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# RAMSAY Sedation Scale and Richmond Agitation Sedation Scale (RASS): A Cross Sectional Study

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## Abstract

**Background:** Many sedation scales and tools have been developed and compared for validity in critically ill patients.

**Objective:** The aim of this study is to compare the reliability of two sedation scales; RAMSAY sedation scale and Richmond Agitation Sedation Scale (RASS) in the adult intensive care unit.

**Methods:** 290 patients in intensive care unit were recruited for the study and were independently assessed for sedation effect by investigator and bedside nurses simultaneously using RAMSAY scale and RASS scale.

**Results:** Agreement between the nurse and researcher scores on RAMSAY scale (weighted  $\kappa=0.449$ ,  $p<0.001$ ) indicating weak level of agreement. Agreement between the nurse and researcher on RASS scale (weighted  $\kappa=0.879$ ,  $p<0.001$ ) indicating strong level of agreement. Cronbach's alpha analysis showed that 10 items of RASS had excellent level of internal consistency ( $\alpha=0.989$ ) compared to good level of internal consistency of RAMSAY scale ( $\alpha=0.828$ ).

**Conclusion:** RASS showed excellent inter-rater agreement compared to weak inter-rater agreement of RAMSAY scale. The results also support that RASS has consistent agreement with clinical observation and practice among different observers. The results suggest that use of RASS is linked to more reliable assessment of sedation levels in the ICU.

**Keywords:** Sedation; Sedation scale; RAMSAY sedation scale; Richmond Agitation Sedation Scale (RASS)

## Introduction

Patient anxiety, restlessness, agitation, aggressiveness and pain are among the most common reasons to start sedation and analgesia for critically ill patients [1,2]. Maintaining of patient care-devices is an additional reason. Sedation aims to promote patient tolerance and adaptation to tracheal intubation and mechanical ventilation, in addition to enhance daily care and nursing procedures in the Intensive Care Unit (ICU) [2-4]. A systemic review study evaluated the sedation practice and its impact from 82 study, it showed that proper use of sedation can improve patient outcomes and optimize resource usage; this includes reduction in duration of mechanical ventilation days, reduction in weaning duration, reduced length of stay in the ICU, reduction in hospital stay [5]. Yet the optimal sedation practice varies among different ICUs worldwide [2,6]. Sedative agents and targeted sedation level may vary according to the individual medical condition of patients and their treatment needs [7]. While some patients in the ICU need deep sedation, still there are some other patients needed light or no sedation [2].

Although the clinical benefits of sedation and analgesia in ICU are enormous, still its use is associated with significant adverse effects and complications. Many studies showed that excessive use of sedation in ICU is associated with prolonged stay, prolonged mechanical ventilation and risk of infection and mortality rate [8-10]. Patients who are inadequately sedated resist assisted mechanical ventilation and might attempt to harm themselves by removing invasive devices or attempting unplanned self extubation [8,11,12].

Therefore, it is very important to titrate sedation level according to desired patient outcomes and targeted patient response. The evaluation of sedation adequacy is a bedside maneuver, in which nurse's assessment is critical, as he or she often observes any variation from an optimal or targeted level of sedation [2]. The use of sedation scales to target proper sedation level has been linked to decreased use of sedatives, analgesic and inotropic agents, decreased ventilation hours in

critically ill patients, and decreased risk for delirium for critically ill patients [13-18]. Typically, sedation scales are used to titrate sedative drugs appropriately. Many instruments for measuring the level and effectiveness of sedation in adult had been developed [19]. De Jonghe et al. [10] had reviewed 25 studies discussing 25 tools to assess sedation effectiveness in the ICU. RAMSAY sedation scale (RSS), was introduced in 1974 to help in titrating sedation to a targeted outcome [20]. Subsequently, many scales and tools have been developed and compared for validity [21,22]. Riker Sedation Agitation Scale (SAS) [23,24], Richmond Agitation Sedation scale (RASS) [24] in addition to other used scales. Studies showed that both (RASS) and RSS have excellent inter-rater reliability and validity beside the feature of "easy to use" by nurses [23,25-29]. We conducted this study to compare the reliability of RAMSAY sedation scale and (RASS) in the adult intensive care unit.

## Methodology

This is a cross-sectional study that was carried out between April 2017 and March 2018. A total number of 290 ICU who had met the inclusive criteria were recruited for the study and were independently assessed for sedation effect by investigator and bedside nurses. Sedation scoring was performed as standard care for sedated patients using RAMSAY scale. Bedside nurses were requested to score the patient sedation level on additional sedation scales (i.e., RASS). The bedside nurse and investigator were approaching the patient simultaneously, concurrent and separate scoring was measured and recorded by the investigator to validate bedside nurse ranking and define any variation in scoring between bedside nurse and investigator (if present). Bedside and RASS) with related competency approved according to the guidelines provided in original tools, **Figures 1 and 2**.

