

THESIS

PREDICTING OCCUPATIONAL THERAPY SERVICE UTILIZATION IN AGITATED OR
SEDATED PATIENTS IN THE NEUROCRITICAL CARE UNIT

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ABSTRACT

PREDICTING OCCUPATIONAL THERAPY SERVICE UTILIZATION IN AGITATED OR SEDATED PATIENTS IN THE NEUROCRITICAL CARE UNIT

Purpose: The extent by which patient arousal levels relate to occupational therapy (OT) utilization in the neurocritical care unit (NCCU) is unknown. Understanding how arousal levels in patients influence their ability to engage with OT interventions will better equip therapists to provide appropriate treatments to patients. This study sought to examine whether the Richmond Agitation and Sedation Scale (RASS) is independently associated with OT service utilization.

Methods: This cross-sectional retrospective study utilized data obtained from electronic health records from 1,134 patients admitted to the neurocritical care unit at an academic acute care hospital between May 2013 and September 2015. Separate regression models identified the predictive ability of the RASS and other patient factors in relationship to the dependent variables of receipt of OT in the neurocritical care unit (NCCU) and OT intervention categories. The independent variable was initial RASS score. Covariates included patient age, gender, minority status, Charlson Comorbidity Index, and initial Glasgow Coma Scale (GCS). OT intervention categories were: (1) self-care/home management, (2) functional-cognitive, and (3) therapeutic exercise.

Results: 420 patients received OT in the NCCU (37.0%). The initial RASS score was not a significant predictor of receipt of OT, however, higher initial GCS and CCI scores and patient age were associated with greater odds of receiving OT. The initial RASS score was not a

significant predictor of OT intervention type Higher CCI and initial GCS scores and increased patient age were associated with greater odds of receiving therapeutic exercise intervention. Increased initial GCS score was found to be associated wither greater odds for receiving self-care/home management interventions. Higher patient age was found to be associated with a higher odd of receiving functional-cognitive interventions.

Conclusion: The initial RASS score was not a significant predictor of OT receipt or intervention type, suggesting that there may be other factors that are more influential for therapists to use for clinical reasoning. There could be a need for a different measures or education on potential OT roles related to different on patient arousal levels.

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INTRODUCTION

Many neuro-critical care unit (NCCU) patients experience arousal impairments; these altered arousal states may manifest as agitation or sedation. Agitation is experienced by about 70% of patients at least once during their critical care unit stay (Paul & Paul, 2013). Agitation can manifest as excessive motor activity including aggressive behaviors, such as tube and catheter removal (DeBiasi, Akgun, & Pisiani, 2015; Mansouri, 2013). Medical providers may combat agitation in NCCU patients with sedation techniques to decrease combative behaviors (Mansouri et al, 2013), however, over-sedation is a problem for many patients (Hughes, McGrane & Pandhairpande, 2012). When sedation is used to treat agitation, other risks can be a concern for patients, including higher risk of delirium, sleep disturbances, and intensive care unit acquired infections (Roberts, Haroon, & Hall, 2012). Besides treating agitation, other common reasons for a patient to be sedated include the presence of severe traumatic brain injury, hypertension, and hemodynamic instability (Roberts, Haroon, & Hall, 2012). Agitated and sedated states can make engagement difficult, including interactions with care providers and participation in treatment (European Delirium Association & American Delirium Society, 2014). Sedated or agitated patients may be at higher risk for poorer health outcomes and have limited opportunity to meaningfully engage in treatment during a NCCU stay.

Traditionally, the critical care unit has been viewed as a setting designed to stabilize physiologic conditions and prevent death in patients. However, there is a growing body of evidence suggesting that increased rehabilitation services providing early mobility in the critical care unit is beneficial for patients. Although rehabilitation services within the NCCU are challenging in patients with impaired arousal, existing literature suggests that early mobilization can increase a patient's muscle strength and functional mobility (Adler & Malone, 2012). While early mobilization is successful, it is a simple intervention provided in the critical care unit

setting. Occupational therapy (OT) is a specific rehabilitation service that can provide more complex interventions that enhance and enable participation in roles, habits, and routines through the therapeutic use of everyday life activities to some NCCU patients (American Occupational Therapy Association, 2014). Within the NCCU, occupational therapists can work with a wide range of patients who have arousal deficits. OT provides interventions including early mobility, positioning, cognitive stimulation, upper extremity exercise and range of motion, as well as training in activities of daily living (ADL) (Weinreich, Herman, Dickason & Mayo, 2017). These services provided by OT can decrease delirium and sedative use, improve strength and function and shorten lengths of stay (Weinreich, Herman, Dickason & Mayo, 2017).

