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A Quantitative Study of the Effectiveness of the Nurse-Led Delirium Protocol on Hospitalized Older Adults Utilizing the Confusion Assessment Method (CAM)

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Abstract

Delirium presents as a reversible, fluctuating, altered state of consciousness that leads to an increase in length of hospital stay, a decline in the functional and cognitive status, and increased mortality rates. There are many risk factors and predisposing conditions, and the onset of delirium is thought to be multifactorial. Delirium remains the most common complication of hospitalized older adults. The Confusion Assessment Method (CAM) is one of the assessment tools available to diagnose delirium, and has been implemented at the study hospital. The goal of this quality improvement project is to determine the effectiveness of interventions set forth in the Nurse-Led Delirium Protocol (NLDP) at the study hospital. A comprehensive review of 259 charts tracked the CAM scores before and after implementation of the interventions, and the data was analyzed to determine the effectiveness. Analysis of data suggests that the implementation of the interventions set forth in NLDP lead to a decrease in the proportion of patients that test positive for delirium when assessed utilizing the Confusion Assessment Method (CAM). Because of this finding, the continued use of the NLDP for management of delirious patients is supported.

Introduction

The aim of this quality improvement project is to determine the effectiveness of interventions included in the Nurse-Led Delirium Protocol (NLDP). The study hospital implemented the reassessment of hospitalized older adults, regardless of their status of delirious or non-delirious, every 12 hours utilizing the CAM (Confusion Assessment Method) tool. Using periodic assessment scores, the project aimed to determine whether or not the NLDP leads to a decrease in the proportion of patients who score positive for delirium utilizing the CAM. Because delirium is fluctuating and reversible, the delirious patient should be periodically reassessed to follow the progression or regression of delirium and determine the effectiveness of nursing interventions designed to bring the patient back to their mental health baseline.

Delirium is a fluctuating state of consciousness that, when superimposed on older adults during hospitalization, can cause health complications leading to additional health care costs for the individual and the hospital. Individuals may be at risk for developing delirium if they possess predisposing factors or have physiological causes including inadequate rest, nutrition, and hydration status. Because delirium is a potentially reversible alteration in cognition that complicates the existing illness, it is essential that the delirium be managed and treated rapidly to prevent progression.

Every 12 hours, adults in the study hospital are assessed using the CAM tool to detect the presence or absence of delirium. Prior to the study, once a patient was diagnosed with delirium, the nursing staff no longer assessed the delirious patient based on the CAM, but instead began a NLDP to attempt to bring the patient back to their baseline. Policies were not in place to include

reassessment to determine improvement of delirious patients; therefore effectiveness of the nursing interventions was unknown.

Literature Review

Delirium is characterized by a reduced ability to focus attention and can include the development of a perceptual disturbance. The change is acute in nature and generally fluctuates throughout the day (American Psychiatric Association, 2000). This acute, changing state of confusion may cause complications for older adults and longer lengths of stay in hospital settings (Halter, 2014). When a patient experiences delirium superimposed on dementia (DSD), it is associated with a progression of the individual's dementia (Steis & Fick, 2012). Because delirium signifies a change in a clinical condition, it is considered an additional vital sign (Morandi et. al., 2012). Delirium is typically a reversible alteration in consciousness accompanied by fluctuations of disturbances in cognition, perceptions, and memory (Detroyer et al., 2014). It can be caused by medications or physiological abnormalities, such as metabolic disturbances and organ insufficiencies, and is the most common complication of hospitalization in older patients (Agarwal et al., 2013; Halter, 2014).

Delirium can be divided into subtypes related to its clinical manifestations (Lynch, Dahlin, & Bakitas, 2012). The subtypes are termed hyperactive, hypoactive, and mixed; with hypoactive being the most common form of delirium in the geriatric population (Matarese et. al., 2013). Individuals who have hyperactive delirium may show signs of agitation, while those with hypoactive delirium appear withdrawn. Mixed delirium presents with a combination of the before mentioned symptoms, along with the possibility of paranoia (Matata, Defres, Jones,

Gummery, & Solomon, 2013). Regardless of the subtype, the delirium can be classified as potentially reversible or irreversible depending on certain criteria. Delirium is considered irreversible if the treatment options are not congruent with the patient's individualized goals of care, or if the underlying causes can either not be determined, or are untreatable (end-stage organ failure) (Irwin, Pirrello, Hirst, Buckholz, & Ferris, 2013). It is not uncommon for patients to be discharged from an acute setting without the reversal of their delirium (Anderson, Ngo, & Marcantonio, 2012). When this occurs, those individuals are frequently admitted to long-term care facilities due to the need for more supervision and care (Anderson et. al., 2012).

Primary prevention is the most effective way to reduce the number of delirious patients in hospitalization (Varghese, Macaden, Premkumar, Mathews, & Kumar, 2014). Although it is not possible to predict specifically who will become delirious or when, there are predisposing risk factors that, when recognized, can increase detection. Some of these risk factors include: "hypoxia, dehydration, constipation, pain, pyrexia, infection, intoxication, malnutrition, medication reactions, disturbed sleep patterns, alcohol abuse, poor physical condition, abnormal electrolyte levels," (McDonnel & Timmins, 2012). Individuals are at risk for developing delirium if they possess certain predisposing factors such as alcohol and tobacco use, as well as additional causes such as improper pain management and inadequate sleep cycles (Bell, 2013). Causes of delirium can be as simple as dehydration or a poor oral intake (Lynch et. al., 2012). Once recognized, delirium must be managed and treated quickly in order to bring the patient back to their mental health baseline and prevent progression (Waszynski, 2001). It is important to treat the underlying cause of delirium, manage the confusion, and minimize the occurrence of further complications by providing safety and ensuring the patient remains hydrated, nourished,

and as active and mobile as possible (Beary, 2013). Delirium is multifactorial, and the degree of risk is directly proportional to the number of risk factors present (McDonnel & Timmins, 2012). The geriatric population, individuals aged 65 or older, make up one of the top four specific populations considered at most risk (as well as patients with hip replacement surgery, cognitive impairment, and severe illness) (McDonnel & Timmins, 2012). Detection of delirium can be difficult in older adults and is often mistaken for diseases such as dementia and depression. A thorough understanding of risk factors and the acute nature of delirium can aid in proper diagnosis (Peacock, Hopton, Featherstone, & Edwards, 2012).

Because delirium is fluctuating and generally reversible, it is important to intervene and prevent the progression of the delirium before it requires the use of medications or restraints as a form of treatment. Delirium diminishes the patient's quality of life and ability to perform activities of daily living, as well as increases the risk for death (Hosie, Davidson, Agar, Sanderson, Phillips, 2013). It has been shown that delirium can lead to an increased length of stay in an institution/hospital and a decline in the functional and cognitive status. Delirium increases the risk for readmission, falls, and future admission to a long-term care facility (Philips, 2013). Because of these effects, as well as the cost of managing delirious patients, the estimated national annual expense for delirium is approximately $152 billion (Leslie & Inouye, 2011). This statistic, when compared to that of various other diseases (Cardiovascular disease- $257.6 billion, Diabetes Mellitus- $91.8 billion, Hip Fracture-$7 billion) remains a substantial financial burden (Leslie & Inouye, 2011).

