

Critical Care Nurses' Knowledge of Sedation and Its Management in Mechanically Ventilated Patients at a Tertiary Care Hospital in Pakistan

Samuel MASIH, BSN, MSN,^a Khairunnisa Aziz DHAMANI, RN, RM, BSN, MSN, PhD,^b and Sadia Farhan KHAN, RN, BSN, MSN^c

ABSTRACT

Background: Sedation assessment and management is an essential part of critical care nursing. The patients are at significant risks of undersedation and oversedation. Critical care nurses must possess sufficient knowledge about sedation assessment and its management.

Aim: This study aimed to determine critical care nurses' knowledge of sedation and its management in mechanically ventilated patients in Pakistan. **Methodology:** A cross-sectional descriptive study was conducted. The participants were recruited from three critical care units of a tertiary care hospital using a consecutive sampling technique. Data were collected using a self-administered questionnaire. **Findings:** In total, 91 critical care nurses participated in this study. Most of them had less than 2 years of experience as registered nurses and as intensive care unit nurses. The majority of them had insufficient knowledge (poor knowledge 18.7% and fair knowledge 63.7%), whereas only 17.6% had good knowledge of sedation and its management. The average correct response rate for general knowledge of sedation management practices was 71.3%. Almost half of the participants (51.6%) had poor knowledge of assessing undersedation and oversedation. Overall, 67% of nurses had good knowledge of managing sedative drugs. **Conclusion:** The majority of critical nurses lacked sufficient knowledge related to sedation and its management in mechanically ventilated patients. This poses risks to patients' safety and quality of care.

Keywords: sedation, critical care nurses, mechanical ventilation, knowledge

INTRODUCTION

Critically ill patients in intensive care units (ICUs) require mechanical ventilation as life supporting intervention. Patients on ventilator tend to be agitated, and experience discomfort and pain. Sedatives are used to minimize anxiety, promote tolerance, and achieve the basic goal of mechanical ventilation and disease management (Grap et al., 2012; Riggi & Glass, 2013). Lord (2020) describes that under- or oversedated patients are at risk

of higher complication rates. Therefore, attaining optimal level of sedation for caring for critically ill patients is challenging and complex. However, it is also central to guarantee patients' comfort (Devlin et al., 2008). Previous studies suggested that optimal sedation assessment and management have not been consistently applied in nursing practice which leads to suboptimal or superficial sedation (Dunwoody et al., 2019; Lord, 2020; Shehabi et al., 2012). One of the common factors

^aNursing Manager, Maroof International Hospital, Islamabad, Pakistan. E-mail: samuel_khokhar@hotmail.com

^bAssociate Professor, Shifa College of Nursing, Shifa Tameer-e-Millat University, Islamabad, Pakistan

^cAssistant Professor, Shifa College of Nursing, Shifa Tameer-e-Millat University, Islamabad, Pakistan

for inadequate sedation assessment and implementation among patients in critical care units is nurses' limited knowledge and capacity for sedation management (Dunwoody et al., 2019; Lord, 2020). This study focuses on determining critical care nurses' knowledge of sedation in mechanically ventilated patients (MVPs). By understanding the nurses' knowledge of sedation and its management practices, educational needs of critical care nurses can be identified, along with strategies to upgrade the knowledge on assessment, administration, and management of sedation in ICU (Ramoo et al., 2016). Moreover, these results can inform future areas for research and practice to improve the quality of care.

LITERATURE REVIEW

Potential risks associated with administering higher doses for sedation include, a loss of responsiveness to human contact, respiratory depression, increased length of stay in the ICU and hospital, prolonged mechanical ventilation time, and developing ventilator-associated pneumonia (Tobias & Leder, 2011). On the other hand, under-sedation could lead to risk of self-extubation, patient-ventilator dyssynchrony, increased psychological, and physical stress (Vincent et al., 2016). The primary goal of optimum sedation administration can be achieved by following evidence-based practice guidelines that may be related to a decrease in mechanical ventilation time, ICU and length of hospital stay (Halpern et al., 2014). In 2018, the American College of Critical Care Medicine of the Society of Critical Care Medicine (Delvin et al., 2018) revised and published the clinical practice strategies for using and monitoring sedation in adult ICU to achieve clinical goals. ACCM/SCCM emphasizes the use structured protocols and validated scales in establishing a precise indication of sedation, setting a targeted conscious level, assessing a sedation level, and titrating sedative medications for the aim of attaining lowest effective sedation when making a decision regarding sedation. This prevents the needless deep sedation while administering continuous or intermittent sedatives that delays patient recovery. Hence, using a sedation

protocol is advantageous in inducing adequate sedation in MVP, and in determining patients' sedation needs before the administration of sedative drugs (Abdar et al., 2013)