There are two limitations inhibiting current understandings of the relationship between patients' arousal states and OT utilization. First, we lack analysis of this relationship that accounts for other important patient factors such as age, race/ethnicity, gender, comorbidities, and level of consciousness.. Second, prior research has examined non-critical care unit patients (i.e., in other hospital units or in post-acute care) and OT service utilization. There is little information about what OT services look like within the critical care unit, specifically the NCCU – including what influences the receipt of OT and what interventions are used. Thus, research is needed to understand the relationship between arousal levels and receipt of OT, as well as what OT interventions are provided to agitated or sedated patients in the NCCU. This study aimed to address these gaps by analyzing and identifying the relationships between patient factors, arousal levels and OT services within the NCCU. This study aimed to answer two questions: (1) Is the initial Richmond Agitation and Sedation Scale (RASS) score predictive of the receipt of OT within patients in the NCCU? (2) Is the initial RASS score predictive of the type of intervention provided by OT services within the NCCU?

METHODS

Design

We conducted a retrospective cross-sectional study of de-identified patient data to explore OT service utilization and interventions in the NCCU in relationship to patient arousal levels. The hospital that provided the data was an urban, large academic hospital. The average census for this unit was 21.4 patients and the NCCU had one full-time occupational therapist. Data were obtained from electronic health records (EHR) on adults admitted to the NCCU between May 2013 to September 30, 2015.

Data Collection

A single person extracted, checked for completeness and validated administrative data and data from OT flow sheets. From these sheets, patient factors were determined to be the independent variables for this study. These included: initial Richmond Agitation and Sedation Scale (RASS) score, patient age, gender, minority status, Charlson Comorbidity Index (CCI), and initial Glasgow Coma Scale (GCS) score. Research question one sought to identify the predictive ability of the initial RASS score in relation to the receipt of OT. Research question two sought to identify the predictive ability of the initial RASS score in relation to the type of OT intervention a patient received during their stay in the NCCU. Three intervention categories were identified as: (1) self-care/home management, (2) functional-cognitive, and (3) therapeutic exercise/sensorimotor/modalities. Dichotomous variables included receipt of OT (yes/no), patient gender, minority status (yes/no), and if they were billed for the 3 intervention categories (yes/no). Continuous variables included the initial RASS, GCS and CCI scores.

The RASS is an assessment used in the neurological intensive care unit to determine levels of agitation and sedation in patients. The RASS is scored on a ten-point scale ranging from

-5 to +4 (Sessler et al, 2002). The negative scores are associated with levels of sedation, with -5 being unarousable and -1 being drowsy. A score of zero is given to patients who are calm and alert, and positive scores are given to patients who are agitated, with +1 denoting restlessness and +4 indicating combativeness (Sessler et al, 2002). The RASS is performed by clinicians in the NCCU to ensure that patients are being kept comfortable and safe by receiving the correct amount of sedative medications. The RASS is observation based, and scores are assigned based on the level of eye contact and alertness that is seen in a patient (Sessler et al, 2002). The RASS has been found to have high inter-rater reliability and validity across multiple types of intensive care units (medical, surgical, cardiac, coronary and neurological) (Sessler et al, 2002).

To score the RASS, a practitioner observes the patient. Patients are given a score of zero if a practitioner observes a patient to be alert and calm (Sessler, Grap, Brophy, O'Neal, Keane, Tesoro, & Elswick, 2002). The next thing a clinician will observe is signs of agitation or restlessness within the patient; if a patient is demonstrating any signs of agitation, they will receive a positive score. If a patient not alert, the clinician will state the patient's name and direct them to open their eyes. A negative score will be assigned to the patient based on the length of eye contact sustained once the patient is aroused (Sessler, Grap, Brophy, O'Neal, Keane, Tesoro, & Elswick, 2002). Patients who are unresponsive to the instructions given to them, the practitioner will shake the patient's shoulders and rub the sternum. A score of either -4 or -5 will be assigned based on if a patient moves in response to physical stimulation (Sessler, Grap, Brophy, O'Neal, Keane, Tesoro, & Elswick, 2002).

The CCI is a validated index created to measure comorbid disease via assessing the risk of 1-year mortality for 17 defined clinical conditions (Sundararajan, Henderson, Perry, Muggivan, Quan, & Ghali, 2004). It is associated with mortality within the critical care unit

(Brazzarola, Rueda, Cardozo-Diaz, Wexler, Katarzyna, Dorn, Sorab, & Loganathan, 2018) and was used as an indicator of illness severity in this study. The GCS is a reliable and validated tool that assesses motor, verbal and eye responses of critically ill patients to assess their level of consciousness (Reith, Synnot, Physio, van den Brande, Gruen, & Maas, 2017). For, the initial GCS was used as an indicator of consciousness, which could be influential on the types of therapy interventions that patients were able to participate in.