With the knowledge that delirium is potentially reversible, it is essential to screen for and readily detect its presence. There are multiple assessment tools utilized for the detection of

delirium and acute confusion that are designed to work in specific patient populations. The main focus of this study is the Confusion Assessment Method (CAM), because it can be easily used in any setting and has been implemented at the local hospital under study (Inouye, 2003). The Confusion Assessment Method (CAM) is a tool designed to enable all clinicians, even those not psychiatrically trained, to screen patients for cognitive impairment. The CAM was developed by Dr. Sharon Inouye in 1988-1990 to provide a standardized assessment tool that could quickly and accurately identify and recognize delirium in patients of all settings in less than 5 minutes (Inouye, 2003). The assessment method has a sensitivity of 94-100% and a specificity of 90-95% (Waszynski, 2001). The four domains the CAM includes are: an acute onset and fluctuation in course, inattention, disorganized thinking, and an altered level of consciousness (Inouye, 2003).

Although this tool is the most widely used, there are other assessment tools used in areas such as intensive care units (CAM-ICU), as well as other cognitive assessments, including the NEECHAM Confusion Scale (NCS) (Matarese et. al., 2013). Unlike the CAM, which solely detects the presence or absence of delirium, the NCS detects delirium in addition to monitoring the fluctuations in its severity (Matarese et. al., 2013). The NCS was created for use in the hospitalized geriatric population, and takes into account cognitive processing, behavior, and physiological characteristics (Matarese et. al., 2013). Because the tool accounts for a more complete picture of the delirious patient, administration of screening requires more time than the CAM. The CAM alone does not detect or describe the severity of delirium; therefore certain measurements can be added to the tool to create a new scale, the CAM-S (Inouye et. al., 2014). The CAM-S is available in a short form (four items) and a long form (ten items) for ease of use

at the bedside. The short form measures the same areas as the CAM (acute onset and fluctuation, inattention, disorganized thinking, and an altered level of consciousness), but additionally ranks them as 0 (absent), 1 (mild), or 2 (marked), with the exception of fluctuation, which is ranked as 0 (absent) or 1 (present). Studies suggest that the CAM-S shows a significant association with increased score and increased clinical outcomes related to delirium, suggesting adequate accuracy and reliability (Inouye et. al., 2014). The use of a measurement tool that detects both the presence and severity of delirium in its patients allows for a better understanding of response to interventions.

The detection of delirium requires an understanding of the patient's cognitive, behavioral, and physiological baseline. Because of this, there are concerns about the ability of nurses who may not be familiar with the patient's baseline to recognize these changes. A study was conducted in which family members of hospitalized patients administered the CAM, termed the FAM-CAM, to detect the presence of delirium in their loved one (Steis et. al., 2012). The results of the FAM-CAM were compared with that of the CAM administered by a clinician to determine if the clinician assessment was as sensitive as the family assessment for signs of delirium (Steis et. al., 2012). Results suggest a significant agreement between the scores, which suggests that clinicians are indeed able to detect these acute changes in their patients, despite the lack of personal history (Steis et. al., 2012). That being said, this information also suggests that family members' concerns regarding their delirious loved ones should be heard, as they are familiar with the patient and may recognize a subtle change that the nurse may not.

A local hospital has implemented the CAM, which allows for a quantitative measure of the level of consciousness of each geriatric patient to detect the presence of delirium. Their

current policy is to assess patients every 12 hours. Previously, if a patient was determined to have delirium, interventions were instituted and the assessment was not repeated. Knowing that delirium is a fluctuating mental state that can potentially be prevented and regressed, it was proposed that periodic reassessments of all patients, whether they are delirious or not, be implemented and continued in order to follow the progression or regression of delirium in each patient. This allowed for evaluation of the effectiveness of nursing interventions included in the NLDP. This quality improvement project proposed to monitor the impact of these nursing interventions on the delirium assessment status of patients.

It is common for hospitalized older adults to experience delirium that increases fatality rates. The prevalence of delirium in the geriatric population ranges from 22% to 89%, with the majority of these individuals residing in acute care situations (Bull, 2011). Longer hospitalization and the need for long term care after discharge are typical for delirious patients, and this in turn increases medical costs (Inouye et al., 1990). Delirium can increase the length of stay in a hospital as well as result in a functional decline for the older adult patient (Bull, 2011). Elderly patients with cognitive impairment of any kind, an infection, dehydration, or malnutrition are at risk for developing delirium and should be assessed daily (Waszynski, 2001). The presence of delirium results in increased cost to the individual and the facility due to the use of medications, restraints, and need for additional care (Inouye, 2003).

Because delirium is such a prevalent problem, specifically in geriatric populations, there are clinical practice guidelines to help guide the management of care for these patients. Authorities overwhelmingly agree that recognition of risk factors and prevention of delirium is the most important aspect of care, followed by early detection (Barr et. al., 2013). Nurses work closely

with patients and, because of this, are in a good position to recognize acute changes in their conditions. Education about risk factors provides the necessary foundation to support the knowledge base of nurses and increase awareness for individuals that have multifactorial predispositions for the development of delirium (Baker, Taggart, Nivens, & Tillman, 2015). Along with information about risk factors, nurses must be adequately educated about how to properly perform the assessment tool (CAM) in order to reliably detect delirium (Andrews, Silva, Kaplan, & Ximbro, 2015). It is not uncommon for nurses to feel burdened when caring for delirious patients who are uncooperative and, at times, combative. Improper or incomplete understanding of delirium can increase feelings of burden. Continuing education should be provided to reiterate information and ensure nurses are not overwhelmed by the burden of caring for delirious patients (McDonnel & Timmins, 2012).

When a patient has been diagnosed with delirium, the management of care begins to take a different route. Initially, the physician may order a variety of tests, including blood tests, urine tests, chest x-rays, neurological assessments, and possibly psychiatric consultations in an attempt to determine the underlying cause(s) (Recognizing and Managing Delirium, 2012). Evidence suggests that treatment of the precipitating cause can reverse the delirium and return a patient to their cognitive baseline (Recognizing and Managing Delirium, 2012). Therefore, the goal of care for a delirious patient is to identify the cause and maintain patient safety (Recognizing and Managing Delirium, 2012). Management of delirious patients should incorporate the use of non-pharmacological interventions primarily, with pharmacological interventions utilized only when necessary, as there have been no medications approved by the FDA for the specific management of delirium (Recognizing and Managing Delirium, 2012).

Non-pharmacological interventions are the safest and most effective interventions for the management of delirious patients (Lynch et. al., 2012). Simple interventions such as providing orientation, ambulation, ensuring adequate hydration and nutrition status can help prevent the progression of delirium (Beary, 2013). Although interventions should be determined based on the individualized needs of the patient, there are several that have proven to be effective. Studies suggest that protocols with many different interventions are more effective than those with two or fewer interventions, because they are more effective at addressing the multifactorial causes of delirium (Rivosecchi, Smithburger, Svec, Campbell, & Kane-Gill, 2015). The most recommended area of interventions consists of actions to create a safe environment (Irwin et. al., 2013). To minimize risks, evidence-based interventions such as lowering the beds, padding bed rails, limiting access to dangerous items, and reducing movement-restricting devices (Foley catheters, etc.) should be utilized (Irwin et. al., 2013). Because delirium is not a disease, but rather a symptom, interventions should address the symptoms of delirium. (Irwin et. al., 2013). Other non-pharmacological interventions include, but are not limited to, monitoring fluid intake and output, providing orientation and familiar objects to the patients to help them become more aware of their surroundings, ensuring patients have good nutrition and bowel/bladder management, and engaging patients in "mentally stimulating" activities (Irwin et. al., 2013). Orientation strategies should be used carefully, as orientation to reality can potentially cause the delirious older patient to be further agitated or anxious, and may lead to mistrust of nursing staff (Day, Higgins, & Keatinge, 2011). Environmental orientation techniques such as providing a 24-hour clock in the patient room and changing lighting based on the time of day are beneficial without introducing a large risk for patient conflict (Faught, 2014). Utilization of a broad range

of these interventions can minimize the symptoms that are associated with delirium and help prevent complications such as falls and further injury (Irwin et. al., 2013).

