

## Abstracts Accepted for a Poster Presentation at the 2019 Annual Meeting of the American Delirium Society

### **1: Structured delirium care pathway is associated with reductions in length of stay, cost and readmissions in hospitalized adults - on behalf of the Delirium Reduction Campaign Writing Group**

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**Objective:** To determine if a structured delirium care pathway is associated with improved clinical outcomes in hospitalized adults.

**Methods:** In this retrospective cohort study, we compared outcomes before and after delirium care pathway implementation on a general medicine ward. The pathway included admission delirium risk assessment, nursing delirium screening every twelve hours, and a non-pharmacologic care bundle for high risk and delirious patients. We included all patients >49 years old hospitalized for at least 24 hours on the general medicine ward from 1/9/2016-1/8/2017 (pre-pathway) and 1/9/2017-1/8/2018 (post-pathway). Patients who spent any time in the intensive care unit were excluded. Primary outcome was length of stay. Secondary outcomes included restraint use, safety attendant use, hospitalization cost and 30-day readmission. Since delirium screening was only implemented with the care pathway, delirium rates could only be measured in the post-pathway period. Outcomes were compared between time periods using multivariable generalized linear, Poisson and logistic models as appropriate, adjusting for clinical variables that were significantly different between groups.

**Results:** 5419 patients were included (2594 patients pre-pathway). Average age was  $70 \pm 13$  years; age and other demographic variables did not change over time. The prevalence of delirium after pathway implementation was 24.3%. Mean length of stay decreased after the intervention by 0.8 days (95% CI 0.8, 1.1;  $p < 0.0001$ ). Hospitalization cost decreased by an average of \$850 per patient (95% CI -1505, -197;  $p < 0.0001$ ) and odds of readmission were reduced by 30% (OR 0.7, 95% CI 0.6, 0.7;  $p < 0.0001$ ). Patient safety attendant ( $p = 0.3$ ) and restraint ( $p = 0.2$ ) use did not change. The rate of delirium remained constant over the course of the twelve months after the pathway was implemented ( $p = 0.2$ ).

**Conclusions:** Implementation of a delirium care pathway on a general medicine ward was associated with reductions in hospital length of stay, hospitalization cost and 30-day readmissions.

### **2: Evidence that the Heightened Vulnerability of the Pre-Adolescent Population to Delirium Triggered by Anesthesia is Linked to Increased Blood-Brain Barrier Permeability Associated with Neovascularization and Rapid Brain Growth**

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**Objective:** OBJECTIVE: Pediatric post-operative delirium (POD) is rampant (25-40% incidence) and has been associated with widespread use of Sevoflurane. Epidemiologic studies have established an association between Sevoflurane and long-term outcomes that include learning disabilities and behavioral and developmental disorders, especially in children 2-4 years of age. Here, we use a pre-adolescent rat

model to ask whether this heightened sensitivity to Sevoflurane is linked to increased Blood-Brain Barrier (BBB) permeability.

**Methods:** METHODS: Two week old (pre-adolescent), four week old (adolescent), and six month old (adult) rats were subjected to Sevoflurane or Isoflurane for three hours. Animals were sacrificed and fixed by perfusion. Brains were processed for immunohistochemistry (IHC) and scanning electron microscopy (SEM). IHC was used to detect the presence, location, and extent of BBB compromise. SEM was used to directly visualize the effects of anesthesia on the luminal surfaces of brain vascular endothelial cells (BVECs) forming the BBB.

**Results:** RESULTS: Following Sevoflurane anesthesia, pre-adolescent rats showed increased BBB permeability as evidenced by the amount of extravasated IgG and binding of brain-reactive autoantibodies to neurons, especially pyramidal neurons, compared to adolescent, adult, and untreated controls. Increased BBB permeability was most prevalent in brain regions of pre-adolescent rats showing rapid growth and coincident neovascularization. SEM revealed Sevoflurane-induced structural alterations in cell surface topography at the interface between adjacent BVECs, the site corresponding to the newly forming BBB. These changes were not seen with Isoflurane.

**Conclusions:** CONCLUSIONS: Results suggest that the sensitivity of pre-adolescent children to Sevoflurane is due to an anesthesia-induced increase in BBB permeability. Pre-adolescents are most vulnerable to this effect because the brain is engaged in a period of exceptionally rapid growth accompanied by extensive neovascularization and BBB formation. We propose that the resulting plasma influx disrupts brain homeostasis and neuronal activity, triggering POD and favoring long-term learning and behavioral sequelae.

### **3: Creating a cross-walk between two commonly used proxy-based measures of cognitive impairment to assess baseline function in patients with delirium**

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**Objective:** The Informant Questionnaire on Cognitive Decline in Elderly (IQCODE) and the Alzheimer's Disease 8 (AD8) are proxy-based assessments for mild cognitive impairment (MCI) and dementia that are particularly useful when direct cognitive testing of patients is not possible, such as during delirium. The IQCODE consists of 16 Likert questions, while the AD8 consists of 8 yes/no questions and is briefer to administer. We aimed to develop a crosswalk of scores between these measures, and to use established IQCODE cutoffs for MCI and for dementia to define similar cutoffs for AD8.

**Methods:** We administered both the IQCODE and AD8 to proxies of enrolled hospitalized patients from two medical centers. We used equipercenile equating to develop the crosswalk of scores between the two instruments. The study sample consisted of 151 patients, with mean age  $79 \pm 11$  years, 55% female. Of the proxies, 47% lived with the patient, and included 34% spouses, 50% children/children-in-law, and 16% other.

**Results:** We equated AD8 and IQCODE scores with good precision (standard error=0.04) throughout the range of cognitive decline (3.0-5.0 for IQCODE, 0-8 for AD8). Previously established cut-off scores of

3.2 for MCI and 3.5 for dementia on the IQCODE equated to scores of 2 for MCI and 4 for dementia on the AD8.

**Conclusions:** Our results suggest that the previously published AD8 cut-off score of 2 for dementia might be overly sensitive, and a cut-off of 4 should be considered. Our results will enable researchers and clinicians to more directly compare studies using these two proxy-based cognitive measures.

#### 4: Catatonia, Delirium and Coma: Implications for Mortality

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**Objective:** Delirium, a form of acute brain dysfunction, characterized by changes in attention and alertness, is a known independent predictor of mortality in the Intensive Care Unit (ICU). We sought to understand whether catatonia, a more recently recognized form of acute brain dysfunction, is associated with increased in-hospital mortality in critically ill older adults.

**Methods:** We prospectively enrolled critically ill patients at a single institution who were on a ventilator or in shock and evaluated them daily for delirium using the Confusion Assessment for the ICU and catatonia using the Bush Francis Catatonia Rating Scale. Coma, was defined as a Richmond Agitation Scale score of -4 or -5. Cox Proportional Hazards model predicting in-hospital mortality and adjusting for delirium and catatonia status was used for the primary outcome.

**Results:** We enrolled 335 medical, surgical or trauma critically ill patients with 1103 matched delirium and catatonia assessments. Median age was 58 years (IQR: 48 -67). Main indications for admission to the ICU included: airway disease or protection (32%; N=100) or sepsis and/or shock (25%; N=79). In the Cox model, CAM-ICU+ (delirious) patients had 1.67 times the hazard (p<0.001) of death compared to a CAM-ICU- (non delirious) individual. Holding CAM-ICU assessment status constant, a one unit increase in the number of DSM-5 catatonia items present was associated with a 1.18 times the hazard (p <0.001) of in-hospital mortality.

**Conclusions:** Non-delirious (CAM-ICU-) individuals seem to have the highest median survival times, while those who are comatose seem to have the lowest median survival times after a critical illness, holding catatonia status constant. Comparing the absence and presence of catatonia, the presence of catatonia seems to worsen survival. Those individual who are both comatose and catatonic appear to have the lowest median survival time.

#### 5: Validation of the "4AT" delirium screening tool in a cardiac surgery patient population

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**Objective:** Delirium is a common yet under-detected condition in post-cardiac surgery patients, and it's shown to be associated with increased morbidity/mortality. Although several delirium screening tools exist, there are concerns on the sensitivity and real-world feasibility of these instruments in clinical practice. We sought to validate the use of the 4 A's Test (4AT) for delirium screening on the postoperative

ward, and hypothesized that it would be a more sensitive tool than the currently used Confusion Assessment Method (CAM).

**Methods:** This single centre, prospective observational study evaluated the 4AT as a delirium screening tool against a reference rater (RR) using DSM-V criteria. The 4AT was compared to the existing nurse-administered Confusion Assessment Method (CAM) for delirium screening on post-operative cardiac surgery patients. Assessments were undertaken during the patient's first 3 postoperative days on the ward, and the evaluators were double-blinded to the results. Finally the data was collected and the test parameters were analyzed statistically.

**Results:** A total of 140 patients were included in the final analysis. The 4AT identified 77 total cases of delirium compared to the RR of 54 cases (sensitivity of 85% (95% CI, 73%-93%) and specificity of 90% (95% CI, 85%-93%) when using all assessments. The CAM had a sensitivity of 23% (95% CI, 13%-37%) and specificity of 100% (95% CI, 99%-100%). The inter-rater reliability between the 4AT and reference rater was =0.69, the CAM vs. reference rater was =0.34, and the 4AT vs. CAM was =0.22.

**Conclusions:** The 4AT demonstrated a high level of agreement with the DSM-V criterion for delirium. The 4AT demonstrated superior sensitivity versus CAM in postoperative cardiac surgery patients. Since the presence of delirium indicates an underlying neurological disturbance, better detection is a key step to finding and treating the precipitating factors, and thus improving patient outcomes.