Despite the use of various protocols and scales, patients may remain under- or oversedated due to the inappropriate management practices of sedation (Hetland et al., 2018). Proper sedation assessment and management for these patients is the key in preventing the adverse outcomes both from undersedation or oversedation (DeBiasi et al., 2015).

Nurses are usually responsible for administering and manipulating sedation according to patient's condition, consciousness level, and treatment plan. Therefore, it is of utmost importance that nurses possess adequate knowledge and expertise to maintain sedation of MVP (Aitken et al., 2009). Literature supports that nurses with a good level of knowledge regarding sedation use in ICU can provide standard care to their patients and contribute to health promotion and maintenance (Varndell et al., 2015). On the other hand, poor knowledge of sedation and its management compromise the quality care and worsen the disease process.

Having an adequate knowledge of sedation and its management is imperative and contributes to effective nursing management of MVP to decrease their agitation and anxiety (Hughes et al., 2012). However, there is lack of research in Pakistani critical care nurses' knowledge of sedation and its management.

METHODS

Design and Setting

A cross-sectional descriptive study design was used. Study was performed at three ICUs (35 beds) of a tertiary care hospital of Pakistan.

Sampling and Sample Size Calculation

All the eligible critical care nurses who had more than 6 months of working experience in ICU during the study period were enrolled in the study

through a nonprobability consecutive sampling technique. Sample size was determined by using online available Open-Epi software. The minimum sample size for the study was 86 with the finite population of 110 with confidence interval 95%, prevalence of average knowledge 60.7% (Ramoo et al., 2016), and absolute precision of 5%. In addition, a 5% increase in sample size to address the nonresponse rate was taken into account.

Data Collection Tool

A self-administered questionnaire was developed by adapting items from previous tools (Guttormson et al., 2010; Mehta et al., 2007; Ramoo, 2016). The questionnaire consisted of three sections. Section-A included demographic information, Section-B had five items related to information on sedation protocol and the sedation assessment scale being used in ICU, and Section-C consisted of 25 items measuring general knowledge of sedation management (10 items), knowledge of assessing undersedation and oversedation (10 items), and knowledge of managing sedative drugs (5 items). Each item was marked on a true or false scale. True items were assigned a score of one and for the false statements it was zero. Six negative items on the scale were scored inversely (false statement carried one score and true got zero). The knowledge levels were categorized as poor knowledge ($\leq 60\%$), fair knowledge (61%–79%), and good knowledge ($\geq 80\%$).

Validity and Reliability of the Tool

Six critical care experts determined the face and content validity of the questionnaire. The calculated content validity index of the questionnaire was 0.90. The experts suggested revising a few items in the tool. As a result, one item with seven subitems on identification of sedation drugs was removed, and two items on under- and oversedation were added. In order to determine the content validity, a four-point Likert scale was used: clarity (1 = not clear, 2 = somewhat clear, 3 = quite clear, 4 = highly clear) and relevance (1 = not relevant, 2 = somewhat relevant, 3 = quite relevant, 4 = highly relevant). Furthermore, pilot-testing of the ques-

tionnaire was performed on 10% of the sample ($n = 10$) size to assess the linguistic or other difficulties.

Data Collection Procedure

An information sheet explaining the study background, purpose, and eligibility criteria were shared with the nurse in charges of critical care units. They were requested to distribute this sheet and posted on notice board of all units. Those participants who wished to participate voluntarily in the study approached the primary researcher directly or through the nurse in charge. Consequently, the questionnaires were distributed to those who expressed interest in participating. A serial code was assigned to each questionnaire at the time of its distribution for maintaining confidentiality of the participants. All the study participants were requested to complete, seal, and drop their data collection forms at least within 72 hours at the unit reception area or call the researcher to collect it. In case the participants needed more time, they were advised to drop their data collection forms before the end of August, 2018. All the data collection forms were checked for completeness and researcher contacted those nurses who wished to complete their forms later.