When non-pharmacological approaches do not provide enough relief from symptoms and the delirious patient remains at risk for injury, pharmacological interventions should be considered. Although, as previously stated, no medications have been approved by the FDA for the specific treatment of delirium, first-generation antipsychotics have been utilized as first-line (Irwin et. al., 2013). Haloperidol is the most commonly used, even though there is no evidence that it reduces the duration of the delirium (Barr et. al., 2013). Evidence suggests that atypical antipsychotics are not effective, and does not recommend the use of benzodiazepines as first-line treatment, but rather as a second-line option used in combination with first-generation antipsychotics (Irwin et. al., 2013). Potential side effects of benzodiazepines include sedation, which may worsen the delirium and increase the risk for further injury from falls or memory difficulties (Irwin et. al., 2013). Studies suggest that the use of antipsychotics does not correlate with patient benefits, but instead that medicated individuals require an increased length of stay (Jung et. al., 2013). New studies suggest that the use of a melatonin agonist nightly in the geriatric population may potentially act as a preventative measure and protect older adults from developing delirium (Melatonin Agonist, 2014). Guidelines for the management of hypoactive delirium, which is most prevalent in the geriatric population, suggest avoiding pharmacological interventions unless delusions provide an increased risk for the patient's safety (Matarese et. al., 2013; Irwin et. al., 2013).

The continued reassessment every 12 hours of the CAM assessment tool was implemented on the study population in January 2013. This quality improvement study was

performed to determine whether or not implementation of the interventions included in the NLDP was effective in preventing the progression of delirium in hospitalized older adults, determined by CAM scores before and after.

Previously, geriatric patients were assessed every 12 hours using the CAM to keep track of their level of consciousness and assess for the sudden onset of delirium. If a patient was determined to have delirium, the CAM assessment tool was no longer used. Instead, a NLDP was instituted. This protocol includes a variety of nursing interventions that can be implemented into the patient's care plan to help reorient them and return them to their baseline. The interventions are divided into categories that can be chosen by the RN caring for the delirious patient. There is not a minimum or maximum number of interventions that can be selected, and each patient receives a unique combination of these interventions. There was not a way to evaluate the effectiveness of the interventions based on the outcomes of the patient, as additional CAM assessments were not performed. The aim of this quality improvement project was to evaluate the effectiveness of nursing interventions in halting the progression of delirium while hospitalized.

Nurse-Led Delirium Protocol

Safe Environment Interventions	**Prevent Further Cognitive Decline**
☐ Call light within reach ☐ Family support ☐ Bed/chair alarm ☐ Eliminate tethers if possible (foley, IV, restraints, telemetry, SCD's) ☐ Check bladder scan if at risk for urinary retention ☐ Pain scale and treat according to scale ☐ Family education materials, keep them informed ☐ Physician notified of positive CAM	☐ Frequent time/place orientation ☐ Current date/time on communication board ☐ Comfort items from home at bedside ☐ Patient wearing own clothes ☐ Sensory aides readily available (glasses, hearing aides, etc)

Protect Circadian Rhythm	Maximizing Functional Independence
☐ Lights on during day ☐ Curtains open ☐ Minimize daytime napping ☐ Lights off at night ☐ Toilet before bedtime ☐ Warm blanket/warm drink at bedtime ☐ Hand massage, foot massage, or back rub prior to bedtime ☐ Utilize "Adult Delirium Cart" (ADC) if needed ☐ Keep room quiet and decrease stimuli ☐ Adequate nutrition & hydration (dentures if needed) ☐ Constipation protocol	☐ Walk three times a day ☐ Up in chair for meals ☐ Utilize assistive devices/prosthetics ☐ Utilize gait belt ☐ Range of motion exercises if bedfast ☐ PT, OT, ST referrals ☐ Specialty mattress used
Protect from Iatrogenic Harm	**Spiritual Interventions**
☐ Review medications ☐ Assess for ETOH withdrawal (based on PMH, HPI) ☐ Assess for medication withdrawal (benzodiazepines, narcotics, antidepressants) ☐ Have Geriatrician, Pharmacist, GNP, GRN assist in review of medications ☐ Monitor orthostatic blood pressures ☐ Specialty mattress used ☐ Check for fecal impaction (if no BM in past 24-48 hours) initiate the constipation protocol	☐ Provide comfort with presence, touch, and soothing voice ☐ Supply religious objects and read materials if appropriate ☐ Consult hospital chaplain
Fluid Interventions	**Nutrition Interventions**
☐ 200mL fluid with each medication pass ☐ Encourage fluids ☐ Oral care provided before eating and at bedtime ☐ Reevaluate need for IV fluids daily and request DC if appropriate	☐ Provide meal/feeding assistance ☐ Socialization with each meal ☐ Offer snacks between meals
Elimination Interventions	**Other Interventions**
☐ Offer Toileting frequently ☐ Bladder scan prn ☐ Urinary catheter indication addressed daily ☐ Assess for fecal impaction ☐ Constipation protocol	(text box available)

Goals

This quality improvement project was conducted following approval by the University of Arkansas Institutional Review Board and the study hospital's Quality Improvement Department. During the study period, the staff agreed to implement the CAM assessment on all patients regardless of the delirium status every 12 hours.

By continuing the assessment of every patient, the level of consciousness and orientation can be reassessed to better track the progression or regression of a patient's delirium. Reassessment and modification of interventions may inhibit the progression of delirium in each patient and thereby shorten the length of their hospitalization. The research study looked at whether or not the Nursing-Led Delirium Protocol leads to a decrease in the proportion of patients who score positive for delirium utilizing the Confusion Assessment Method.

Methods

This quality improvement project was conducted as a medical record audit and comprehensive chart review of geriatric patients admitted during the months of August through December 2014. Charts were randomized and all patient information was de-identified according to current HIPPA guidelines.

Design

The nursing staff performs the CAM on every geriatric patient at 0800 and 2000. There are four sections to the CAM. Patients receiving a five or six on the assessment tool are considered positive for delirium. The electronic charting system prompts the nurse to initiate the NLDP for delirious patients, which will continue until discharge of the patient from the hospital. Patients receiving a CAM score of <5 will continue to receive routine nurse care. If the patient

displays an acute change in mental status from the baseline and the abnormal behavior fluctuated during the day, they receive two points. If they have difficulty focusing attention, they receive two points. If they demonstrate disorganized thinking, they receive one point, and if they are functioning at an altered level of consciousness, one point. To be considered delirious (5 or 6), they must have both an acute change in mental status and fluctuating abnormal behavior, and must at least demonstrate disorganized thinking or an altered level of consciousness.