IRB was approved for this study. Inclusive criteria included: all ICU patients who spent at least 24 hours in the ICU and older than 14 years old. Exclusion criteria were patients with structural or metabolic neurological deficit (as identified by documented medical diagnosis on patient's file). Informed consent had been obtained from each patient guardian/relative.

Ramsay Sedation Scale	
Score	Definition
1	Anxious and agitated or restless or both
2	Cooperative, oriented, and tranquil
3	Responds to commands only
4	Brisk response to a light glabellar tap or loud auditory stimulus
5	Sluggish response to a light glabellar tap or loud auditory stimulus
6	No response to a light glabellar tap or loud auditory stimulus

Performed using a series of steps: observation of behavior (score 1 or 2), followed (if necessary) by assessment of response to voice (score 3), followed (if necessary) by assessment of response to loud auditory stimulus or light glabellar tap (score 4 to 6) [35].

**Figure 1** RAMSAY sedation scale [14].

Score	Term	Description
4	Combative	Overtly combative or violent; immediate danger to staff
3	Very agitated	Pulls on or removes tube(s) or catheter(s) or has aggressive behavior toward staff
2	Agitated	Frequent nonpurposeful movement or patient-ventilator dyssynchrony
1	Restless	Anxious or apprehensive but movements not aggressive or vigorous
0	Alert and calm	
-1	Drowsy	Not fully alert, but has sustained (more than 10 s) awakening, with eye contact, to voice
-2	Light sedation	Briefly (less than 10 s) awakens with eye contact to voice
-3	Moderate sedation	Any movement (but no eye contact) to voice
-4	Deep sedation	No response to voice, but any movement to physical stimulation
-5	Unarousable	No response to voice or physical stimulation

**Figure 2** Richmond agitation sedation scale [25].

## Setting

The research was conducted in the ICU of King Saud Medical City (KSMC) which has 120 ICU bed capacities. The ICU in KSMC provides care for different categories of critically ill patients who need comprehensive stabilization. On average, 196 patients are admitted every month. Around 100 patients are receiving care in ICU every day; 50-60 patients-on average-is connected to assisted mechanical ventilator and may need certain amount of sedation based on clinical decision.

## Sampling technique

Cross sectional design was used for selecting the patient's enrollment in the study. All newly admitted patients who were admitted from the first day of the month during the study period and had met the inclusive criteria were recruited for the study.

## Statistical analysis

SPSS (version 21) program was used for analysis. Descriptive study factors were expressed with N (%) for categorical variables, and mean  $\pm$  SD for continuous variables. To test criterion validity, Spearman's correlation coefficient was computed to compare scores of RAMSAY and (RASS) between bedside nurse and investigator. Bedside nurse and investigator's scoring were compared using an equally weighted Cohen's kappa coefficient.

## Results and Discussion

290 patients were recruited in the study, **Table 1** shows summary of patients demographic and clinical characteristics. 70.7% of patients are male and 29.3% are female. The patients

mean (SD) age was 48.5 (1.03), ranged from 22-85 years and median was 52 years. 168 (57.9%) patients were on assisted mechanical ventilation when received sedation. Out of 290 patients encountered, 137 (47.2%) patients received sedation during the first 24 hours of admission. Sedation administration as infusion was the most common mode of administration (38.6%). Out of 136 sedated patients, 64 patients (22.1%) did not receive sedation vacation. The mean (SE,SD) RAMSAY scores were 3.96 (0.099, 1.16) and 3.85 (0.12, 1.44) for the nurses and researcher, respectively. The mean (SE,SD) (RASS) scores were -2.03 (0.14,2.41) and -2.05 (0.14,2.44) for the nurses and researcher, respectively.

**Table 1** Summary of patient’s demographic and clinical characteristics.

		N (%)
Gender	Male	205 (70.7)
	Female	85 (29.3)
Assisted Mechanical Ventilation	Yes	168 (57.9)
	No	122 (42.1)
Sedated ( in prior 24 hours)	Yes	137 (47.2)
	No	153 (52.8)
Mode of Sedation	Infusion	113 (38.9)
	Intermittent	10 (3.4)
	Mixed	14 (4.8)
	Not on Sedation	153 (52.8)
Sedation Vacation	Yes	37 (12.7)
	No	64 (22.1)
	Not applicable	36 (12.4)
	Not on Sedation	153 (52.8)