Ethical Considerations

The study approval was obtained from the Institutional Review Board and the Ethical Committee (IRB & EC) of the hospital. Permission to collect data from the participants was also taken from administration of the hospital. An informed consent was offered to ensure the voluntary participation. There were no known risks involved in this study. Participants were allowed to ask any question related to the study and were informed about the right to withdraw from the study anytime during the study period.

Data Analysis

Descriptive data analysis was done using Statistical Package for the Social Sciences (SPSS, Version 20) and the frequencies of the categorical responses were determined.

RESULTS

Demographic Characteristics

A total of 91 out of 95 critical care nurses (response rate was 95.7%) participated in the study. The internal consistency of the tool was determined (Cronbach's $\alpha = .70$). The mean age and standard deviation of the participants were 26.1 ± 3.1 years; 54.9% were female; and half of them had less than 2 years of ICU experience. Only 19.8% had Diploma in ICU specialization (Table 1).

Table 2 describes the Section B of the questionnaire that contains the information on existence of sedation protocol and sedation assessment scale being used in ICU. The majority of the nurses (96%) were aware about the existence of a sedation protocol. All the participants knew that a sedation assessment scale was being used in their unit and 96% mentioned the Richmond Agitation Sedation Scale (RASS) for sedation assessment and management. More than half of the nurses (59%) had received training on sedation assessment and management as compared to 41% who did not receive any training/education. The frequency of using sedation assessment scale by participants was every 2 (5.5%) or every 4 hours (30.8%), while the 63.7% used sedation scale hourly.

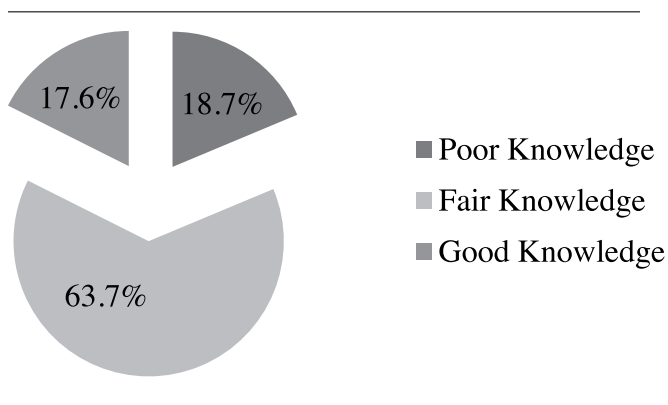
Overall Knowledge Levels Related to Sedation and Its Management

Overall knowledge levels of sedation and its management are reported in Figure 1. Almost two-third (63.7%) of the critical nurses had fair knowledge, 18.7% had poor knowledge whereas only 17.6% nurses had good knowledge of sedation and its management. The mean knowledge score was $17.4 (SD \pm 2.2)$ out of 25. The minimum score obtained by participants was 11 and maximum score was 22.

Knowledge Levels of Three Constructs

According to Table 3, 30.8% nurses reported poor knowledge, 34.1% had fair knowledge, and 35.2% nurses had good knowledge of *sedation management*. On the other hand, 27.5% nurses had good knowledge of *assessing undersedation*

Figure 1. Knowledge levels of sedation and its management.



and oversedation; almost two-third (67%) nurses demonstrated good knowledge of *managing sedative drugs*.

General knowledge levels of sedation management practices are reported in Table 4. All nurses were knowledgeable that sedation providing comfort to patients who are on mechanical ventilator and that its requirements vary. In addition, 70.3% participants did not know that sedation actually contributes to the risk of developing ICU delirium. The average correct response rate related to sedation management was 71.3%. The total score of general knowledge of sedation practices was 10 out of 25 with mean of $7.1 (SD \pm 1)$.

The average correct response rate for items related to undersedation and oversedation was 62.5%. The mean score of undersedation and oversedation was $6.4 (SD \pm 1.7)$ out of total score of 10. Most of the participants (95.6%) responded correctly that oversedation prolongs mechanical ventilation time. Only 45.1% participants knew that the MVPs may be undersedated if they spontaneously move their hands or feet (Table 5).

The participants who had good knowledge of managing sedative drugs were 67%. The average correct response rate of knowledge of managing sedative drugs was 76.9%. The mean score of knowledge of sedative drugs was $3.8 (SD \pm 1)$ from the total score of 5 (Table 6).