## **6: Knowledge and adherence to the ABCDEF bundle: An Argentinian Survey**

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**Objective:** To assess the knowledge and use of the A Assess, prevent and manage pain; Both spontaneous awakening trials and spontaneous breathing trials; Choice of sedation; Delirium: assess, prevent and manage; Early mobility and exercise; Family engagement and empowerment (ABCDEF) bundle in intensive care units (ICU) in Argentina.

**Methods:** A national online survey was conducted on physicians, nurses, kinesiologists and occupational therapists working in ICUs in Argentina.

**Results:** There were 138 responders from 25 provinces, 66% had implemented the ABCDEF bundle with various degrees of compliance. Most of the respondents (64%) used a scale to evaluate pain. Spontaneous awakening trials and spontaneous breathing trials are performed in 81% and 89% of the responder ICUs, respectively. Sedation scale was used in 91% of ICUs. Delirium monitoring was implemented in 62% of ICUs with a validated delirium tool. Likewise, early mobilization was prescribed by most of the responders (92%), but 72% had no mobility team. Finally, only 16% reported that their unit was open 24hr/d for family visits.

**Conclusions:** The majority of the professionals (66%) reported knowing and implementing the ABCDEF bundle with various degrees of compliance. No statistically significant differences were found in the adherence to the bundle between regions of the country ( $p=0.12$ ), neither among institutions with state funding regarding private financing ( $p=0.07$ ), nor among academic units (those that have residence in intensive care and critical care) vs. non-academic units ( $p=0.31$ ).

## **7: A delirium training for the surgical resident**

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**Objective:** Although perioperative delirium is a highly prevalent, there are very few standardized delirium teaching tools that are specifically tailored for surgical residents. Our team developed a formalized geriatric surgical curriculum with foundations in prevention, assessment and management of delirium with the purpose of changing knowledge and behaviors of these residents as they cared for the geriatric surgical patient.

**Methods:** Each training session involves a half-day interactive, case-based training for surgery residents. During the first year of the training we collected data on knowledge of the core concepts of delirium. After 3 years of the training we sent a follow-up survey to a subset of the residents who participated in the training to assess retention and application of the knowledge they gained during the training.

**Results:** A total of 64 residents have participated in our training over 3 years. Pre-post data revealed that nearly 80% of residents either improved or maintained the same knowledge base after the training. A follow-up survey showed that 81% of respondents recalled taking the training their intern year. 63% of participants responded that they had a standardized way to assess for delirium post-operatively with the majority identifying the 3D-CAM and others noting they rely on nursing assessment to assist in that determination. 96% of residents felt they had strategies to treat delirium with every resident identifying non-pharmacologic and harm-reducing techniques as the first line of intervention. All but one resident felt the training was helpful to their understanding of delirium in the surgical patient. 23% of residents requested a longitudinal training in delirium.

**Conclusions:** Training programs that start early in surgery residency and give practical skills for assessment, management and prevention of delirium are key with an emphasis on a longitudinal component to the training to reinforce concepts and update as our understanding of delirium grows.

## **8: Evaluation of a Pharmacist-Driven Intervention to Reduce Deliriogenic Medication Use in a Health-System Wide Delirium Reduction Pathway**

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**Objective:** Objective: Pharmacists have an important role in recommending safer medication use in patients at risk for delirium. We aimed to examine the beliefs and attitudes of pharmacists and providers regarding the current pharmacist-driven intervention to reduce deliriogenic medication use in a health-system wide delirium reduction pathway.

**Methods:** Methods: Online surveys using the Likert scale were administered to a randomly selected group of pharmacists, and providers to assess their beliefs about the effectiveness and personal work burden of the workflow to reduce deliriogenic medication administration. This workflow includes a one-time medication review by pharmacists with recommendations written in a consult note. In addition, chart review was done to determine if pharmacy recommendations were implemented.

**Results:** Results: Fourteen pharmacists and thirteen providers were surveyed and we found different beliefs about the current workflow. 29% of pharmacists and 62% of providers agreed the current delirium prevention system helps reduce use of deliriogenic medications. 86% of providers agreed that pharmacist recommendations were valuable to reduce delirium, but only 44% of pharmacists believed that providers followed their requests to change medications. However, in a random sampling of 76 chart reviews, 83% of recommended changes were made by the provider.

**Conclusions:** Conclusions: Our study revealed that pharmacists at our institution may be less confident in their role of the current delirium reduction pathway while the providers they work with are quite likely to trust and implement their recommendations. The data will be used to redesign the pharmacy workflow using increased education and protocols.

### **9: A qualitative study of patient, family, staff and volunteer perspectives during a phase 2 trial of a multicomponent non-pharmacological delirium prevention intervention for inpatients with advanced cancer**

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**Objective:** To explore patient, family, staff and volunteer perspectives of the feasibility and acceptability of a multicomponent non-pharmacological delirium prevention intervention for inpatients with advanced cancer.

**Methods:** We undertook a qualitative study within a phase 2 cluster randomised waitlist controlled trial in four Australian palliative care units. Following the intervention (delirium screening, diagnostic assessment, and prevention strategies addressing sleep, vision, hearing, eating and drinking, orientation, mobility and family partnership), we conducted semi-structured interviews with those involved in its implementation. We framed data analysis according to the Behavior Change Wheel (BCW) theoretical domains.

**Results:** Participants (n=39) were multidisciplinary staff (n=28), patients (n=6), family members (n=4), and one volunteer. Influences upon intervention delivery aligned with the BCW core domains of capability, motivation and opportunity. Resultant themes were 1) Capability: Knowledge is essential to engage with delirium prevention strategies and Value of the intervention in influencing attention and memory of caregivers 2) Motivation: Delirium prevention strategies valued as routine care, Interpretation of the goals of palliative care influences perceptions of acceptability of delirium prevention strategies and Clarifying roles and responsibilities; and 3) Opportunity: Intervention supported by the enabling culture of palliative care and Addressing environmental barriers to delirium prevention.

**Conclusions:** Obtaining and framing these qualitative data according to a behavior change theory proved invaluable in the phase 2 trial of the intervention. Overall, participants confirmed that this multicomponent non-pharmacological delirium prevention intervention was feasible and acceptable for inpatients with advanced cancer. Feasibility of and adherence to the intervention in a future phase 3 trial will be enhanced by continuing to build the delirium prevention capabilities, motivation and opportunities of staff, family and volunteer caregivers; specifically, through simplifying the intervention, modifying documentation and data collection processes, and developing a structured process to better engage family and volunteers in the delivery of patient care.

## 10: Microbiome dysbiosis and postoperative delirium pathogenesis

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**Objective:** Postoperative delirium (POD) is associated with substantially increased rates of morbidity and mortality, as well as an increased cost of care. However, the pathogenesis of POD is still largely unknown. Only subsets of patients (e.g., senior patients) develop POD, the reason behind this clinical observation is largely unknown. Aging is known to be associated with marked microbiome changes and microbiome dysbiosis links with disorder in immune, endocrine, and nervous system. We therefore set out to assess anesthesia/surgery caused age-dependent changes in delirium-like behavior, brain mitochondrial function in mice, and the microbiome-associated underlying mechanism.

**Methods:** We performed abdominal surgery under 1.4% isoflurane in mice for 2 hours in 9 month-old and 18 month-old WT mice. We then measured: (1) gut microbiome (16s rRNA gene sequencing) before and after the anesthesia/surgery; and (2) mitochondrial function (Seahorse XFp Extracellular Flux Analyzer); and (3) POD-like behavior, a battery of behavior tests. Composite Z scores were calculated. We also use lactobacillus to treat the mice before anesthesia/surgery and detect the above changes.

**Results:** Anesthesia/surgery induces POD-like behavior in mice. The aged mice (18 months-old) have significantly larger composite Z-scores compared to adult (9 months-old) mice at 6 and 9 hours, but not 24 hours. Anesthesia/surgery decrease OCR and induce a greater reduction in OCR in aged mice and cause greater brain mitochondrial dysfunction in aged mice. Finally, anesthesia/surgery decreases the levels of gut lactobacillus in the aged mice, moreover, lactobacillus mitigates mitochondrial dysfunction and the POD-like behavior in the aged mice.

**Conclusions:** In conclusion, we have showed the age-dependent changes in gut microbiome, mitochondrial function, and POD-like behavior and revealed the mitigation effects of lactobacillus in the POD-like behavior in the mice. Clinically, these efforts may challenge the current practice and provide better postoperative outcomes for POD patients.

## 11: Utility of the 4AT assessment of delirium in acute care: a multi-center blinded independent rater diagnostic test accuracy study

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**Objective:** Delirium affects 15% of hospitalised patients but remains underdetected. The 4AT (Test: Alertness, Attention (Months of the Year Backwards), Abbreviated Mental Test-4 to test orientation; Acute change) is a short (<2 min) delirium assessment tool designed for routine clinical use which does not require special training: [www.the4AT.com](http://www.the4AT.com). Primary objective: diagnostic accuracy of the 4AT for delirium detection in acute older patients. Secondary objectives included comparative performance of Confusion Assessment Method (CAM) and to determine if 4AT scores predict outcomes.