Statistical Analysis

Patient characteristics and OT services were summarized with descriptive statistics (Table 1). Independent sample t-tests were used to compare initial RASS scores between the following groups: those who received OT/did not, minority/non-minority status, female/male, those who received self-care/home management interventions versus those who did not, those who received functional-cognitive interventions versus those who did not, and those who received therapeutic exercise interventions versus those who did not. Binary logistic regression models were used to identify the predictive ability of the initial RASS score for the receipt of OT while accounting for patient age, gender, minority status, CCI score, and initial GCS score. (research question 1). Separate regression models were used to investigate the predictive ability of the initial RASS score to the three separate intervention categories (research question 2). All statistical analyses were conducted with IBM SPSS Statistics for Windows, Version 26 (Armonk, NY: IBM Corp.). We set $\alpha = .05$ for all analyses.

RESULTS

Patient Characteristics. 1,134 patients were admitted to the NCCU between May 2013 – September 2015. Of these, 420 patients (37.0%) received OT services at least once. The average age of patients in the NCCU was 55.1 years (± 16.2). On average, the initial RASS score was -0.58 (± 1.23), demonstrating that patients were slightly more sedated than agitated. The average initial GCS score was 13.7 (± 2.8) out of 15, indicating that on average, patients were more often conscious than not. The average CCI score was 1.36 (± 1.51). OT interventions that were most commonly billed were self-care/home management (20.8%) and functional-cognitive (20.8%). Therapeutic exercise was billed the least (7.2%).

Comparing patients who received OT and those who did not, there was no significant difference between the groups' initial RASS scores ($t_{(680)} = -1.625, p = 0.105$). There was significant difference between those identified as a minority status versus not. Those identified as being a minority status received an average score of -0.71 on the initial RASS, while the non-minority group received an average score of -0.53 ($t_{(1004)} = -1.953, p = 0.051$). On average, males were likely to be more sedated than females ($t_{(1001)} = 1.919, p = 0.055$). When comparing recipients and non-recipients of self-care and functional-cognitive initial RASS scores did not significantly differ. On average, patients who received therapeutic exercise interventions were more sedated than those who did not ($t_{(374)} = -1.916, p = 0.056$).

Initial RASS Score and OT Receipt. The full model with the dependent variable receipt of OT was significant ($\chi^2_{(6)} = 56.9, p < 0.001$) and explained 7.6% of the variance in who received OT (Nagelkerke $R^2 = 0.076$). Examination of predictor variables revealed the odds of receiving OT in the NCCU increased by 25% for each 1-point increase in the CCI score (OR = 1.25; 95% CI: 1.13-1.37), indicating that those with more comorbidities were more likely to be

seen by OT. The odds of receiving OT increased by 1.8% with higher age (OR = 1.018; 95% CI: 1.01-1.027), indicating that older patients were slightly more likely to be seen by OT. The odds of receiving OT increased by 7.1% with each 1-point increase in initial GCS score (OR = 1.071; 95% CI: 1.02-1.13) indicating that patients who had a higher level of consciousness were more likely to receive OT. Initial RASS score, patient gender, and minority status were not significant predictors of OT receipt.

Initial RASS Score and Intervention Type. The full model with dependent variable self-care/home management intervention was not significant ($\chi^2_{(6)} = 9.25, p = 0.16$). The initial GCS score was the only significant predictor ($p = 0.026$). For every one-point increase in initial GCS score, the odds of receiving self-care interventions increased by 10.7% (OR = 1.107; 95% CI: 1.012 -1.211). The full model with dependent variable functional-cognitive intervention was not significant ($\chi^2_{(6)} = 7.45, p = 0.28$). The only significant predictor in this model was patient age ($p = 0.069$), while initial RASS scores, gender, minority status, initial GCS score, and CCI scores were not. The odds of a patient receiving functional-cognitive interventions increased by 1.3% for every 1-year increase in age (OR = 1.013; 95% CI: 0.99-1.03). The full model with dependent variable therapeutic exercise intervention was significant ($\chi^2_{(6)} = 25.55, p < 0.001$). This model accounted for 10.9% of variance in who received therapeutic exercise intervention (Nagelkerke $R^2 = 0.109$). Three significant predictors emerged from this model: CCI score ($p < 0.001$), patient age ($p = 0.049$), and initial GCS score ($p = 0.015$). The odds of a patient receiving therapeutic exercise decreased by 3.3% for every 1-point increase in the CCI score (OR = 1.33; 95% CI: 1.13-1.56). The odds of a patient receiving therapeutic exercise interventions decreased by 2.8% for every 1-year increase in age (OR = 0.982; 95% CI: 0.965-1.00). The odds of a

patient receiving therapeutic exercise interventions decreased by 12.6% for every 1-point increase in the initial GCS score (OR = 0.884; 95% CI: 0.801-0.976).