**Tables 2 and 3** show the frequency of scoring for nurses and researcher on both RAMSAY scale and (RASS).

**Table 3** Comparison between frequency of nurses and researcher scoring on RASS levels (n=290).

(RASS) Scoring	Unarousable -5	Deep Sedation -4	Moderate Sedation -3	Light Sedation -2	Drowsy -1	Alert and Calm 0	Restless +1	Agitated +2	Very Agitated +3	Combative +4
Nurse	48 (16.6)	69 (23.8)	33 (11.4)	13 (4.5)	21 (7.2)	73 (25.1)	8 (2.8)	10 (3.4)	13 (4.5)	2 (0.7)
Researcher	51 (17.6)	70 (24.1)	29 (10.0)	14 (4.8)	19 (6.6)	72 (24.8)	10 (3.4)	8 (2.8)	16 (5.5)	1 (0.4)

## Discussion

RASMAY has been used since many years to assess level of sedation in ICUs [20]. RASS has been used internationally in many ICUs and developed to enhance simplicity, clarity and ease of use [25-28]. In this study, RASS has shown excellent inter-rater agreement (weighted  $\kappa=0.879$ ,  $p<0.001$ ) compared to weak inter-rater agreement of RAMSAY scale (weighted

Among nurses scoring on RAMSAY scales, 89.8% scores were in the sedation range, 3.6% scores were in the agitation range and 6.6% scores were in the cooperative and oriented score; score=0. Among researcher RAMSAY scores, 83.2% were in the sedation range, 8.8% were in the agitation score; score=1, and 8.0% were cooperative and oriented; score=2 (**Table 2**). Results showed strong association in RAMSAY scale score between nurses researcher (Pearson Chi-Square=206.52,  $p<0.001$ ). Among nurses (RASS) scores, 63.5% were in the sedation range, 11.4% were in the agitation range and 25.1% were zero. Among researcher (RASS) scores, 63.1% were in the sedation range, 9% were in the agitation range, and 27.9% were zero (**Table 3**). There was strong association in (RASS) score between nurses and researcher (Pearson Chi-Square=1854.09,  $p<0.001$ ).

Agreement between the nurse and researcher scores on RAMSAY scale (weighted  $\kappa=0.449$ ,  $p<0.001$ ) indicated weak level of agreement. On the other hand, Agreement between the nurse and researcher RASS scores (weighted  $\kappa=0.879$ ,  $p<0.001$ ) indicated strong level of agreement. Internal consistency was tested for both tools. Cronbach’s alpha analysis showed that 10 items of RASS had “excellent” level of internal consistency ( $\alpha=0.989$ ) compared to “good” level of internal consistency of RAMSAY scale ( $\alpha=0.828$ ).

**Table 2** Comparison between frequency of nurses and researcher scoring on RAMSAY scale levels (n=137).

RAMSAY Scoring level	1	2	3	4	5	6
Nurse	5 (3.6)	9 (6.6)	23 (16.8)	65 (47.4)	20 (14.6)	15 (11.0)
Researcher	12 (8.8)	11 (8.0)	25 (18.2)	49 (35.8)	17 (12.4)	23 (16.8)

$\kappa=0.449$ ,  $p<0.001$ ). The results also support that RASS has consistent agreement with clinical observation and practice among different observers [25-27].

RAMSAY scale had been originally developed to be used only for sedated patients to monitor level of sedation [14]. The fact that the RASS has an expanded set of clinically relevant scores for tracking both agitation and sedation, makes it well suited for better understanding of both states (sedation and

agitation) [27]. Unlike other sedation scales that describe only the level of sedation, RASS can be used for all hospitalized patients to describe agitation, alertness and sedation level [27]. RASS can be used to assess responsiveness even in patients who are not receiving sedatives [30]. In addition, RASS can help in applying other clinical tools. RASS is the first step in describing ICU delirium using Confusion Assessment Method in the ICU (CAM-ICU), validated tool for delirium assessment among critically ill patients in ICU [31]. RAMSAY scale has limited ranking for agitation status and levels of restlessness; one score only describes agitation [14]. Since RASS can be used for all patients (regardless on sedatives or not) bedside nurses can continuously observe for patient's awareness and recognize for both types of delirium; hyperactive and hypoactive [30].

In our hospital, we adopted RASS to replace RAMSAY scale in order to control sedation practice in a better way. Medical and Nursing teams had received extensive program of awareness and training. Doctors are assessing patients on daily basis and determine the "target RASS score" for each patient according to his/her clinical condition. The bedside nurses are monitoring patients and record each patient's score on RASS at least every four hourly, bedside nurses are titrating sedatives to achieve target RASS score accordingly. Furthermore, using RASS has been linked to start observing delirium in our ICU populations. CAM-ICU has been started concurrently in our ICU with start using of RASS.

## Conclusion

In this study, RASS showed excellent inter-rater agreement compared to weak inter-rater agreement of RAMSAY scale. The results also support that RASS has consistent agreement with clinical observation and practice among different observers. The results suggest that use of RASS is linked to more reliable assessment of sedation levels in the ICU.

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