**Methods:** This was a STARD-compliant, prospective, randomized, double-blind diagnostic test accuracy multi-site study of 785 patients aged  $\geq 70$  in the Emergency Department within 12 hours, or acute wards within 96 hours of attendance. Each patient underwent (1) DSM-IV reference standard delirium

assessment informed by the Delirium Rating Scale-Revised-98, and (2) assessment with either 4AT or CAM (randomized).

**Results:** Mean age was 81.4 (SD 6.4) years, 45% male, 9% known dementia diagnosis. 96 (11.7%) had reference standard delirium. The 4AT had an area under the receiver operating characteristic curve of 0.90. The 4AT had specificity of 95% (95% CI 92-97%) and sensitivity of 76% (95% CI 61-87%). The CAM had specificity of 100% (95% CI 98-100%) and sensitivity of 40% (95% CI 26-57%). Patients with positive 4AT had longer lengths of stay (median 5 days (IQR 2.0-14.0) than negative 4AT (median 2 days (IQR 1.0 -6.0) and higher mortality.

**Conclusions:** The 4AT is a rapid delirium assessment instrument which has good overall diagnostic accuracy for delirium in acutely unwell older patients.

## **12: Older women who exercise daily before surgery suffer from less postoperative delirium**

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**Objective:** Late-life cognitive reserve is associated with decreased incidence and severity of postoperative delirium (POD)<sup>1</sup>. Our objectives were to determine the effect of baseline physical activity on the incidence of POD in older patients and to determine whether these effects were independent of cognitive reserve. We hypothesize that physical activity protects against POD by bolstering the physiologic reserve needed to withstand the stressors of surgery.

**Methods:** We performed a secondary analysis of a prospective, single-center cohort study. Non-demented, English-speaking adults over 60 years undergoing elective orthopedic surgery were screened for POD using the Confusion Assessment Method on postoperative days 1 and 2. Baseline cognitive reserve and physical activity were assessed with a validated Leisure Activity Scale (LAS)2-4 The LAS measures frequency of cognitive activities as a marker for late-life cognitive reserve as well as number of days per week of physical activity. Multivariable logistic regression was performed adjusting for age, sex, Charlson Comorbidity Index, cognitive reserve and cognitive function.

**Results:** 41 of 132 (31.1%) patients developed POD. Daily physical activity was associated with a 73% reduction in risk for POD (OR 0.27 95% CI 0.08-0.85). The product term testing for interaction between physical activity and cognitive reserve was not significant (p=0.21). 25 of 85 women (29.4%) and 16 of 47 men (34.0%) men developed POD, but stratified analysis showed that women who exercised daily had dramatically reduced risk of POD, OR 0.07 (95% CI 0.01-0.62) compared with men OR 0.99 (95% CI 0.19-5.16).

**Conclusions:** Daily physical activity is associated with decreased incidence of POD among older women undergoing elective orthopedic surgery. A robust amount of physical activity was required before a benefit was observed, but this was independent of cognitive reserve. It is unclear why women showed more benefit from exercise than men which should be addressed in future studies.

### **13: Characterization of the electrophysiological features of sepsis-induced delirium in a mouse model using EEG**

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**Objective:** The purpose of this work was to facilitate development of a reliable method to measure the severity of delirium in an animal model using electroencephalography (EEG). Such an approach could lead to a breakthrough in understanding the pathophysiology of delirium and developing an effective therapeutic intervention.

**Methods:** We used a mouse model with lipopolysaccharide (LPS) injection (2 mg/kg) to induce a sepsis-like reaction in C57Bl/6 mice (7-8 months old, n=20), with 24-hour, two channel EEG recordings. The uniqueness of our approach is that we applied a novel algorithm to yield a EEG score comparing low to high frequency to measure the severity of delirium.

**Results:** Testing of C57Bl/6 mice (7-8 months old, n=20) attached to two EEG channels revealed diurnal changes over 24-hour periods, both at baseline and after injection of vehicle saline. When mice were injected with LPS (2 mg LPS/kg body weight), the EEG score increased dramatically, reaching a peak score within 12 hours, and the diurnal changes diminished for the next 2-3 days. Our data in mice is consistent with our previously published data from human studies (Shinozaki et al., 2018).

**Conclusions:** Our pilot data show that use of EEG in conjunction with our novel algorithm makes it possible to objectively and precisely quantify delirium in mice using a translatable method, consistent with our findings using EEG in humans. Key next steps will be to make the mouse model of LPS-induced delirium more effective by optimizing the LPS dose; to define the relationship between aging and increased risk of delirium by assessing the effects of LPS in mice at different ages; and delineate delirium pathophysiology by assessing the correlation between the change in EEG score and cognitive disturbances measured by behavioral experiments.

### **14: A Pilot Study Assessing the Feasibility of a Remote Telemedicine Delirium Assessment Tool**

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**Objective:** Assessment of delirium outside of the hospital setting is currently limited, as clinical assessments for delirium require a face-to-face encounter. This limits the ability to feasibly perform frequent delirium assessments in the post-discharge setting. We sought to examine the acceptability of a remote videoconference-based delirium assessment tool in an older population.

**Methods:** We conducted a prospective pilot study at the UNC Geriatric Specialty Outpatient Clinic from June-August 2018. Investigators utilized HIPAA-compliant doxy.me videoconferencing services on a tablet device to assess subjects for delirium with the 3-minute Diagnostic Interview for Confusion Assessment Method (3D-CAM). Subjects were then assessed face-to-face with the 3D-CAM. We obtained qualitative data on the acceptability of the tablet-based diagnostic tool through surveys and an open-ended interview. We also compared the results of the face-to-face assessments with the remote assessments to assess test validity.

**Results:** We enrolled 30 subjects (median age 77.80 years; 87% female, 100% white and non-Hispanic). Face-to-face delirium assessments were consistent with remotely performed delirium assessments in terms of diagnosis. A bipolar Likert scale revealed overall videoconferencing interface satisfaction with the subject's average rating of 8.16 and above on a scale of 0-9 with higher scores indicating more satisfaction. A one-way ANOVA revealed no significant difference in mean responses in any domain by age category.

**Conclusions:** The use of telemedicine in assessment of delirium in older adults is promising. Remote videoconferencing-based delirium assessment is an acceptable method for delirium assessment in the clinic setting. Our next step will be to assess the acceptability and validity of this assessment method in the home setting.

## 15: Comparative Effectiveness and Efficiency of 4 Delirium Screening Protocols

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**Objective:** We investigated the comparative effectiveness and efficiency of 4 delirium screening protocols that use the Ultra-Brief 2-item screener (UB-2), and the 3D-CAM, a structured assessment that operationalizes the CAM algorithm. A skip pattern that ends assessment of each 3D-CAM feature if a single item is incorrect (triggers feature presence) further shortens the assessment. We compared the sensitivity, specificity, and time required to complete the: 1) full 3D-CAM on all patients, 2) 3D-CAM with skip on all patients, 3) UB-2, followed by the full 3D-CAM in positives, and 4) UB-2, followed by the 3D-CAM with skip in positives.

**Methods:** We combined data from the completed 3D-CAM validation study and the currently enrolling READI: Researching Efficient Approaches to Delirium Identification study. Both enrolled older general medicine inpatients. We simulated the items administered under each protocol from 3D-CAM, and calculated median administration time per item from READI. We combined these data to calculate sensitivity and specificity relative to a clinical reference standard, and total administration time for each of the 4 protocols.

**Results:** The 3D-CAM and READI studies have similar mean age (84 and 81 years, respectively), and proportion of patients with dementia (28% (56/201) and 34% (112/332)). Sensitivity and specificity were 95% (40/42) and 94% (150/159) for Full 3D-CAM and 3D-CAM-Skip, and 93% (39/42) and 95% (151/159) for UB-2+Full 3D-CAM and UB-2+3D-CAM-Skip. Total administration times were 3 mins, 24 secs for Full 3D-CAM, 2 mins, 29 secs for 3D-CAM-Skip, 1 min, 55 secs for UB2+full 3D-CAM, and 1 min, 16 secs for UB-2+3D-CAM-Skip, with the last 3 protocols being shorter than full 3D-CAM,  $p < .001$ .

**Conclusions:** The UB-2+3D-CAM-Skip is a high performing protocol that can be completed in slightly over 1 minute. If prospectively validated, this approach holds promise for increasing implementation of systematic screening and improving detection of delirium in hospitalized older adults.

## **16: Intravenous Acetaminophen versus Placebo combined with Dexmedetomidine versus Propofol on Postoperative Delirium in Older Cardiac Surgical Patients (DEXACET trial): A Randomized, Factorial, Clinical Trial**

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**Objective:** We hypothesized that postoperative IV acetaminophen given for 48 hours and dexmedetomidine as a sedative would reduce the incidence of Postoperative delirium (POD). The aim of this study was to investigate the effect of IV acetaminophen and dex on the incidence, duration, and severity of POD.

**Methods:** One hundred twenty patients, 60 years and older undergoing coronary artery bypass grafting with or without valve surgery were enrolled in a prospective, randomized, placebo controlled, triple-blinded factorial trial. Using a block randomization, patients were allocated to either dexmedetomidine or Propofol as a sedative until extubation and acetaminophen or placebo as adjunct analgesic for 48 hours. Dex was not blinded. The primary outcome was in-hospital POD incidence (measured by CAM). Rescue analgesic was quantified as morphine equivalents. t-tests or Wilcoxon Rank-Sum tests was used for continuous data and a chi-square test (or Fisher's Exact test) was used for categorical data. SAS v9.4 was utilized for analyses.  $P < 0.05$  was considered significant.

