.038).**

19. Barr J, Fraser GL, Puntillo K, et al. Clinical practice guidelines for the management of pain, agitation, and delirium in adult patients in the intensive care unit. Crit Care Med. 2013 Jan;41(1):263-306. PMID: 23269131.

**PRO:** Use either a daily sedation interruption or titrate sedative medications to maintain light levels of sedation. Suggest using non-benzodiazepines rather than benzodiazepine infusions for sedation. Use sedation protocols and daily checklists to integrate and to facilitate management of pain, sedation, and delirium in all intensive care unit patients.

20. Patel SB, Kress JP. Sedation and analgesia in the mechanically ventilated patient. Am J Respir Crit Care Med. 2012 May;185(5):486-97. PMID: 22016443.

**PRO:** Consensus guidelines for sedation management for mechanically ventilated patients in the ICU. Sedation and analgesia are important components of care the mechanically ventilated patient in the ICU. Objective assessments of pain, sedation, and agitation have been validated for use in the ICU for assessment and titration of medications. An evidence-based strategy for administering these drugs can lead to improvements in short-and long-term outcomes of the mechanically ventilated patient.

21. Blackwood B, Alderdice F, Burns K, et al. Use of weaning protocols for reducing duration of mechanical ventilation in critically ill adult patients: Cochran systematic review and meta-analysis. BMJ. 2011 Jan 13;342:c7237. PMID: 21233157.

**PRO:** Systematic review. Study focused on 11 RCTs that evaluated the effect of weaning protocols on the duration of mechanical ventilation in 1, 971 critically ill patients in the ICU. Study findings showed that weaning protocol was associated with significant reduction in the mean duration of mechanical ventilation by 25 percent (95% CI 9% to 39%, p=0.006; 10 trials); the duration of weaning was reduced by 78 percent (31%–93%, p=0.009; six trials); and length of stay in the ICU by 10 percent (2%–19%, p=0.02; eight trials).

AHRQ Pub. No. 16(17)-0018-19-EF

January 2017