TABLE 1. Demographic Information (n = 91)

Variables	Frequency (%)
Gender	
Female	50 (54.9%)
Male	41 (45.1%)
Experience as registered nurse	
< 2 years	45 (50%)
2–4 years	26 (28.9%)
4–7 years	12 (13.3%)
> 7 years	7 (7.8%)
Working experiences of ICU	
2 years	58 (63.7%)
2–4 years	19 (20.9%)
5–7 years	11 (12.1%)
7 years	3 (3.3%)
Highest professional qualification	
Diploma in Nursing	51 (56%)
BSc Nursing	29 (31.9%)
PRN-BSc Nursing	11(12.1%)
MSc Nursing	0
Diploma in ICU specialization	
Yes	18 (19.8%)
No	73 (80.2%)

Note. ICU = intensive care unit.

DISCUSSION

To the best of the researcher’s knowledge this is the first study in Pakistan which assessed nurses’ knowledge of sedation and its management. While considering the low level of nurses’ knowledge, the study findings will help in planning educational interventions for enhancing critical care nurses’ knowledge and skills in sedation assessment and management. Moreover, the study provides a knowledge base for future studies in Pakistan (data on questionnaire, preliminary findings for determination of sample size, and baseline data for comparisons).

An adequate level of critical care nurses’ knowledge of sedation and its management is important to decrease patient’s ventilator time, promote comfort, and relief agitation. The majority of nurses who participated in this study had insufficient knowledge, whereas only few had

good knowledge of sedation and its management. The average correct response rate for general knowledge of sedation management practices was 71.3%. Almost half of the participants had poor knowledge of assessing undersedation and oversedation and 67% nurses had good knowledge of managing sedative drugs.

These findings were contrary to existing studies done in Kenya and Canada (Mehta et al., 2007; Mwangi, 2010) where more than 75% nurses demonstrated very good knowledge of sedation management. These differences may be due to having used more questions addressing knowledge compared to previous studies (current study: 25 questions, compared to 8 questions in previous studies).

In the present study, more than one-third (41%) critical care nurses had not received any

TABLE 2. Nurses' Awareness About Sedation Assessment Scale and Protocol in ICU

Questions	Frequency (%) (n = 91)
Is there any sedation protocol exist in ICU?	
Yes	87 (96%)
No	4 (4%)
Is there any sedation assessment scale exist in ICU?	
Yes	91 (100%)
No	0
What is the name of the sedation assessment scale being used in ICU?	
Richmond Agitation Sedation Scale	87 (96%)
Ramsay Sedation Scale	3 (3%)
Riker Sedation Agitation Scale	1 (1%)
Others	0
Training/education on sedation	
Yes	54 (59%)
No	37 (41%)
Frequency of using sedation scale	
1 hourly	58 (63.7%)
2 hourly	05 (5.5%)
4 hourly	28 (30.8%)

Note. ICU = intensive care unit.

TABLE 3. Knowledge Levels of Three Constructs

Constructs	Knowledge Levels Frequency (%)		
	Poor	Fair	Good
I—General knowledge of sedation management	28 (30.8%)	31 (34%)	32 (35.2%)
II—Knowledge of assessing under-and oversedation	47 (51.6%)	19 (20.9%)	25 (27.5%)
III—Knowledge of managing sedative drugs	30 (33%)	0	61 (67%)

training on assessing sedation and its management practices and most of the nurses (56%) had a diploma in nursing. In Pakistan, many diploma prepared nurses are trained in the hospital under an apprenticeship model (Gul, 2008). It is possible that they are receiving limited theoretical knowledge about nursing practice standards and care protocols. Therefore, a low level of knowledge regarding sedation assessment and its management could be attributed to the education level of the nurses. In the present study, majority of the nurses (63.7%) had less than 2 years of critical care

experience. O'Connor et al. (2010) reported that the level of ICU experience of nurses and doctors affects sedation management during care provision to the patients on ventilator. Therefore, less experience of nurses in this study may have contributed to poor level of knowledge.