**Results:** Acetaminophen group had a significantly lower incidence of POD, as compared to the placebo group (10% vs 28%,  $p = 0.01$ ) whereas POD was similar in the dex vs Propofol comparison ( $p = 0.54$ ). No significant interaction was seen between sedation and analgesics ( $p = 0.62$ ). Patients in the acetaminophen group experienced fewer delirium days (1.0[IQR: 1-1] vs 2.0[IQR 1-3] days;  $p = 0.03$ , shorter ICU stay (46[27.8-81.4]hours;  $p = 0.02$ ). Rescue analgesic dosage was higher in the placebo group (405.3 [306.5-590.3] vs 322.5 [233.0-450.0]mcg;  $p = 0.04$ ). The median and worst daily pain scores were comparable between the two groups.

**Conclusions:** This study showed significant and meaningful reduction of POD with the use of IV acetaminophen. If these findings are replicated in a larger trial, intervention with IV acetaminophen has the potential to be the first effective therapeutic intervention for the prevention of POD in the highly vulnerable population of older adults undergoing cardiac surgery.

## **17: Delirium Triage Screen-Brief Confusion Assessment Method in Adult Acute Care: A Validation Study**

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**Objective:** Delirium in the hospitalized patient is associated with numerous negative outcomes. Assessing for the presence of delirium at the bedside using a feasible, easy to use, tool is essential. However, the number of validated bedside screening tools is limited and delirium continues to be under recognized and misdiagnosed. The purpose of this study was to validate and test the reliability of the Delirium Triage Screening and brief Confusion Assessment Method (DTS/bCAM) to screen for delirium in verbal, non-intensive care patients.

**Methods:** This was a prospective, observational study. Seventy-six delirium assessments were completed on 29 adult patients with orthopedic or hematologic diagnoses. The primary nurse performed the

DTS/bCAM during every 12-hour shift. Within 2 hours of this assessment, a research investigator performed both the DTS/bCAM and the Confusion Assessment Method (CAM). Each patient had a maximum of three assessments by a research investigator. Inter-rater reliability for the primary nurse and the researcher was measured through comparison of positive and negative DTS/bCAM results. Validity was measured by comparing the matched DTS/bCAM and CAM results, both performed by the researcher.

**Results:** The DTS/bCAM and CAM results had 100% agreement. Two patients (7%) screened positive for delirium. Sensitivity of the DTS/bCAM was 100% (95% CI, 15.8%-100%) and specificity was 100% (95% CI, 95.1%-100%). There was 86% agreement (43/50) between the clinical nurse and researcher for the DTS/bCAM.

**Conclusions:** In adult patients not receiving intensive care, the DTS/bCAM may be a valid, reliable, and rapid screening tool for delirium.

### **18: Validation and transcultural adaptation of the 3-Minute Diagnostic Interview for CAM (3D-CAM) for delirium detection in a Brazilian cohort of hospitalized older adults: preliminary results.**

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**Objective:** To analyze the performance of the 3-Minute Diagnostic Interview for the Confusion Assessment Method (3D-CAM) to diagnose delirium in hospitalized older adults.

**Methods:** Prospective cohort study in a geriatrics ward in Brazil, including consecutive admissions of acutely ill older adults aged +60 years, from August 2018 to January 2019. Comprehensive geriatric assessments were performed at baseline and throughout hospitalization. Trained physicians screened eligible patients for delirium within 48 hours of admission and every 24 hours until death or discharge. Daily assessments were made using the adapted Portuguese version of the 3D-CAM, the long version of CAM (Long-CAM) and criteria from the Diagnostic and Statistical Manual of Mental Disorders (DSM-V), Fifth Edition. Reference standard diagnosis of delirium also included medical records review, patient and caregiver interview, and cognitive evaluation using the 10-point Cognitive Screener (10-CS). Our primary outcome was delirium diagnosis according to 3D-CAM (vs. Long-CAM and DSM-V criteria). Our main secondary outcome was in-hospital mortality. Multivariate analysis was performed using logistic regression models adjusted for sociodemographic factors and comorbidities.

**Results:** Ninety-four patients were included, with a mean age of 81 years, and 60% were women (N=56). The median follow-up time was 8 days and overall in-hospital mortality reached 18%. Delirium was detected in 45 patients (48%), of which 14 (15%) had incident delirium, and 31 (33%) had prevalent delirium. After a total of 1164 evaluations, diagnosis of delirium by 3D-CAM showed a strong correlation with DSM-V criteria (92% agreement; kappa=0.70) and Long-CAM (91% agreement; kappa=0.87). Delirium diagnosed by 3D-CAM was independently associated with higher in-hospital mortality, as compared to patients without delirium (29% vs. 7%; adjusted relative risk=1.64; 95%CI=1.34-2.01; P<0.001).

**Conclusions:** The 3D-CAM has excellent properties to diagnose delirium in acutely ill older adults. Being a brief and practical tool, it emerges as a useful resource for routine delirium screening.

## **19: Evaluation of a Pharmacist-Directed Medication Review Program for Older Adults with Delirium in the Emergency Department: The SCREENED-ED STUDY**

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**Objective:** Delirium is prevalent among older adults who present to the Emergency Department (ED). Medication is a common precipitating cause for delirium in this population given their frequent use of psychoactive medications and the high prevalence of polypharmacy. We characterized the outcomes and value of ED pharmacist-led medication reconciliation of home medications for older adults who screened positive for delirium in the ED.

**Methods:** As part of the SCREENED-ED protocol, 179 older adults (mean age=79  $\hat{\pm}$  6 years) who presented to the ED at a large academic medical center were assessed for delirium by a trained evaluator using the Confusion Assessment Method (CAM). For those patients who screened positive for delirium, the ED pharmacist reviewed the current home medication list to determine if a medication(s) could be contributory. The results of the review, and recommendations for other strategies to reduce delirium, were communicated to the ED physician where appropriate.

**Results:** Of the 179 evaluated, 32 (18%) screened positive for delirium. Of these, 19 (59%) were evaluated by the pharmacist. Evaluation of the home medication list identified a potential drug(s)-associated cause for delirium in 7/19 (37%). Pharmacists identified specific medication classes related to delirium (e.g., antipsychotics, opioids) as well as issues related to polypharmacy and medication side effects (e.g., dizziness, confusion) that could contribute to delirium.

**Conclusions:** The pharmacist can play an important role in recognizing medication-associated causes for delirium in the ED. Our pilot findings support the role for increased ED pharmacist evaluation of home medications in older adults found to have delirium. Further research is required to evaluate the impact of this program in relation to delirium resolution and other related clinical outcomes.

## **20: Delirium Prevalence and Screening Compliance in Children Admitted to the ICU with Cardiac Disease**

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**Objective:** Single-center studies have shown that children admitted to a PICU or PCICU (pediatric cardiac intensive care unit) with a primary cardiac diagnosis are at high risk of delirium development. This study characterizes delirium screening compliance and the point prevalence of delirium in patients admitted to PICU/PCICUs with cardiac disease.

**Methods:** Data were obtained from the PARK-PICU Study, a two-day point prevalence study of routine acute rehabilitation practices in children admitted to a dedicated PICU >72hrs. We included all children with a primary cardiac diagnosis (medical or surgical). Delirium screening compliance was defined as a screen being conducted in the previous 24hrs and positive delirium status was defined as a positive screen in the previous 24hrs.

**Results:** 556 patients (43% F; 83%  $\leq$  2 years) admitted to 54 PICU/PCICU were included. 52% were admitted to a dedicated PCICU. 54% were in a unit where routine delirium screening was the standard of care; 85% of those units reported screening once per shift. Among these units, 82% utilized the CAPD screening tool. Only 45% of patients in units with routine screening had a documented screen. Delirium prevalence was 24% among all cardiac patients who were screened for delirium, and was not significantly different between cardiac surgical (21%) and medical patients (28%;  $p=.276$ ). Those admitted to a dedicated PCICU with routine delirium screening were more likely to be screened for delirium than patients in a general PICU with routine delirium screening (55% vs. 33%;  $p<0.001$ ).

**Conclusions:** In this point prevalence study, delirium screening compliance was low in patients with primary cardiac diagnoses even when routine unit-based delirium screening was in place. Patients in a dedicated PCICU are more likely to be screened. This study confirms previous prevalence data in pediatric cardiac patients and supports the need for interventions to improve delirium screening compliance in a vulnerable population.

## 21: Postoperative Delirium Diagnosis in Older Adults Using the CAM-ICU outside the ICU

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**Objective:** To evaluate the diagnostic performance of the CAM-ICU among postoperative older patients outside the ICU.

**Methods:** Postoperative patients aged 60 and above in general wards without critical illnesses were evaluated prospectively for delirium by trained staff after surgery for 7 consecutive days using the CAM-ICU, with results compared to delirium diagnoses obtained by geriatricians using DSM-5 criteria as the reference standard.

**Results:** Enrolled patients, with a mean age of 75 years, had mostly undergone elective surgeries. The postoperative delirium incidence outside the ICU was 11.1%. The sensitivity of delirium detection using the CAM-ICU was 31.6%; (95% confidence interval [CI]: 12.56-56.6), while specificity was 97.6%; (95%CI: 94.9-99.1), positive predictive value was 50.0%; (95%CI: 26.3-73.7), and negative predictive value was 95.0%; (95%CI: 93.3-96.3). Among all features of the CAM-ICU, feature 4 (disorganized thinking) yielded the highest sensitivity of 60.0%; (95% CI: 14.7-94.7). Meanwhile feature 2 (inattention) yielded a low sensitivity of 36.8%; (95%CI: 16.3-61.6). Further analyses to explore the highest sensitive criteria revealed that if delirium diagnoses were made by the presence of any 2 out of feature 1 (acute change or fluctuation of cognition), 3 (altered level of consciousness) or 4, a sensitivity substantially increased to 80.0%; (95%CI: 28.4-99.5) with a specificity of 81.8%; (95%CI: 48.2-97.7).