A comprehensive chart review tracked initial CAM assessment scores, whether or not the NLDP was initiated, and the CAM scores following the initiation of the protocol. In addition to this information, data was collected regarding the frequency of interventions selected from each given category, as well as the use of restraints and antipsychotic medications throughout the stay of these delirious patients. 259 charts were reviewed for patients admitted from March through December 2014. From the reviewed charts, 48 patients were found to have positive CAM scores. Three of these charts were excluded because these patients were discharged before an additional CAM score could be obtained. Data from a total of 45 charts was analyzed for this quality improvement project.

Data Analysis

A purposive sampling (nonprobability approach) was used for this quality improvement project. Patients were selected on the basis of specific criteria (CAM score of ≥5, ≥65 years old). To determine whether the nursing-led delirium protocol interventions lead to a *decrease* in the proportion of patients who are considered positive for delirium, the significance of the difference between two *correlational* proportions was investigated, since the same patients were assessed before and after (on a yes/no basis) the nursing-led delirium protocol intervention. Data

was analyzed at the initial CAM score, and subsequent scores at 12, 24, 36, and 48 hours. A one-way repeated measures analysis of variance (ANOVA) was conducted to determine whether statistically significant differences in CAM scores occurred over the five time intervals. A pairwise comparison of the CAM scores was performed and analyzed to determine which time period varied statistically from the initial CAM score. In further analysis, the Related-Samples Wilcoxon Signed Rank Test was used to determine the number of patients in whom the CAM score decreased, increased, or experienced no change. From this information, the median of the CAM scores for each population was determined and results indicate whether or not the data is statistically significant.

Results

The mean age of the participants was 82.67, with an age range of 70 to 101 years. The population included both males and females. There were 19 males and 26 females to make a total of 45 participants. To make up the population, 42.2% were male, while 57.8% were female.

Mauchly's 's test of sphericity was used to assess the homogeneity of the variance between conditions in repeated measures. Mauchly's test of sphericity indicated that the assumption of sphericity has not been violated, $\chi^2(2) = 16.731$, $p = .053$ (df=9). This analysis tests the variance within the subjects to ensure there are no outliers.

Machly's Test of Sphericity

Within Subjects Effect	Machly's W	Approx. Chi-Square	Degrees of Freedom (df)	Sig.
Time	.577	16.731	9	.053

A repeated measures test was utilized to describe the means and standard deviations of CAM Scores at each time interval: initial, 12 hours, 24 hours, 36 hours, and 48 hours. N = 33: 33 of the total 45 patients were still hospitalized and received a CAM assessment for all of the studied time intervals.

Descriptive Statistics

	Mean	Std. Deviation	N
CAM Initial	5.42	.502	33
CAMS 12hours	2.52	1.584	33
CAM 24hr	2.97	2.038	33
CAM 36hr	2.64	1.966	33
CAM 48hr	2.121	2.0880	33

To look individually at CAM scores at each 12-hour interval, frequencies and percentages were analyzed. The initial mean CAM score is 5.42 (standard deviation of .502), mean at 12 hours is 2.52 (standard deviation of 1.584), mean at 24 hours is 2.97 (standard deviation of 2.038), mean at 36 hours is 2.64 (standard deviation of 1.966), and the mean at 48 hours is 2.121 (standard deviation of 2.0880). The total number of patients delirious for the initial CAM was 45 (100%). This proportion was determined for each 12-hour interval and the results are as follows: seven (15.6%) delirious patients at 12 hours, 11 (25%) at 24 hours, seven (17.9%) at 36 hours, and five (15.2%) at 48 hours.

CAM Scores at 12 Hours			CAM Scores at 24 Hours		
CAM Score	Frequency	Percent	CAM Score	Frequency	Percent
0	7	15.6	0	11	25
1	2	4.4	1	2	4.5
2	7	15.6	2	7	15.9
3	17	37.8	3	9	20.5
4	5	11.1	4	4	9.1
5	7	15.6	5	6	13.6
6	0	0	6	5	11.4
Patients Present	45		Patients Present	44	
Discharged Patients	0		Discharged Patients	1	
Positive for Delirium (5-6)	7	15.6	Positive for Delirium (5-6)	11	25
Negative for Delirium (0-4)	38	84.4	Negative for Delirium (0-4)	33	75

CAM Scores at 36 Hours			CAM Scores at 48 Hours		
CAM Score	Frequency	Percent	CAM Score	Frequency	Percent
0	12	30.8	0	13	39.4
1	4	10.3	1	2	6.1
2	1	2.6	2	2	6.1
3	10	25.6	3	8	24.2
4	5	12.8	4	3	9.1
5	6	15.4	5	2	6.1
6	1	2.6	6	3	9.1
Patients Present	39		Patients Present	33	
Discharged Patients	6		Discharged Patients	12	
Positive for Delirium (5-6)	7	17.9	Positive for Delirium (5-6)	5	15.2
Negative for Delirium (0-4)	32	82.1	Negative for Delirium (0-4)	28	84.8

Every patient in this study was initially determined delirious based on a CAM score of ≥5. Because of this, the RNs caring for each patient were prompted to complete a NLDP with various interventions available for selection and implementation. These intervention categories are as follows: Safe Environment Interventions, Prevention of Further Cognitive Decline, Protection of Circadian Rhythms, Maximization of Functional Independence, Protection from Iatrogenic Harm, Spiritual Interventions, Fluid Interventions, Nutrition Interventions, Elimination Interventions, and Other Interventions (which may be typed into an available text

box). Because each patient received a unique combination and frequency of interventions from each category, the individual interventions cannot be evaluated for effectiveness on their own. The interventions are analyzed for effectiveness as a whole based on a change in CAM score from delirious (5-6) to non-delirious (0-4). The most commonly used intervention category is that of 'Safe Environment Interventions', which were utilized for every patient in the study. The least commonly used category is that of 'Other,' where the RN can determine an intervention specific to the individual, which was not utilized for any patients in the study.

A pairwise comparison test was used to determine the relationships between mean CAM Scores at the given time intervals: initial, 12 hours, 24 hours, 36 hours, and 48 hours. Data are mean ± standard deviation, unless otherwise stated. There was a decrease in initial CAM Score from 5.42± 0.502 to 2.52± 1.584 at 12 hours, a statistically significant decrease (95% CI, 2.006 to 3.812) $p < .0005$. There was a decrease in initial CAM Score from 5.42 ± 0.502 to 2.97 ± 2.038 at 24 hours, a statistically significant decrease (95% CI, 1.356 to 3.553) $p< .0005$. There was a decrease in initial CAM Score from 5.42 ± 0.502 to 2.64 ± 1.966 at 36 hours, a statistically significant decrease (95% CI, 1.765 to 3.811) $p < .0005$. There was a decrease in the initial CAM Score from 5.42 ± 0.502 to 2.121 ± 2.0880 at 48 hours, a statistically significant decrease (95% CI, 2.171 to 4.435) $p < .0005$. There were no other statistically significant results in regards to the other time intervals.