DISCUSSION

This study sought to explain the relationship between OT service utilization in the NCCU and arousal levels in patients. We specifically examined the extent to which initial RASS score was independently associated with receipt of OT in the NCCU (research question 1) and OT intervention type (research question 2) while accounting for other important predisposing, enabling and illness independent variables. The models predicting receipt of OT, receipt of self-care and receipt of functional-cognitive interventions were not significant. However, the model that attempted to examine the predictive ability of the initial RASS score in relation to the receipt of therapeutic exercise was significant.

This study was primarily focused on determining the predictive strength of the RASS. While separate means comparisons revealed lower RASS scores (more sedated) for males, racial/ethnic minorities, and recipients of therapeutic exercise intervention, the initial RASS score was not a significant predictor within our regression models. While the RASS is a validated and reliable tool used in a multitude of critical care unit settings, it is an observational, subjective scale. It uses categorical grading, making it difficult to distinguish between separate levels of agitation and sedation (Rinaldi, Consales, De Gaudio, 2006). Because it does not distinguish between separate levels of agitation or sedation, practitioners may not be able to identify a patient's needs based solely on this scale. This measure is context-dependent, which requires therapists to use their judgement about which patient should receive OT and when, as well as what therapy may look like for that patient. This makes it difficult to use the RASS as a clinical decision-making tool, so it may not be considered by therapists when they prioritize patients to see throughout the day. It is worth noting that the RASS was not developed to be a predictor of rehabilitation services, including occupational therapy. It may be beneficial for

therapists to receive education on what OT services may look like based on varying patient arousal levels. From personal communication with occupational therapy practitioners within the NCCU at the academic hospital that data were obtained from, we learned that the RASS can be performed at the start of every OT encounter and after a skilled intervention is performed, meaning the amount of RASS scores can vary within one session with one therapist. Multiple disciplines, including nursing, physical therapy and speech language pathology also document RASS scores.

The three independent variables that were consistent predictor variables in all four regression models were patient age, initial GCS score and CCI score. Increased age increases the risk for poorer outcomes, including increased medical complications such as infections, increased length of stay and increased likelihood of being discharged to another healthcare facility (Vanzant et al, 2015). This suggests that patients who are older are sicker and may need increased services, such as OT, to reduce the risk of these poorer outcomes. This could explain why age was a significant predictor in the receipt of OT. GCS scores have been found to be related to functional outcome within head-injured patients (Udekwu et al, 2004); while there is limited literature on the specific relationship between GCS scores and rehabilitation services, using this measure as a way to evaluate rehabilitation service utilization may be beneficial for practitioners. This suggests that patients who have higher initial GCS scores may have better functional outcomes, influencing the type of intervention that practitioners perform with these patients. There are few studies that examined the use of CCI scores for rehabilitation service utilization in critical care units. However, other studies have examined the relationship between CCI scores and functional outcomes. The CCI has been found to be a good predictor of long-term functional outcomes for stroke populations (Tessier, Finch, Daskalopoulou, & Mayo, 2008).

This suggests that the CCI may be a good instrument for practitioners to consider when prioritizing patients and determining what interventions to do with patients. A patient's functional level may be influential on the types of interventions they are able to participate in with OT.

Implications

This study showed that occupational therapists should consider a wide range of factors when delivering services, including age, illness severity and consciousness levels rather than just arousal levels. Therapists may be more influenced by the level of consciousness a patient is experiencing than the level of arousal, and this can be a determining factor in the type of intervention the client receives. Therapists should be aware of what intervention types a patient is able to participate in to ensure they are receiving the most engaging, appropriate interventions to aid in their rehabilitation.

Limitations

The data used in this study came from one NCCU at an academic hospital, making it difficult to generalize these results to other hospitals or critical care unit settings. Another issue seen in this data is that the OT referral process and billing codes used can be subjective to each therapist. This makes it difficult to know if there is consistency between therapists and what billing codes are accurately portraying each intervention type. The intervention categories used in this study were created by the authors, but do not necessarily cover all potential intervention types that a patient may receive in the NCCU. The timing of the initial RASS scoring is subject to change depending on a patient's needs at any given time. Because of this, there may be significant changes in a patient's arousal levels and what is captured by the RASS may not be the most accurate depiction of what a patient is experiencing.

