Transition Probability Towards Target Richmond Agitation Sedation Scale Scores at a Single Neurological Intensive Care Unit

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Introduction

Proper sedation is an important factor for minimizing mortality and length-of-stay in the ICU. Previous studies have shown a correlation between heavier sedation and increased risk for mortality. Our overall study goal is to validate wrist accelerometers in optimizing sedation rates in the ICU. In this substudy, we investigated the patterns between target Richmond Agitation Sedation Scale (RASS) score and observed RASS score.

Methods

IRB approval was obtained for this study. Patients requiring mechanical ventilation in the neuroICU at the University of Minnesota were screened and enrolled as part of a larger study investigating the use of wireless accelerometers in the management of ICU sedation. RASS scores were collected from nursing assessments. Mean RASS scores with standard deviations were calculated across patients. Probability for the RASS score to transition change at the subsequent time point was calculated and examined. The K-S test was used to compare transitional probabilities.

Results

10 patients in the neuroICU were enrolled who were status-post neurosurgical interventions. Target RASS score was -1 for all patients based on standard of care for their diagnoses. The mean deviation from target RASS score across all patients was -1.8465 points. Each RASS score had the highest probability of staying the same from one time point to the next with an overall trend towards transitioning to a lower score (Table 1).
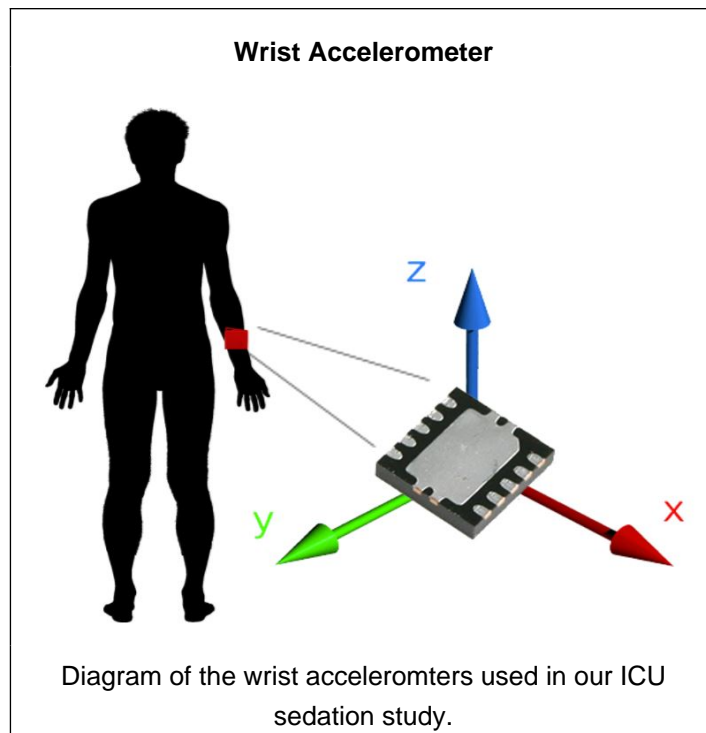
Wrist Accelerometer

Diagram of the wrist acceleromters used in our ICU sedation study.

Table 1

RASS Score Transition Probabilities

Initial RASS score	RASS score *transitioned to*										
	-5	-4	-3	-2	-1	0	1	2	3	4	5
-5	0.727	0.042	0.049	0.007	0.063	0.056	0.049	0.007	0	0	0
-4	0.083	0.725	0.046	0.009	0.046	0	0.073	0.009	0	0.009	0
-3	0.111	0.178	0.556	0.022	0.022	0.044	0.044	0.022	0	0	0
-2	0.08	0.04	0.08	0.56	0.08	0.08	0.04	0.04	0	0	0
-1	0.131	0.098	0.016	0.049	0.492	0.148	0.049	0	0	0.016	0
0	0.229	0	0.086	0.057	0.2	0.286	0	0	0	0	0
1	0.163	0.163	0.047	0.023	0.14	0.07	0.372	0.023	0	0	0
2	0	0.2	0	0.2	0.2	0.2	0.2	0	0	0	0
3											
4	0	0.5	0	0	0	0	0.5	0	0	0	0
5											

Transition probabilities for RASS scores collected on 10 enrolled patients. Read as the probability that the RASS score in the row will transition to the score in the column for the next observation recorded in the chart.

Conclusions

At our center, patients were consistently rated at a lower RASS score than their target and were more likely to have their score decrease over time. Transition probabilities should indicate that patients will trend towards the goal RASS. However, several possibilities exist for why this may not be observed including difficult to control sedation and poor communication about goals. These results highlight a significant opportunity for an automated system to measure the level of sedation to optimize patient outcomes. The beginnings of such a system are currently being evaluated at our center. We have started experimentally using wrist accelerometers to correlate movement to sedation levels in the ICU with the hope that they will one day replace the subjective RASS score.

Learning Objectives

By the end of this session, participants should be able to:

1. Describe the role of RASS scores in managing sedation levels in the ICU.
2. Understand some of the issues arising from using RASS scores.
3. Discuss possibilities for improving sedation management in the ICU.

References

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Darrow D, Peterson N, Ladd B, Quinn C, Grande A. Prediction of Sedation Score Using Wireless Accelerometers. Journal of Neurotrauma. June 2016, 33(13): A-1-A-139.