**Conclusions:** The conventional CAM-ICU may not be a suitable delirium screening tool for postoperative older inpatients without critical illnesses, given its low sensitivity. But a modification of the CAM-ICU criteria not including feature 2 gives rise to a higher sensitivity, as the evaluation method of feature 2 could be too simple for this context and unable to early detect inattention in patients with subtle delirium. Further revision of feature 2 which is one of the main features of delirium should be performed to improve sensitivity of the CAM-ICU in older inpatients without critical illnesses.

## 22: External Validation of Emergency Department Derived Delirium Prediction Models Using a Hospital-Wide Cohort

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**Objective:** Approximately 80% of delirium cases are missed in the ED by clinical gestalt alone. We conducted an observational study from a hospital-wide database to externally validate three delirium prediction models: Delirium Risk Score, Risk Prediction Rule, and Susceptibility Score.

**Methods:** This was an observational cohort study to evaluate the diagnostic accuracy of three previously developed delirium prediction models compared to a gold standard for diagnosis of delirium. We included patients aged 65 years and older who presented to our ED from 2014 to 2017 and were hospitalized. All patients were evaluated by using the Delirium Observation Screening Scale (DOS) twice daily while hospitalized as part of standard institutional protocol. We extracted variables to examine the three prediction models within seven days of ED arrival. We defined a positive DOS as the gold standard and also examined ICD9/10 diagnoses to test its robustness. The predictive ability of the feature(s) in a model was summarized using the area under a receiver operating characteristic curve, or AUC.

**Results:** We identified 4,745 visits with a positive DOS and 1,316 patients with a diagnosis of delirium from ICD9/10 codes from a total of 14,526 encounters. The c-statistics of these prediction models ranged from 0.70 to 0.80 when compared to the DOS, and 0.64 to 0.69 when compared to the ICD9/10 diagnosis (Table). In our cohort, Delirium Risk Score predicted DOS positive delirium with a c-statistic of 0.8. The sensitivity, specificity, positive and negative predictive values were 96.5 (95% CI 95.8-97.1), 36.9 (95% CI 35.6-38.1), 48.7 (95% CI 47.5-49.9), and 94.3 (95% CI 93.4-95.3).

**Conclusions:** In this external validation study, the delirium risk score had the highest diagnostic accuracy, sensitivity and negative predictive value to predict delirium. The delirium risk score is a useful tool to detect and rule out delirium in the acute care setting.

## 23: Decreasing Delirium through Music: A Feasibility Trial

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**Objective:** Music may be a promising intervention to reduce delirium in mechanically ventilated (MV) patients. We tested the feasibility of music and estimated its potential effect on delirium/coma free days in MV patients.

**Methods:** In this single-blind feasibility study, patients were randomized to either (1) personalized music (PM), (2) classical music (CM), or (3) attention-control (AC through audio book). Inclusion criteria were adults admitted with respiratory failure requiring mechanical ventilation. Exclusion criteria were: acute or subacute neurologic deficit, dementia, drug intoxication, pregnant/nursing, incarcerated, or diagnosis of bipolar disorder or schizophrenia. Participants received two 1-hour audio sessions daily using noise-canceling headphones for up to 7 days. Clinical data and music preferences were collected. Level of sedation and delirium screening were assessed twice daily with Richmond Agitation-Sedation Scale (RASS), and Confusion assessment Method for ICU-7 (CAM-ICU-7), respectively. Baseline

characteristics were compared using Fisher's exact tests (categorical variables), and Wilcoxon Rank Sum tests (continuous variables).

**Results:** Fifty-six patients consented, and 52 were randomized (PM: n=17, CM: n=17, AC: n=18). There were no significant differences in baseline characteristics between groups. Adherence was significantly higher in PM (median 11.2 sessions) and CM arms (median 10.5 sessions) compared to AC (median 4.7 sessions),  $p=0.017$ . Of 10 randomly surveyed patients, the acceptability of the intervention was 80%. There was a trend towards greater median delirium/coma-free days by day 7 in CM (3, IQR: 1-6) vs. PM (2, IQR: 1-6) vs. AC (2, IQR: 0-3),  $p=0.09$ .

**Conclusions:** Personalized and classical music were associated with high adherence and acceptability. CM showed a trend toward greater delirium/coma-free days. A larger follow-up study is needed.

## 24: Tracking RASS and CAM-ICU from EEG using Deep Learning in the ICU

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**Objective:** Behavioral assessments of delirium and sedation in the ICU, including the CAM-ICU and RASS, are limited by being non-physiological, subjective, and intermittent. We aim to develop continuous, physiologically based measures of the level of consciousness and delirium in ICU using EEG

**Methods:** Data were collected prospectively at the Massachusetts General Hospital following an IRB approved protocol. The dataset includes 174 mechanically ventilated patients primarily sedated with propofol. The median (IQR) length of ICU stay is 12 (7 -20) days. The Richmond Agitation-Sedation Scale (RASS) was assessed every 2 hours. The Confusion Assessment Method for the ICU (CAM-ICU) was assessed every 24 hours. We trained a deep learning model consisting of a convolutional neural network and long-short term memory using 10-fold cross-validation. The model takes the EEG as the input and outputs the ordinal level of RASS and the probability of delirium for every 4-second segment of EEG. The performance was evaluated using the testing patients across all folds.

**Results:** For RASS, the system obtained 71% accuracy when allowing  $\leq 1$  RASS level prediction error between the nurse and model prediction. For CAM-ICU, the system achieved area under the ROC curve of 0.80. The optimal operating point had 80% specificity and 70% sensitivity. Investigation of the features learned by the model revealed that it learned appropriate physiological features, such as eye movements as evidence of the awake and calm state, and slow waves for the comatose state.

**Conclusions:** We have developed a system to continuously track the level of consciousness (RASS) and delirium (CAM-ICU) in ICU patients. To further validate the benefit of this system, randomized trials to study the effect of this system on outcomes are necessary.

## 25: Machine learning to predict post-operative delirium

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**Objective:** Machine learning has proven useful for uncovering predictive patterns using large datasets. Our objective was to assess the performance of these methods in predicting delirium with cohort data of more tractable size, but featuring extensive phenotyping by a clinical research team.

**Methods:** The Successful Aging after Elective Surgery (SAGES) study is an ongoing prospective, observational cohort study of 560 older adults ( $\geq 70$  years) without dementia. Delirium was determined by the Confusion Assessment Method supplemented by medical chart review. Five machine learning models were developed in a training sample (80% of participants) and evaluated in the remaining test sample (20%). We performed each of the five models using three overlapping feature sets, all restricted to variables that are readily available to or minimally difficult to collect by clinicians: 1) a limited feature set ( $n=18$ ) selected by an expert panel using an iterative process, 2) the same limited feature set plus a measure of pre-operative cognitive function (Modified Mini Mental State Examination, 3MS), 3) a large feature set ( $n=97$ ) spanning multiple domains.

**Results:** For the limited feature set that did not include cognitive function (3MS), all models exhibited utility only marginally better than chance ( $AUC=0.51\pm 0.57$ ). When 3MS was added to the limited feature set, AUC reached 0.65. Expanding to the full feature set further improved performance; when the detection prevalence was set to 25% for comparison across models, elastic-net regularized regression had the highest  $AUC=0.70$ , positive predictive value (0.43), negative predictive value (0.84), sensitivity (0.46), and specificity (0.81).

**Conclusions:** We developed machine learning prediction models for post-operative delirium based on variables that are readily available to or easily attainable by clinicians, in a relatively small prospective, observational cohort. Our best models predicted delirium better than chance, and our findings support the importance of measuring pre-operative cognitive function for delirium prediction.

## **26: The Relationship between Postoperative Delirium and Unplanned Perioperative Hypothermia in Non-Cardiac Adult Patients**

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**Objective:** The purpose of this study was to investigate associations between unplanned perioperative hypothermia (UPH) and the incidence of postoperative delirium (POD) among adults undergoing non-cardiac surgery.

**Methods:** A retrospective, exploratory study was conducted with data electronically abstracted from a purposive, convenience sample of medical records of adult patients undergoing non-cardiac surgery from January 2014 to June 2017. Logistic regression was conducted predicting probability of POD from UPH and other known and suspected variables. Specifically, the model included age, BMI, ASA class, duration of hypothermic temperatures, duration of anesthesia, anesthesia type, and three two-way interactions among patient age, minutes hypothermic, and ASA class. The analyzed dataset included 22,548 surgeries.

**Results:** Mean age was 63.23 (+ 15.37); mean hypothermic minutes was 42.41 (+ 55.19); and 9% experienced documented POD. Males made up 44.7% of the sample and 91.4% received general anesthesia. Logistic regression indicated ASA class was the strongest predictor of POD ( $X^2 = 1269.19$ ,  $df = 12$ ). Of particular interest, a significant relationship between UPH and POD ( $X^2 = 58.97$ ,  $df = 9$ ) and a complex relationship among UPH, patient age, ASA class, and POD was also found.