In regard to the specific research questions, the predictive ability of the initial RASS score for the receipt of OT was not significant. This could be because there are other independent variables that were not included in this study. Variables that could be considered in future research include patient insurance type and diagnosis category. The type of insurance that a patient has is influential on the types of services that patient is able to receive and their willingness to accept those services (Woolhandler & Himmelstein, 2013). This can affect when and if they receive OT services during a NCCU stay, as well as how long those services are available to the patient. Diagnosis category was not used in this study because it was too large to handle. This study used the CCI scores of patients as an indicator of illness severity; however, separate diagnosis categories may be more exact to understand the differences in what services look like. The CCI relies on a sum of scores to determine disease burden and estimate mortality, making it difficult to tease out the differences between each diagnostic category (Sundararajan, Henderson, Perry, Muggivan, Quan & Ghali, 2004). There may be differences between each diagnostic category before creating the index sum score, which may be influential on service utilization.

CONCLUSION

This study illustrated the factors that are influential on the receipt of OT services and the types of interventions performed during treatment sessions. Our findings suggest that the patient's arousal level upon admission to the NCCU is not a significant predictor of OT receipt or OT intervention types the patient may receive. However, other factors may be used by therapists to assist in clinical reasoning when prioritizing patients, including their age, initial GCS and CCI scores. Future research would be warranted to take a deeper look at other independent variables that may be influential on OT service utilization within the NCCU, as well as determining if there is a better measure than the RASS to assist in clinical decision making.

Table 1: NCCU Patient Characteristics

Patient Characteristic		
Total Number of Patients	1134	
Female (n, %)	559	49.3%
Male (n, %)	575	50.7%
Age ($\bar{x}$, SD)	55.1	16.2
Racial or ethnic minority – yes (n, %)	301	26.5%
Racial or ethnic minority – no (n, %)	809	71.3%
Initial RASS Score ($\bar{x}$, SD)	-0.58	1.3
Glasgow Coma Score-Admission ($\bar{x}$, SD)	13.7	2.8
Charlson Comorbidity Index score ($\bar{x}$, SD)	1.36	1.51
Received OT – yes (n, %)	420	37.0%
Received OT – no (n, %)	714	63.0%
Received self-care/home mgmt. intervention (n, %)	236	20.8%
Received functional-cognitive intervention (n, %)	236	20.8%
Received therapeutic exercise/modalities intervention (n, %)	82	7.2%
Key: RASS – Richmond Agitation & Sedation Scale GCS – Glasgow Coma Scale CCI – Charlson Comorbidity Index n, sample size $\bar{x}$, mean SD, standard deviation		

Table 2: Odds ratios for predictors of OT receipt

Predictor variable	Receipt of OT		
	Odds ratio	95% CI	
		Lower	Upper
Gender	0.964	0.74	1.26
Age	1.018 *	1.01	1.03
Minority status	1.083	0.79	1.47
Initial RASS	0.910	0.82	1.01
Initial GCS	1.071 *	1.02	1.13
CCI Score	1.246 *	1.13	1.37

Key:

RASS – Richmond Agitation & Sedation Scale

GCS – Glasgow Coma Scale

CCI – Charlson Comorbidity Index

*p≤.05

Table 3: Odds ratios for predictors of OT intervention category

	A) Self-Care/Home Management			B) Functional-Cognitive			C) Therapeutic Exercise/Sensorimotor		
	95% CI			95% CI			95% CI		
	Odds ratio	Lower	Upper	Odds ratio	Lower	Upper	Odds ratio	Lower	Upper
Gender	0.804	0.53	1.23	0.88	0.57	1.34	1.245	0.71	2.17
Age	1.008	0.99	1.02	1.013 *	0.99	1.03	0.982 *	0.96	1.00
Minority status	0.936	0.57	1.53	0.856	0.52	1.40	0.78	0.42	1.43
Initial RASS	0.882	0.76	1.03	0.919	0.79	1.07	0.916	0.76	1.09
Initial GCS	1.107 *	1.01	1.21	0.954	0.87	1.04	0.884 *	0.80	0.97
CCI	1.017	0.89	1.16	1.032	0.90	1.18	1.327 *	1.13	1.56

Key:

RASS – Richmond Agitation & Sedation Scale

GCS – Glasgow Coma Scale

CCI – Charlson Comorbidity Index

*p≤.05

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