In this study, the majority of the participants (96%) were aware of the availability of the sedation protocol and sedation assessment scale (RASS) in their units, but there were variations in its utilization. For example, the frequency of using

TABLE 4. Responses on Statements Related to General Knowledge of Sedation Management

Item #	Statements	Correct f (%)	Incorrect f (%)
01	Sedation is essential for the comfort of mechanically ventilated patients.	91 (100%)	0
02	Sedation requirement varies among mechanically ventilated patients.	91 (100%)	0
03	Deciding the choice of sedative to be administered should be based on the assessment of patient's needs.	88 (96.7%)	3 (3.3%)
04	Sedation reduces the risk of developing ICU delirium.*	27 (29.7%)	64 (70.3%)
05	All intubated patients should be sedated because being on the ventilator is stressful to patients.*	30 (33%)	61 (67%)
16	Moderate sedation indicates that patient is not easily aroused but purposely responds to physical stimulation.*	7 (7.7%)	84 (92.3%)
17	All intubated patients should be sedated because caring patients on ventilator is uncomfortable to nurses.*	60 (65.9%)	31 (34.1%)
18	Sedation given through a standard protocol assists nurses to determine sedation effectiveness.	88 (96.7%)	3 (3.3%)
19	A nurse-regulated sedation protocol helps to decrease the length of mechanical ventilation.	86 (94.5%)	5 (5.5%)
20	Interruptions in sedative infusions on daily basis indicate a reduction in length of mechanical ventilation.	81 (89%)	10 (11%)

*negatively worded statements.

sedation assessment scale by almost one-third of the participants was every 2 (5.5%) or every 4 hours (30.8%), while the 63.7% used it every hour. In a study done in hospitals of Belgium (Sneyers et al., 2014), the frequency of using sedation assessment scales varied too; some of them used it less than three times a day and majority of the respondents used them less than six times daily (17% and 53% respectively). A multidisciplinary team of physician, nurses, and pharmacist established the hospital-wide guidelines for sedation management. They emphasized to use RASS on MVP for assessment and documentation every 2 hours (DeGrado et al., 2011).

In this study, general knowledge of sedation management practices was lacking among one-third of the nurses. Mwangi et al. (2014) also found similar practice gap in nurses related to sedation management. In addition, all of the participants answered that sedation was essential for comfort and its requirement varied among MVP. This finding is consistent with another study (Guttormson

et al., 2019; Guttormson et al., 2010) in which respondents indicated that sedation is necessary for comfort of the patients in ICU, but also during intubation procedure. Similarly, a study (Hetland et al., 2018) explored the views of their study participants who verbalized that sedation is required for the comfort of intubated patients (Guttormson et al., 2019) and it permits effective mechanical ventilation.

In the present study, many nurses (70.3%) demonstrated knowledge deficit regarding the role of sedation in ICU delirium. They did not know that sedation is a risk factor for delirium. Similarly, in a study (Devlin et al., 2008), nurses were infrequently evaluating ICU delirium in sedative patients because 40% nurses responded that they were not sure about their units' sedation assessment protocol specify the assessment of delirium, and they prefer to use antipsychotic medications for delirium because they thought sedation lessens the ICU delirium-related symptoms such as hallucinations or paranoia. In addition, nurses

TABLE 5. Responses on Knowledge of Assessing Under and Oversedation

Item #	Statements	Correct f (%)	Incorrect f (%)
06	Patients on ventilator are undersedated if they are reaching for their endotracheal tube or lines.	70 (76.9%)	21 (23.1%)
07	Intubated patients are undersedated if they are spontaneously moving such as their hands and/or feet.*	41 (45.1%)	50 (54.9%)
08	Undersedated patients may have increased heart rate or blood pressure.	53 (58.2%)	38 (41.8%)
09	Mechanically ventilated patients are considered undersedated if they move their trunk or lifting their legs off the bed.	61 (67%)	30 (33%)
10	Intubated patients are considered undersedated if a ventilator alarms frequently due to patient ventilator dysynchrony.	70 (76.9%)	21 (23.1%)
11	Intubated patients can be tachypneic because of undersedation.	50 (54.9%)	41 (45.1%)
12	Duration of mechanical ventilation can be prolonged with oversedation.	87 (95.6%)	4 (4.4%)
13	Mechanically ventilated patients are oversedated if they do not have a cough reflex with suctioning.	50 (54.9%)	41 (45.1%)
14	Mechanically ventilated patients are oversedated if they respond only to noxious stimuli such as suctioning or nail bed pressure.	58 (63.7%)	33 (36.3%)
15	Mechanically ventilated patients are considered oversedated if they do not follow simple commands.	46 (50.5%)	45 (49.5%)

*negatively worded statements.