Pairwise Comparisons of CAM Scores

(I) time	(J) time	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
					Lower Bound	Upper Bound
Initial	12 Hours	2.909*	.300	.000	2.006	3.812
	24 Hours	2.455*	.364	.000	1.356	3.553
	36 Hours	2.788*	.339	.000	1.765	3.811
	48 Hours	3.303*	.376	.000	2.171	4.435
12 Hours	Initial	-2.909*	.300	.000	-3.812	-2.006
	24 Hours	-.455	.299	1.000	-1.355	.446
	36 Hours	-.121	.310	1.000	-1.056	.814
	48 Hours	.394	.444	1.000	-.944	1.732
24 Hours	Initial	-2.455*	.364	.000	-3.553	-1.356
	12 Hours	.455	.299	1.000	-.446	1.355
	36 Hours	.333	.421	1.000	-.937	1.603
	48 Hours	.848	.427	.554	-.438	2.135
36 Hours	Initial	-2.788*	.339	.000	-3.811	-1.765
	12 Hours	.121	.310	1.000	-.814	1.056
	24 Hours	-.333	.421	1.000	-1.603	.937
	48 Hours	.515	.444	1.000	-.824	1.854
48 Hours	Initial	-3.303*	.376	.000	-4.435	-2.171
	12 Hours	-.394	.444	1.000	-1.732	.944
	24 Hours	-.848	.427	.554	-2.135	.438
	36 Hours	-.515	.444	1.000	-1.854	.824

Based on estimated marginal means.
*. The mean difference is significant at the < .05 level.
b. Adjustment for multiple comparisons: Bonferroni.

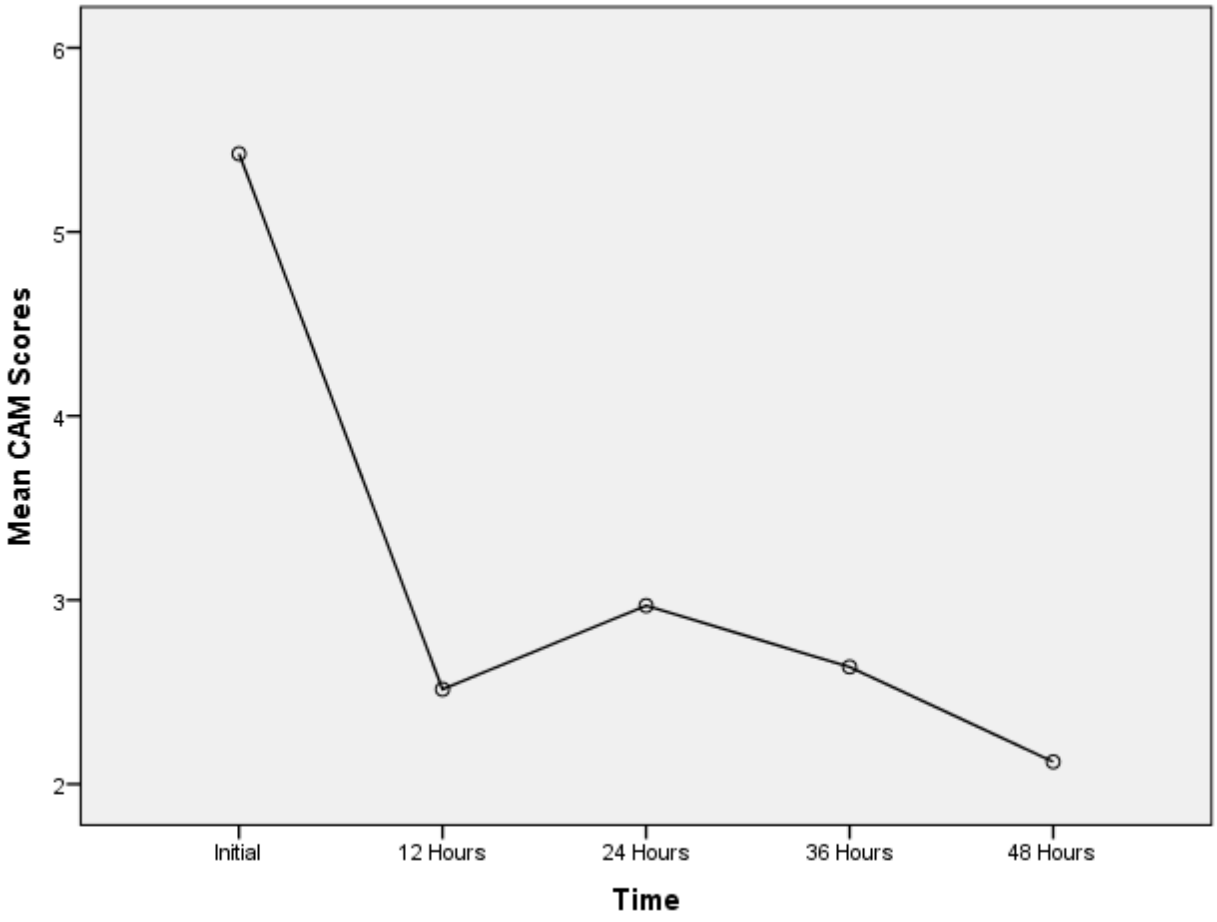


Fig. 2: Pairwise comparison of CAM scores at each time interval (initial, 12-hour, 24-hour, 36-hour, and 48-hour.

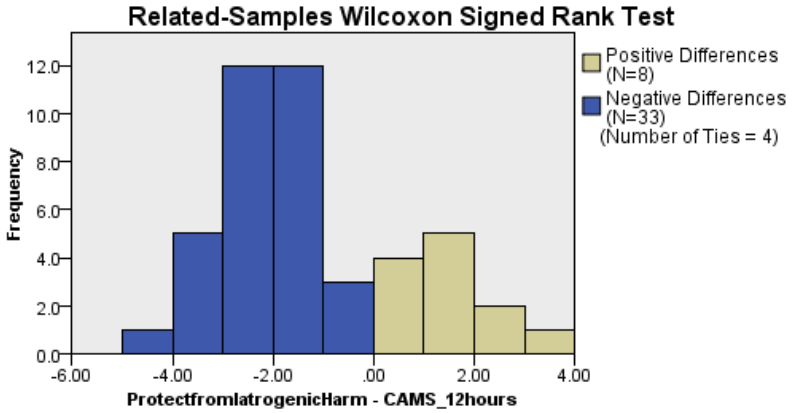
Forty-five patients remained present at the 12-hour interval and received CAM Scores at that time. CAM scores for these patients were analyzed in comparison to interventions from each category included in the NLDP, using the Related-Samples Wilcoxon Signed Rank Test. The Wilcoxon Signed Rank Test analyzes whether or not the median difference between the related groups is zero in the given population. Statistically significant results are found with a p-value < .05, indicating that the mean difference is statistically different from zero.

The patient population that received interventions from the category *Protection from Iatrogenic Harm Interventions* elicited a statistically significant mean difference in the CAM scores at 12 hours, compared to those of the initial CAM, $z = -4.554$, $p < .0005$. This category is associated with a decrease in the CAM scores for 33 patients, increase for eight patients, and four patients experienced no change in CAM score.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The median of differences between CAM score at 12 hours and the patient population receiving Protection from Iatrogenic Harm Interventions equals 0.	Related-Samples Wilcoxon Signed Rank Test	.000	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.