**Conclusions:** There is a relationship between UPH and POD with a notable complex relationship among UPH, age, ASA class, and POD. UPH was found to be protective to the development of POD in the oldest of old. UPH, however, was a contributing factor to POD in the younger patient, particularly sicker patients. Although we found an interesting relationship, complete case analysis excluded a large proportion of younger patients compared to older patients due to missing POD documentation. Accordingly, future studies should investigate the effect of POD data missing not at random for young patients to confirm results presented here.

## **27: Creating a cognitive vital sign for detecting and monitoring delirium**

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**Objective:** The primary objective is to develop and validate a tablet-based measure of attention as a cognitive vital sign. We implemented a battery of six established tests of attention and working memory to create a gold standard attentional battery. We contrasted performance on this gold standard battery to a brief serious game we referred to as ‘cats and dogs’. We are testing whether this task can act as a brief, reproducible measure with an easily interpreted scale that could be used to assess and track the presence and severity of delirium.

**Methods:** Patients with major depression who were receiving electroconvulsive therapy (ECT) were tested on the gold standard battery and the ‘cats and dogs’ task both before their treatment (baseline); and again immediately after undergoing anesthesia and an induced, generalized tonic-clonic seizure (under neuromuscular blockade). The intervention causes a severe delirium, allowing for testing within subjects to establish individual baselines and delirium-induced declines in performance.

**Results:** We acquired data from n=12 participants at 33 ECT sessions for a total of 80 data points (including n=26 pre-ECT, n=30 immediately post-ECT, and n=24 delayed after ECT). For the comparison between performance pre- and post- ECT, paired t-tests showed large and highly significant differences, with t-statistics being 4.9 and 6.8 and all p-values being less than  $1 \times 10^{-5}$ .

**Conclusions:** Our results show both the severity of delirium after ECT and the sensitivity of the cognitive tasks employed, highlighting that these tasks are capable of assessing encephalopathy. We have used these results to modify the gold standard battery to improve its performance. We are collecting additional data on the new version of the gold standard battery along with the ‘cats and dogs’ serious game with the goal of creating a cognitive ‘vital sign’ that can be applied in multiple clinical settings to assess delirium.

## **28: Prevention of Early Postoperative Decline (PEaPoD): A randomized controlled trial investigating the feasibility of a perioperative cognitive training program**

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**Objective:** Older cardiac surgery patients are at the highest risk of postoperative delirium, leading to an increased risk of in-hospital mortality and long term cognitive deficits. Training software may increase cognitive reserve in areas that are affected in delirium, such as memory and processing speed. The feasibility of this approach to prevent delirium is currently unknown.

**Methods:** Patients aged 60-90 years undergoing cardiac surgery with cardiopulmonary bypass at least ten days from enrollment with an educational level of high school graduate or higher were included. Those with previously diagnosed anxiety, depression, stroke, dementia, epilepsy, or other forms of cognitive impairment were excluded. After enrollment, patients were randomized to a mobile application-based cognitive training group (CTG) or a usual care control. Training consisted of two daily 15-minute sessions starting from enrollment through one month postoperatively. Descriptive statistics are reported for study feasibility, evaluated by recruitment patterns and adherence to training protocol. Secondary outcomes included the incidence of postoperative delirium assessed daily with the Confusion Assessment Method (CAM). Patient satisfaction was assessed with a survey. Secondary outcomes were analyzed using t-test, Wilcoxon rank-sum, or chi-square test as appropriate.

**Results:** Overall, 45/69 (65%) eligible patients consented to participate. 73% of patients were male, and the median age was 70 years. Median gameplay was 245, 18, and 122 minutes for the preoperative, immediate postoperative, and post discharge periods respectively. The incidence of postoperative delirium did not differ between groups in this limited sample (6/21 vs 3/20, CTG vs control,  $p=0.28$ ). CTG patients agreed highly that cognitive training was enjoyable and easy to use (87/100, 85/100 agreement respectively).

**Conclusions:** Older patients undergoing cardiac surgery demonstrate sufficient interest but varying ability to adhere to a perioperative cognitive training program. The preoperative period is a potential target of an efficacy trial evaluating whether cognitive prehabilitation can prevent delirium.

## 29: Comparison of Patient Reported Pain between Delirious and Non-Delirious Patients

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**Objective:** To examine the differences in patient reported postoperative pain between delirious and non-delirious patients. We hypothesized that patients who experienced delirium during their postoperative course would report higher pain levels. We also hypothesized that patients who experienced delirium would have more difficulty conveying their pain.

**Methods:** Patients randomized in either the ENGAGES( $n=1232$ ) or PODCAST( $n=672$ ) clinical trials were eligible for this study. Patients were included if they had at least one postoperative delirium assessment outcome by the CAM, CAM-ICU, or structured chart review. Also, patients needed at least one attempted Visual Analog Scale (VAS) score during their first three postoperative days. Median VAS (100-point scale) scores were compared between patients who had any incidence of delirium and those that did not. Patients with un-scorable components of the VAS were also compared between delirium outcomes. Sensitivity analyses was performed to include all uncertain patients as either negative or positive for delirium outcomes in the comparisons.

**Results:** A total of 1727 adult patients (median 69 [60, 95] yrs; 741[42.91%] women) met inclusion criteria. From this cohort, 1710 both attempted a pain assessment and had definitive delirium outcome assessment(s) during their postoperative stay. Of these, 314 (18.36%) patients experienced delirium at least once. Analyses showed that patients who had experienced delirium had significantly higher median pain scores compared to patients who had no occurrence of delirium. (Pain at rest (median[IQR]: 26.0[10.0, 48.5] delirious vs. 15.0[4.0, 32.5] non-delirious, difference (95% CI) 11.0(6.9, 15.1),  $P<.0001$ ). A larger proportion of patients experiencing delirium had un-scorable VAS components (18.79%) compared to those that experienced no delirium (2.51%). Sensitivity analyses showed no change in significance.

**Conclusions:** As hypothesized, patients experiencing delirium after surgery reported higher pain scores and had more difficulty conveying their pain. We plan to refine these analyses by conducting a mixed effects logistic regression to account for repeated measures of daily delirium and VAS assessments.

### **30: C-reactive Protein for Risk Prediction of Postoperative Delirium and Postoperative Cognitive Dysfunction**

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**Objective:** Postoperative delirium (POD) and postoperative cognitive dysfunction (POCD) constitute brain dysfunctions with detrimental effects on clinical outcome. Older surgical patients are particularly at risk. Delirium-specific biomarkers could help to risk stratify patients preoperatively and thus improve clinical management of that vulnerable group. One of the mechanisms underlying cognitive decline is neuro-inflammation. We investigated associations between preoperative C-reactive protein (CRP) and the incidence of POD and POCD.

**Methods:** This secondary investigation of the SuDoCo (ethics approval EA1/242/08) trial analyzed 314 patients with preoperative CRP measurement one day before surgery. Primary outcomes were POD according to the Diagnostic and Statistical Manual of Mental Disorders 4 (DSM-4) assessed from day 1 until day 7 after surgery and POCD calculated by the reliable change index (RCI) in relation to non-surgical controls 3 months post-surgery. Associations between CRP with POD or POCD were assessed using multivariable logistic regression models adjusted for age, sex, randomization to Bispectral Index (BIS) guided and BIS blinded anesthesia, respectively, body mass index, American Society of Anesthesiologists (ASA) status, and intraabdominal/-thoracic versus other types of surgery.

**Results:** Preoperative CRP was significantly associated with POD but not POCD development 3 months after surgery [OR 1.172 (95%CI 1.051, 1.306); p=0.004 and OR 0.652 (0.250, 1.702); p=0.382, respectively]. Moreover, CRP values >5 mg/L increased the POD risk by 5.4 times [OR 5.371 (95%CI 2.011, 14.343; p=0.001)]. Considering CRP quartiles, patients within the 4th quartile had a 3.3-fold increased POD risk compared to patients in the 1st quartile.

**Conclusions:** We could demonstrate an association of preoperative CRP and POD but not POCD development. Higher preoperative CRP levels were related to a higher POD risk suggesting a dose-response relationship. Our findings underscore the contribution of inflammation to POD occurrence and support the use of CRP as a marker for preoperative risk stratification and its potential value in POD prevention.

### **31: Validation and transcultural adaptation of the Confusion Assessment Method Severity Score (CAM-S) in a Brazilian cohort of hospitalized older adults: preliminary results.**

Maiara Llarena Silva Salvador, Flavia Barreto Garcez, Vanessa Rodrigues Barão, Paula Elizabeth Moura Maniçoba, Thiago Junqueira Avelino-Silva  
University of Sao Paulo Medical School, Sao Paulo, Brazil

**Objective:** To investigate the performance of the Confusion Assessment Method's Severity Score (CAM-S) as a measure of delirium severity and a predictor of adverse outcomes in hospitalized older adults

**Methods:** Prospective study in a geriatric unit in Brazil, including consecutive hospitalizations of acutely ill patients aged +60 years, from August 2018 to January 2019. Comprehensive geriatric assessments were performed at baseline and throughout hospitalization. Trained physicians assessed patients for delirium within the first 48 hours of hospitalization and every 24 hours until death/discharge. Delirium was diagnosed using the long version of CAM (Long-CAM) and each symptom was rated as 0=absent, 1=mild or 2=marked. The sum of these scores produced a final CAM-S rating from 0 (no delirium) to 19 (most severe) for each evaluation. Our primary outcome was in-hospital mortality. Multivariate analyses were performed using logistic regression models adjusted for sociodemographic factors and comorbidities.