TABLE 6. Responses on Knowledge of Managing Sedative Drugs

Items #	Statements	Correct f (%)	Incorrect f (%)
21	Midazolam should be used cautiously because it can accumulate and extend sedative effects in obese patients.	62 (68.1%)	29 (31.9%)
22	Midazolam should be used cautiously because it can accumulate and prolong sedative effects in renal compromised patients.	62 (68.1%)	29 (31.9%)
23	Opioids, benzodiazepines, and Propofol have a potential to cause withdrawal effects after use of approximately 7 days of continuous therapy when administered in high doses.	77 (84.6%)	14 (15.4%)
24	Hypertension is a common side effect of Propofol.*	77 (84.6%)	14 (15.4%)
25	Effects of oversedation can be reversed by Flumenazil.	72 (79.1%)	19 (20.9%)

*negatively worded statements.

(28%) were not sure to assess delirium when performing sedation assessment. In another study (Christensen, 2016), only 49% of nurses were confident in recognizing ICU delirium among sedative patients. Likewise, ICU nurses in Jordan

also lacked the knowledge of recognizing the ICU delirium (AbuRuz, 2016).

The majority of participants in the study responded correctly that protocols helps nurses

in sedation administration and that nurse-implemented sedation protocols contribute to decreasing the length of mechanical ventilation (96.7% and 94.5% respectively). These findings were in line with an earlier study in Canada (Mehta et al., 2007), where 84.3% of respondents mentioned that sedation protocols were extremely valuable for their professional practice and 85.3% affirmed that they were important in reducing the duration of mechanical ventilation for critically ill patients.

In the present study, almost half of the participants demonstrated poor knowledge related to assessing undersedation and oversedation in MVP (51.6%). Similar knowledge rate (67.5%) for undersedation and oversedation assessment was identified in an African hospital (Mwangi et al., 2014). This may occur due to the lack of awareness and utilization of sedation assessment instruments such as RASS and sedation protocol (Gurudatt, 2011). Therefore, it is desirable that standardized protocols in ICUs can possibly enhance the effective assessment and management of sedation.

In the present study, 67% of nurses demonstrated good knowledge of managing sedative drugs. It can be inferred from the findings that ICU nurses have acceptable level of knowledge about adverse effects and cautionary use of sedative drugs. These findings are consistent with other studies (Faria & Cassiani, 2011; Hughes et al., 2012). In contrast, a study in United States (Guttormson et al., 2010) reported the attitudes of ICU nurses where 48% intended to sedate all the MVP directly without considering contraindications.

Limitations

The study was conducted in a private hospital, which is believed to have better facilities in the ICUs compared to other public and private hospitals. Therefore, the findings may not be generalized to other hospitals in the country. Moreover, this study only provided a cross-sectional view of nurses' knowledge. Therefore, future

studies should be conducted to explore the changes in nurses' knowledge of sedation and its management over time as education and experience levels increase. The face and content validity of the questionnaire were determined, but a complete robust psychometric testing needs to be performed. The study merely offered description of nurses' knowledge and no inferential statistics were used due to small sample, nonrandom sampling, and use of categorical response set in the data collection instrument. Therefore, the findings can only be used as baseline for further research.

Implications for Nursing

The findings have demonstrated that the adequate level of knowledge related to sedation assessment and management is critical to provide timely and appropriate care to patients on mechanical ventilation. The study findings may assist nursing management including head nurses and nurse managers of critical care units to ensure a proper orientation and training of nurses before they practice independently in the ICUs. It is also important to include some content related to sedation assessment and management in nursing curricula in year 4 of BScN (Bachelor of Science in Nursing) program when students are placed in the ICUs. There is need to carry out multicenter studies to identify the perceived barriers and practices that limit nurses to apply knowledge of sedation and its management in ventilated patients.

CONCLUSION

The majority of critical nurses lacked knowledge related to sedation and its management in MVPs. This poses a risk to patients' safety and the quality of care. Therefore, adequate levels of knowledge are critical for ICU nurses to provide timely and appropriate care to patients. If sedation scales are available in ICU then their use must be standardized. The frequency of using sedation assessment scale should be determined to standardize care. Physicians and nurses should collaboratively take responsibility of shaping sedation protocol.

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