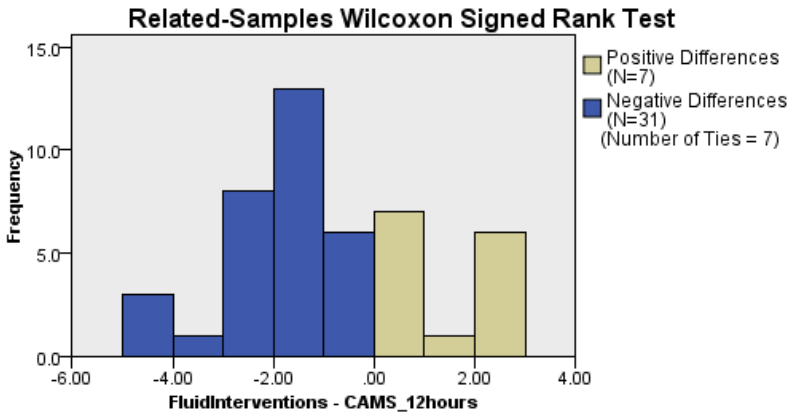
Total N	45
Test Statistic	82.500
Standard Error	76.419
Standardized Test Statistic	-4.554
Asymptotic Sig. (2-sided test)	.000

The patient population that received interventions from the category *Fluid Interventions* elicited a statistically significant mean difference in the CAM scores at 12 hours, compared to those of the initial CAM, z = -3.902, p < .0005. This category is associated with a decrease in the CAM scores for 31 patients, increase for seven patients, and seven patients experienced no change in CAM scores.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The median of differences between CAM score at 12 hours and the patient population receiving Fluid Interventions equals 0.	Related-Samples Wilcoxon Signed Rank Test	.000	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.



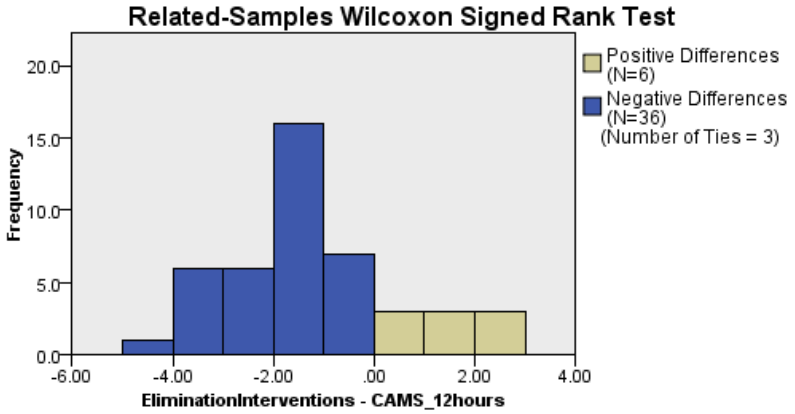
Total N	45
Test Statistic	106.000
Standard Error	67.781
Standardized Test Statistic	-3.902
Asymptotic Sig. (2-sided test)	.000

The patient population that received interventions from the category *Elimination Interventions* elicited a statistically significant mean difference in the CAM scores at 12 hours, compared to those of the initial CAM, $z = -4.753$, $p < .0005$. This category is associated with a decrease in the CAM scores for 36 patients, increase for six patients, and three patients experienced no change in CAM score.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The median of differences between CAM score at 12 hours and the patient population receiving Elimination Interventions equals 0.	Related-Samples Wilcoxon Signed Rank Test	.000	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.



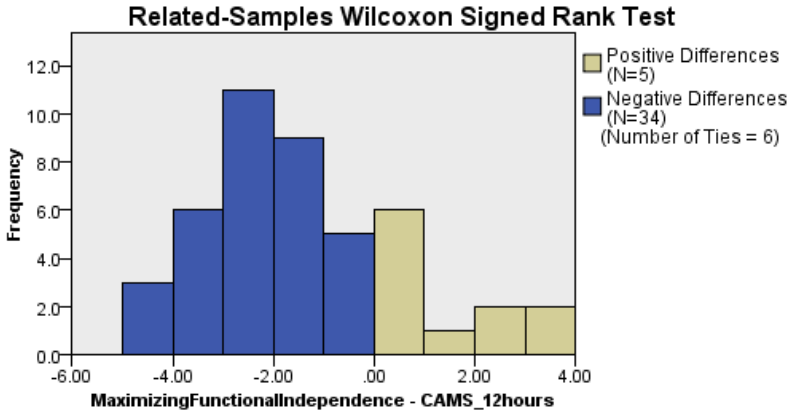
Total N	45
Test Statistic	76.500
Standard Error	78.895
Standardized Test Statistic	-4.753
Asymptotic Sig. (2-sided test)	.000

The patient population that received interventions from the category *Maximization of Functional Independence Interventions* elicited a statistically significant mean difference in the CAM scores at 12 hours, compared to those of the initial CAM, $z = -4.424$, $p < .0005$. This category is associated with a decrease in the CAM scores for 34 patients, increase for five patients, and six patients experienced no change.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The median of differences between CAM score at 12 hours and the patient population receiving Maximizing Functional Independence Interventions equals 0.	Related-Samples Wilcoxon Signed Rank Test	.000	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.



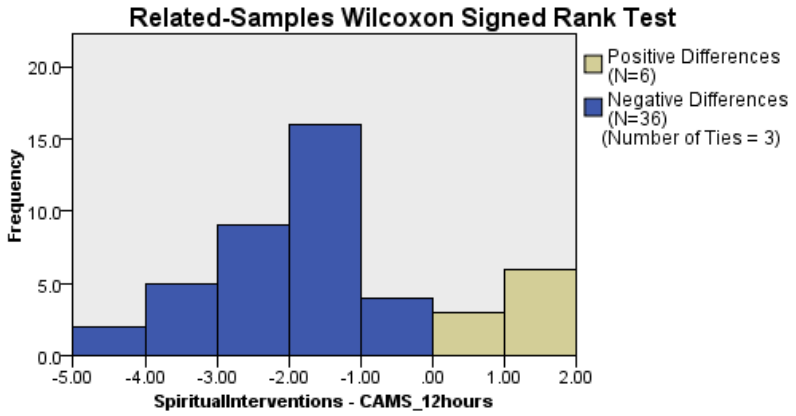
Total N	45
Test Statistic	75.500
Standard Error	71.083
Standardized Test Statistic	-4.424
Asymptotic Sig. (2-sided test)	.000

The patient population that received interventions from the category *Spiritual Interventions* elicited a statistically significant mean difference in the CAM scores at 12 hours, compared to those of the initial CAM, $z = -5.284$, $p < .0005$. This category is associated with a decrease in the CAM scores for 36 patients, increase for six patients, and three patients experienced no change in CAM score.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The median of differences between CAM score at 12 hours and the patient population receiving Spiritual Interventions equals 0.	Related-Samples Wilcoxon Signed Rank Test	.000	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.



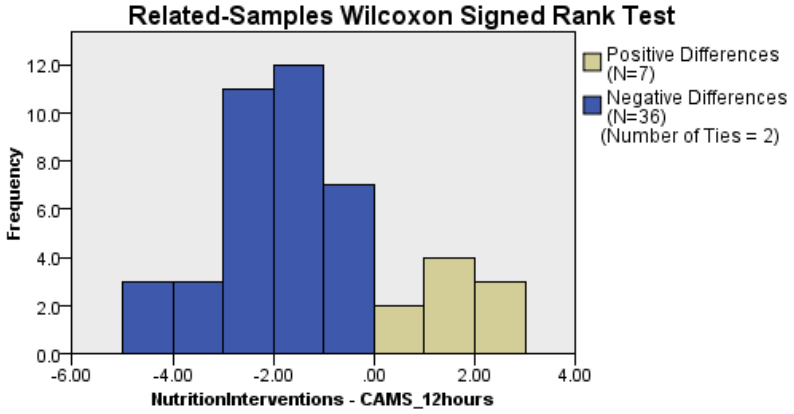
Total N	45
Test Statistic	33.000
Standard Error	79.202
Standardized Test Statistic	-5.284
Asymptotic Sig. (2-sided test)	.000

The patient population that received interventions from the category *Nutritional Interventions* elicited a statistically significant mean difference in the CAM scores at 12 hours, compared to those of the initial CAM, $z = -4.777$, $p < .0005$. This category is associated with a decrease in the CAM scores for 36 patients, increase for seven patients, and two patients experienced no change in CAM score.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The median of differences between CAM score at 12 hours and the patient population receiving Nutrition Interventions equals 0.	Related-Samples Wilcoxon Signed Rank Test	.000	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.