**Results:** We included 94 patients, with a mean age of 81 years, and 60% of women (N=56). Prevalent delirium was observed in 31 patients (33%) and incident delirium in 14 patients (15%). The overall mortality was 18% (N=17). A total of 1164 evaluations were performed, with a median CAM-S score of 4 (interquartile range [IQR]=1, 6). For patients with delirium (48%), CAM-S median score was 6 (IQR = 5, 8). Patients who died during hospitalization had higher CAM-S rating (5; IQR=2, 7) as compared to those who survived (3; IQR=0, 6). Mortality risk was significantly different across CAM-S categories (0-3=6%, 4-7=29%, ≥8=32%;  $P<0.001$ ). A higher CAM-S score was independently associated with increased mortality, both when between 4-7 (adjusted relative risk (RR)=1.84; 95%CI=1.46-2.33) and ≥8 (RR=1.91; 95%CI=1.45-2.52).

**Conclusions:** The CAM-S is a valid scale to determine delirium severity and adverse outcomes in acutely ill older adults. Routine delirium evaluation should include severity assessment as an important prognostic measure.

### **32: Validation of the Portuguese version of the 4A Test (4AT) for delirium screening in hospitalized older adults: preliminary results.**

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**Objective:** To investigate the performance of an adapted Portuguese version of the 4A Test (4AT-Port) for delirium detection in hospitalized older adults.

**Methods:** Prospective cohort study including acutely ill patients aged +60 years consecutively admitted to a geriatrics ward in Brazil, from August 2018 to January 2019. Comprehensive geriatric assessments were performed at baseline and throughout hospitalization. Trained physicians assessed patients for delirium up to 48 hours after admission. Our standardized protocol included daily delirium assessments using the 4AT-Port and the long version of the Confusion Assessment Method (Long-CAM). The 4AT-Port final score was categorized as follows: 0=delirium or severe cognitive impairment unlikely; 1-3=possible cognitive impairment; 4=possible delirium. The presence of cognitive impairment was evaluated using the 10-point Cognitive Screener (10-CS). Further clinical data were collected upon death or discharge. Our primary outcome was the performance of the 4AT-Port (4 points) for delirium diagnosis (vs. Long-CAM as the reference). In-hospital mortality was assessed as a secondary outcome. The association between 4AT-Port score and in-hospital mortality was determined by logistic regression model after adjusting for sociodemographic factors and comorbidities.

**Results:** We included 94 patients, who had a median age of 81 years and were mostly women (60%, N=56). Overall in-hospital mortality was 18% (N=17). Prevalent delirium was observed in 31 patients (33%) and incident delirium in 14 patients (15%) by Long-CAM criteria. A total of 1164 standardized evaluations were performed, with a median 4AT-Port score of 5 (interquartile range=1-8). Delirium was detected in 680 (58%) evaluations using 4AT-Port. The 4AT-Port had 85% agreement with Long-CAM for delirium diagnosis (kappa coefficient=0.64). Delirium detected by 4AT-Port was independently associated with in-hospital mortality with an adjusted relative risk of 4.11 (95%CI=2.75-6.15; P<0.001).

**Conclusions:** The 4AT-Port is an easy-to-use bedside tool with good properties to detect delirium in acutely ill older adults.

### **33: Reducing Behavioral Health Emergencies in Patients with Delirium**

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**Objective:** After initiating a Behavioral Emergency Response Team (BERT) to manage behavioral health emergencies in an academic medical center, it was noted that the highest utilizers of the service in the first year were patients diagnosed with delirium. This etiology accounted for over 40% of the total BERT activations, leading to staff assault and interruptions to patient care. We sought to reduce the amount of behavioral emergencies in patients diagnosed with delirium.

**Methods:** The main intervention focus was developed as proactive management. The BERT service, led by a psychiatric registered nurse, implanted a scripted and focused rounding on high utilizing units. Additionally, scripted interdisciplinary safety huddles were held daily for patients meeting criteria as high risk for having a behavioral emergency. These safety huddles were used to develop individualized care plans specific to diagnosis, including delirium. We also provided targeted education to high utilizing units.

**Results:** The number of BERT activations between the first and second years of implementation was compared, and it was found that the number of calls involving patients with delirium diagnoses decreased by 34%. The number of overall BERT activations decreased by 14%.

**Conclusions:** These findings support the use of proactive management of patients identified as having a diagnosis of delirium can significantly reduce the amount of behavioral emergencies in this population. Through interdisciplinary huddling, delirium is diagnosed, managed and treated more quickly. This results in better patient outcomes and increased staff satisfaction.

### **34: Delirium Education Program for Intensive Care (ICU) Nurses: A Mixed Methods Research Study**

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**Objective:** The purpose of this mixed methods research study was to develop and evaluate the effect of a Delirium Education Program (DEP) on improving ICU nurse knowledge and self-confidence in identifying delirium and associated risk factors.

**Methods:** A sample of 32 ICU nurses from a community hospital was randomly assigned to the intervention and control groups for the quantitative part (Phase I) of the study. Both groups completed the online pre-tests/posttests and the intervention group received the DEP. Mixed model Analysis of Variance (ANOVA) was used to analyze the quantitative data. The results of the Phase I data analysis informed the decisions regarding the sampling (n=6) for the Phase II (qualitative strand). For Phase II, interviews were conducted to gain a deeper understanding of the lived experiences of the nurses related to the DEP.

**Results:** The results showed an increase in the self-confidence of the intervention group. Although the results revealed no significant differences on the knowledge scores between the two groups, the qualitative findings showed that the participants not only indicated knowledge acquisition from the DEP but also reflected on things that they have learned from it. The following five themes permeated the lived experiences of the nurses: participant's outlook about DEP; DEP is high quality; knowledge of delirium comes with DEP; confidence in recognizing delirium stems from DEP; and delirium: frequent or not?

**Conclusions:** This research study was conducted from the perspective of a clinical nurse educator in the acute care where the results will help support hospital administration and nursing educators in developing an effective educational intervention to improve nursing staff early recognition of delirium and its associated risk factors thus improving patient outcomes. This study provided more generalizable results, stronger evidence for the conclusion, and a credible approach to understanding the DEP and its effect on nurses' knowledge and self-confidence.

### **35: Use of implementation science framework for the implementation process and adherence assessment of a non-pharmacological delirium prevention program.**

Eduardo Tobar<sup>1,2</sup>, Maricel Garrido<sup>1</sup>, Felipe Salech<sup>2,3</sup>, Evelyn Alvarez<sup>4</sup>, Daniela Ponce<sup>1,3</sup>, Daniel Tobar<sup>5</sup>  
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**Objective:** Non-pharmacological interventions are useful preventing delirium in hospitalized older adults (OA), however its implementation in clinical practice is low. Our objective was to evaluate the use of a theoretical framework defined by implementation's science as a guide to a delirium prevention program.

**Methods:** Quasi-experimental prospective design (before-after). A non-pharmacological delirium prevention program (NPDPP) was implemented in general ward and intermediate care units of a teaching hospital lacking delirium prevention protocol. The process was guided by the theoretical model of the consolidated framework for advancing implementation research (CFIR). The NPDPP involved actions in 8 domains of CFIR, 4 of them were defined as central. Protocol adherence was evaluated at baseline (O1), after implementation process (O2) and at 6-month follow-up (O3). Knowledge and beliefs about delirium in healthcare personnel were too evaluated. Delirium in hospitalized OA was assessed using CAM at O1, O2 and O3. Sample size estimation was made to document a 20% increase in baseline adherence, power of 80%, alpha value 0,05.

**Results:** 72 OA were included and 149 assessments to clinical staff were made. The implemented NPDPP decreased delirium incidence from (5/25)-20%(O1) to (4/24)-17%(O3) (p >0.05). Overall adherence of the NPDPP increased from (428/735)-58.2%(O1) to (561/720)-77.9%(O2) and (492/651)-75.6%(O3) (p <0.05). That improvement was dependent on two of the four assessed domains, environmental management and early mobilization. The knowledge about delirium increased more in paramedics than medical or nursing staff. There was a significant increase in the claims "not using

benzodiazepines as a prevention strategy", and "the evaluation of delirium is part of my role". Staff perceptions regarding implementation of the NPDPP increased from (476/636)-74.8% to (422/515)-81.4% (p <0.01).

**Conclusions:** Implementation of NPDPP using CFIR is useful assessing changes in the adherence of the different domains that constitute a NPDPP, and might constitute a tool to improve its implementation in clinical practice.

### **36: Improving Delirium Detection in the Medical ICU. An Interdisciplinary Approach to Delirium Screening.**

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**Objective:** To increase detection of delirium in patients aged 65 years or older in the medical ICU (MICU) population by improving the accurate use of the Confusion Assessment Method for the Intensive Care Unit (CAM-ICU).

**Methods:** Based on two previous studies from 2016-2017 we identified that MICU nurses missed 75% of positive delirium screens. Identified errors included marking positive results as negative (35%, n=11), marking the test Unable to Assess (UTA) (41%, n=13), or not performing the CAM-ICU at all (25%, n=8). Throughout 2017-2018 we implemented education sessions by MICU nurse educators, placement of laminated CAM-ICU instructions in each ICU room, and weekly ICU Med-Psych rounds led by an attending psychiatrist. To gauge the effectiveness of these interventions on CAM-ICU delivery we had investigators perform CAM-ICU assessments once a week for MICU patients aged 65+ during a six month period.