Total N	45
Test Statistic	81.000
Standard Error	82.052
Standardized Test Statistic	-4.777
Asymptotic Sig. (2-sided test)	.000

Remaining intervention categories (Safe Environment Interventions, Protection of Circadian Rhythm, Prevention of Further Cognitive Decline) retained the null hypothesis, in that the population of patients receiving the given category of interventions did not yield a statistically significant difference in CAM scores between the initial CAM and the CAM at the 12-hour interval. None of the patients in the study received interventions from the category *Other Interventions*.

In addition to analyzing CAM scores, the use of restraints and antipsychotic medications was determined to better understand the severity of the delirium present in the patient population. Out of the 45 total patients, 31 of these patients were not restrained at any point during their hospital stay, while the remaining 14 patients were restrained at some point during their hospital stay. For those patients that did require restraints, the length of restraint ranged from 1-26 days.

Restraint Use		
Number of Days with Restraints	Amount of Patients with Restraints for the Given Number of Days	Percent
0	31	68.9
1	5	11.1
2	2	4.5
3	2	4.5
4	1	2.2
6	1	2.2
7	1	2.2
12	1	2.2
26	1	2.2

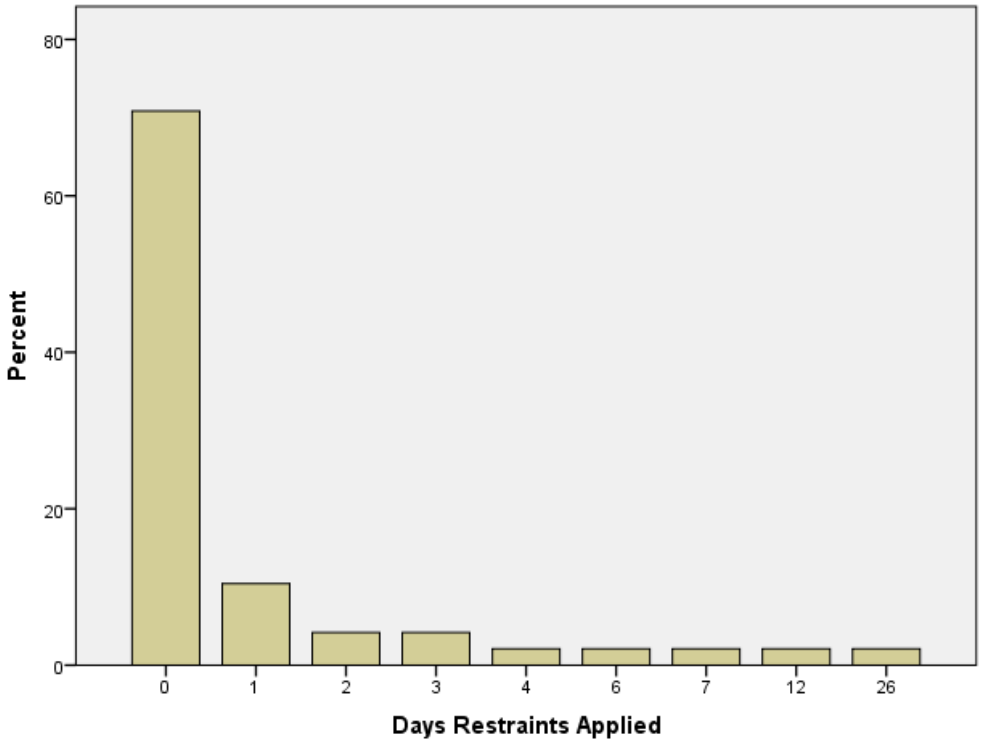


Fig. 1: The length that restraints remained on patients ranged from 1 to 26 days. The majority of patients were not restrained (0 Days).

Pharmacological usage data was collected for the following medications: haloperidol (Haldol), ziprasidone (Geodon), benzodiazepines, anxiolytics, risperidone (Risperdal), and mirtazapine (Remeron). The only medications from this group that were given to study patients during their hospital stay are haloperidol, risperidone, and mirtazapine. The most commonly given medication for these patients was haloperidol, with a total of 45 doses administered, followed by risperidone with 17 doses, and lastly mirtazapine with four doses. Out of the 45 patients in this study, 38 of those did not receive any of the aforementioned medications during their hospital stay.

Only one patient received any mirtazapine, while both risperidone and haloperidol were administered to more than one patient. For this reason, a further breakdown of the data regarding the latter two medications has occurred. The total number of patients that received any pharmacological interventions from the studied group of medications is 13, which indicates that the remaining 32 patients did not receive pharmacological interventions during their hospital stay.

Haloperidol		
Number of Doses	Amount of Patients receiving the Given Number of Doses	Percent
0	35	77.7
1	2	4.5
2	2	4.5
3	1	2.2
5	1	2.2
6	2	4.5
7	1	2.2
12	1	2.2

Risperidone		
Number of Doses	Amount of Patients receiving the Given Number of Doses	Percent
0	42	93.4
3	1	2.2
6	1	2.2
8	1	2.2

Discussion

The results of the pairwise comparison test yield information about the relationships between mean CAM scores from the given time intervals: initial, 12 hours, 24 hours, 36 hours, and 48 hours. Results indicate that there was a statistically significant decrease in the CAM

scores for 12 hours, 24 hours, 36 hours, and 48 hours when compared with the initial CAM scores ($p<0.0005$). For this study, the null hypothesis is that *the proportion of patients who test positive for delirium will not change as a result of the interventions*. The null hypothesis is rejected determined by a significance of <0.05. The data supports the alternative hypothesis that *the interventions lead to a decrease in the proportion of patients who test positive for delirium*. After the initial positive CAM score for each patient and the implementation of the NLDP, 23 of the 45 patients did not test positive for delirium for the next 48-hour time period. This indicates that 51.1% of the study population remained non-delirious following the implementation of interventions.

The interventions of the NLDP were analyzed for effectiveness as a whole based on a change in CAM score from delirious (5-6) to non-delirious (0-4). The most commonly used intervention category is that of 'Safe Environment Interventions', which were utilized for every patient in the study. The least commonly used category is that of 'Other,' where the RN can determine an intervention specific to the individual, which was not utilized for any patients in the study. Literature suggests that the most recommended area of interventions consists of actions to create a safe environment, which is supported by data collected from the study hospital (Irwin et. al., 2013).

The 45 charts were analyzed separately based on populations of patients receiving each category of interventions. A Related-Samples Wilcoxon Signed Rank Test was conducted and yielded hypothesis test summaries for each intervention category when compared with the CAM scores present at the 12-hour interval. Each hypothesis test summary evaluated a null hypothesis for each category of interventions. The null hypothesis for each states: "The median of

differences between CAM scores at 12 hours and the *given intervention category* equals 0." For data sets that do not have statistically significant results, the null hypotheses were retained. This indicates that patients in the given category did not experience a significant change of CAM scores. The null hypotheses were retained for the patient populations within the following categories: Safe Environment Interventions, Protection of Circadian Rhythm Interventions, and Prevention of Further Cognitive Decline Interventions. For data sets that do have statistically significant results, the null hypotheses were rejected. Rejection of the null hypothesis indicates that patients in the given category did experience a significant change of CAM scores. The null hypotheses were rejected for the patient populations within the following categories: Protection from Iatrogenic Harm Interventions, Fluid Interventions, Elimination Interventions, Maximization of Functional Independence Interventions, Spiritual Interventions, and Nutrition Interventions.

The information gathered from the hypothesis test summaries was analyzed further utilizing the Related-Samples Wilcoxon Signed Rank Test. The bar graphs and tables created indicate the amount of patients who experienced a decrease, increase, or lack of change in their CAM scores. *Protection from Iatrogenic Harm Interventions* are associated with a decrease in the CAM scores for 33 patients, increase for eight patients, and four patients experienced no change in CAM score. *Fluid Interventions* are associated with a decrease in the CAM scores for 31 patients, increase for seven patients, and seven patients experienced no change in CAM score. *Elimination Interventions* are associated with a decrease in the CAM scores for 36 patients, increase for six patients, and three patients experienced no change in CAM score. *Maximization of Functional Independence Interventions* are associated with a

decrease in the CAM scores for 34 patients, increase for five patients, and six patients experienced no change in CAM score. *Spiritual Interventions* are associated with a decrease in the CAM scores for 36 patients, increase for six patients, and three patients experienced no change in CAM score. *Nutritional Interventions* are associated with a decrease in the CAM scores for 36 patients, increase for seven patients, and two patients experienced no change in CAM score.

Remaining intervention categories (*Safe Environment Interventions, Protection of Circadian Rhythm, Prevention of Further Cognitive Decline*) retained the null hypothesis, in that the population of patients receiving the given category of interventions did not yield a statistically significant difference in CAM scores between the initial CAM and the CAM at the 12-hour interval. None of the patients in the study received interventions from the category *Other Interventions*.

Out of the 45 total patients, 31 of these patients were not restrained at any point during their hospital stay, while the remaining 14 patients were restrained at some point during their hospital stay. For those patients that did require restraints, the length of restraint ranged from 1-26 days. The vast majority of the patients did not require restraints, which would support the idea that their delirium was being adequately managed.

The most commonly given medication for the study patients was haloperidol, with a total of 45 doses administered, followed by risperidone with 17 doses, and lastly mirtazapine with 4 doses. This finding is not unexpected, as research suggests that haloperidol is most common pharmacological intervention used (Barr et. al., 2013). Out of the 45 patients in this study, the total number of patients that received any pharmacological interventions from the studied group

of medications is 13, which indicates that the remaining 32 patients did not receive pharmacological interventions during their hospital stay. To better understand the significance of the restraint and medication usage, it would be important to gather further data regarding how many days each patient required the restraint/medication and whether or not its usage decreased after the implementation of the interventions set forth in the NLDP.

Limitations to the Study

The study population was determined solely based on three criteria: 1) a positive CAM score indicating a delirious patient, 2) that the patient was greater than or equal to 65 years of age, and 3) that they were present for at least one additional CAM score at the 12-hour interval. For further statistical analysis, it could be beneficial to collect information regarding the presenting diagnoses and baseline conditions of the population to test for any correlation in the recovery from or progression of delirium.

As mentioned previously, it would be beneficial to study the medication and restraint usage based on its relationship with the interventions to determine if the NLDP decreased the need for restraints and pharmacological delirium interventions in these patients.

An additional limitation to the study is that the CAM solely identifies the presence or absence of delirium, without analyzing the severity of a patient's delirium. Because delirium fluctuates, it can be expected that the CAM scores will fluctuate accordingly. Unlike the CAM, which solely detects the presence or absence of delirium, there are assessment tools that can detect the severity of delirium. The study hospital has not implemented the usage of these assessment tools, and therefore, the severity of the study population was unable to be analyzed.

Though 259 charts were reviewed, only 45 charts were analyzed based on the required criteria. The difference between a positive and a negative CAM score relies on a thorough understanding of the Confusion Assessment Method and how to administer the assessment tool properly. From the data collected, there is no way to analyze the knowledge and understanding of the RNs implementing the assessment. That being said, continued education and training should be provided to nurses to ensure they feel comfortable with the assessment tool and to help prevent against false negative or false positive CAM scores (McDonnel & Timmins, 2012).

Conclusion

From this study, it can be deduced that the implementation of the interventions set forth in the NLDP lead to a decrease in the proportion of patients that test positive for delirium when assessed utilizing the Confusion Assessment Method (CAM). Because of this finding, the continued use of the NLDP for management of delirious patients is supported.

Although the study hospital has not yet implemented an assessment tool that can determine the severity of delirium present in their patients, there are various tools available that can be implemented for future practice. The NEECHAM Confusion Scale (NCS) detects delirium in addition to monitoring the fluctuations in its severity (Matarese et. al., 2013). Because the tool accounts for a more complete picture of the delirious patient, administration of screening requires more time than the CAM. As previously stated, the CAM alone does not detect or describe the severity of delirium; therefore certain measurements can be added to the tool to create a new scale, the CAM-S (Inouye et. al., 2014). Studies suggest that the CAM-S shows a significant association with increased score and increased clinical outcomes related to delirium, suggesting adequate accuracy and reliability (Inouye et. al., 2014). If the study hospital

desires to evaluate the effectiveness of the NLDP interventions in decreasing the severity of delirium in patients, one of these assessment tools could be implemented.

Delirium has been shown to lead to an increased length of stay and a decline in the functional and cognitive status. Delirium increases the risk for readmission, falls, and future admission to a long-term care facility (Philips, 2013). With this knowledge, it is important to prevent delirium and be aware of the risk factors that predispose a patient and increase their risk of becoming delirious. Protocols with many different interventions are more effective than those with two or fewer interventions, because they are more effective at addressing the multifactorial causes of delirium (Rivosecchi, Smithburger, Svec, Campbell, & Kane-Gill, 2015). The NLDP in place at the study hospital takes this into consideration and provides 10 categories of interventions.

Currently, the NLDP is composed of 10 intervention categories that contain various interventions relevant to the topic category. Delirious patients receive a unique combination of interventions, with no minimum or maximum amount required. The creation and modification of a designated bundle of interventions that are all implemented for every delirious patient could create a standardized way to provide care. If a bundle of interventions were to be created and implemented, the effectiveness of the bundle could be analyzed and lead to further modification to create a comprehensive, effective protocol.

Ultimately, a vital element of delirium management requires nursing staff to be adequately educated about delirium, its risk factors, and provide a solid understanding and increased awareness to the presence of predisposing factors (Baker, Taggart, Nivens, & Tillman, 2015). Along with information about risk factors, nurses must be adequately educated about

how to properly perform the assessment tool (CAM) in order to reliably detect delirium (Andrews, Silva, Kaplan, & Ximbro, 2015). For future implementation, it would be wise to provide continued education opportunities at the study hospital so that nurses feel comfortable with the Confusion Assessment Method and better understand how to provide care to their delirious patients.

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