**Results:** After our intervention there was a slight trend towards increased recognition of delirium (miss rate 61.5%, n = 57). The highest frequency error was marking a positive score as Unable to Assess, and the rate of this error actually increased (52%, n =1593) from the 2016 study.

**Conclusions:** This study helped us identify that a knowledge gap about how to implement the CAM-ICU correctly continues to be the core issue, especially regarding when it is acceptable to mark the test UTA. We are now moving forward with a new set of interventions which will aim to correct these errors by focusing on interdisciplinary education, implementation of a new delirium algorithm, and weekly one-on-one feedback sessions between a psychiatry attending and the ICU nursing staff.

### **37: Association between Sleep Quality and Delirium Occurrence in Critically Ill Adults: A Secondary Analysis of a Randomized Controlled Trial**

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**Objective:** How delirium and sleep quality in the ICU are linked remains unclear. A recent RCT reported nocturnal dexmedetomidine (DEX) significantly reduced incident ICU delirium; Leeds Sleep Evaluation Questionnaire (LSEQ) scores were similar between DEX (n=50) and PLA (n=50) groups (Skrobik Y et al. AJRCCM 2018;197:1147). We evaluated both the association between nocturnal delirium occurrence

and LSEQ score the next morning (DEL→LSEQ) and the association between the morning LSEQ score and delirium occurrence that night (LSEQ→DEL).

**Methods:** Patients were screened for delirium between 19h - 07h with the Intensive Care Delirium Screening Checklist (ICDSC) when RASS  $\geq$ -3. Patient-perceived sleep quality was assessed at 08h with the LSEQ when RASS  $\geq$ -1. The DEL→LSEQ analysis included all ICDSC-screened ICU patient-nights where an LSEQ was documented the following morning. The LSEQ→DEL analysis included all ICDSC-screened ICU nights where an LSEQ had been documented the preceding morning. Separate logistic regression models controlling for age, baseline APACHE-II score, and DEX/PLA allocation were used to measure the two associations.

**Results:** Overall, the 100 patients spent 1,115 nights in the ICU; coma, delirium, and no delirium were present on 130 (11.7%), 114 (10.2%) and 871 (78.1%) nights, respectively. For the DEL→LSEQ analysis, LSEQ was recorded the morning after 439/985(44.6%) ICDSC-screened nights [(41/439 (9.3%) with delirium]. After controlling for age, severity of illness, and DEX (vs. PLA) treatment, delirium occurrence was not associated with subsequent LSEQ score (OR 0.97, 95%CI 0.72-1.31). For the LSEQ→DEL analysis, LSEQ was recorded the morning before 387/985(39.1%) ICDSC-screened nights [56/387 (14.5%) with delirium]. After controlling for age, baseline severity of illness, and DEX (vs. PLA) treatment, LSEQ score was not predictive of subsequent delirium occurrence (OR 1.02, 95%CI 0.99-1.05).

**Conclusions:** ICU patient sleep quality perception is neither affected by nor predictive of delirium occurrence in critically ill adults.

### **38: A Comparison of the Nursing Delirium Screening Scale (NuDESC), Delirium Rating Scale (DRS-98), and Confusion Assessment Method (CAM-L) in Determining Delirium Symptom Intensity**

Patrick Yuan<sup>1</sup>, Mark Terrelonge<sup>1</sup>, Joan Hilton<sup>1</sup>, Anita Hargrave<sup>1</sup>, James Bourgeois<sup>2</sup>, Jesse Bastiaens<sup>1</sup>, Jacqueline Leung<sup>1</sup>, Vanja Douglas<sup>1</sup>

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**Objective:** We tested whether the Nursing Delirium Screening Scale (Nu-DESC) is an effective alternative to the Delirium Rating Scale- Revised, 1998 (DRS-R-98) and Confusion Assessment Method-Long Form (CAM-L) as a delirium symptom intensity metric.

**Methods:** Subjects were recruited at a university hospital in San Francisco from August 2015 to February 2016. A group of positive Nu-DESC (score  $\geq$ 2; n=213) subjects were matched with negative Nu-DESC (score  $<$ 2; n=192) subjects by age, sex, and nursing unit. Nu-DESC screens were performed by bedside nurses every 12-hour shift. A trained research assistant concomitantly evaluated each subject with the CAM-L, DRS-R-98, and a structured interview over a 2-day period. Total scores for each scale were computed by summing all items for the CAM-L and Nu-DESC and the 13 severity items of the DRS-R-98. We examined these data using scatterplots overlaid with locally weighted scatterplot smoothing (LOWESS) curves with 95% confidence intervals and computed Spearman's rank correlation coefficient to compare the ability of the Nu-DESC to measure delirium intensity against these two previously validated scales.

**Results:** Spearman's rank correlation coefficient between the Nu-DESC and DRS-R-98 (N=404) and Nu-DESC and CAM-L (N=405) were highly positive (0.7415,  $p<$ 0.0001 and 0.7332,  $p<$ 0.0001, respectively).

However, most of the correlation resulted from non-delirious patients. When only delirious patients were included, Spearman's rank correlation coefficient was 0.372,  $p < 0.0001$  for the DRS-R-98 (N=183) and 0.361,  $p < 0.0001$  for the CAM-L (N=183).

**Conclusions:** The Nu-Desc has a modest correlation with validated measures of delirium intensity, but the variability of scores makes it imperfect for predicting delirium intensity. Possible causes include limited question numbers omitting domains better characterized by the CAM-L and DRS-R-98. Further studies are needed to see if Nu-DESC scores correlate to other proxies of delirium intensity including hospital length of stay or post-hospital outcomes.

### **39: Utilization of large datasets to assess the safety of antipsychotic drugs in treating intensive care unit (ICU) delirium**

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**Objective:** Delirium occurs in about 80% cases in the Intensive Care Unit (ICU) and is commonly treated with antipsychotic drugs (APD) without clear evidence of efficacy or safety. To explore safety outcomes associated with APD, we compared the ICU length of stay (LOS) as an outcome variable for APD use in delirium patients in the ICU using large observational data sets. We utilized the MIMIC III database, an extensive electronic health records (EHR) dataset with 53,423 distinct hospital admissions.

**Methods:** From MIMIC III database, we extracted information of subject group diagnosed with delirium (ICD9 code 293.0) and conducted a retrospective cohort analysis. We categorized them in 3 groups; patients prescribed Haloperidol, other APD, and no APD. Primary outcome evaluated is LOS in the ICU.

**Results:** In our analysis, we explored 1426 patients who met the inclusion criteria. 740 (51.9%) received haloperidol, 272 (19.1%) received other antipsychotics and 414 (29.0%) received no drug. We conducted a one-way between subject ANOVA to compare the mean ICU LOS in haloperidol, no drug and other drugs group. With  $p < 0.05$ , we found that the mean of the LOS for the three groups are different. Post hoc comparisons by Tukey HSD test indicates that the mean LOS for the haloperidol group (mean: 7.47 days, deviation: 8.55) was significantly higher compared to no drug group (mean: 4.12 days, deviation: 5.66) and other drug group (mean: 5.44 days, deviation: 6.14).

**Conclusions:** Our study finds a greater correlation of haloperidol versus other drugs in the outcome for LOS for the treatment of delirium in the ICU. However, it is possible that sicker patients are given haloperidol. Further studies are needed with a comprehensive causal model for adjusting of the covariates with different outcome variables such as in hospital and one year mortality.

### **40: Defining Best Practice Methods for Studies of Biological and Clinical Correlates of Delirium: An International Modified Delphi Study (protocol)**

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South Wales, Liverpool, Sydney, Australia,<sup>5</sup> Ingham Institute of Applied Medical Research, Liverpool, Sydney, Australia

**Objective:** AIM: To obtain international consensus on best practice methods and reporting of studies of biological and clinical correlates of delirium. OBJECTIVE(S): 1) To survey expert delirium researchers on their opinions about conducting and reporting biomarker studies in delirium; 2) To reach consensus among experts about the critical elements in delirium biomarker studies; 3) To conduct in-depth interviews with delirium and cancer researchers about the tailoring of delirium biomarker studies when the concomitant condition of cancer is present.

**Methods:** Part one of the study is a modified Delphi study with delirium researchers, consisting of an online survey. Delirium experts will be questioned about current biomarker research in delirium and asked to reflect on what they believe should be best practice using three rounds of a structured survey to gain consensus. The questions will be based on each domain of the REMARK checklist. Part two is a sub-study of in-depth interviews with cancer researchers. Interview questions will focus on the same domains as the Delphi rounds but will explore views about whether there are differences when applied to biomarker research in people with delirium and cancer. Participants will be expert delirium and/or cancer researchers who are or have been involved in conducting delirium research (including but not restricted to biomarkers) and/or cancer biomarker research. Researchers with basic science/animal study backgrounds will also be involved if their research is primarily focused on delirium.

**Results:** The primary outcome of this study is a list of recommendations for reporting delirium biomarker studies.

**Conclusions:** Rigorously conducted and reported delirium biomarker studies are essential for the improved understanding of delirium pathophysiology. The development of these guidelines will promote individual study rigor, strengthen the overall field of delirium research, and increase the potential for synthesis and meta-analysis.

#### **41: Detecting delirium: A systematic review of identification instruments**

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**Objective:** The goal of this study is to determine the 4-5 most commonly used or well-validated instruments for delirium identification.

**Methods:** We searched six different databases (CINAHL, Cochrane, EMBASE, PsycINFO, PubMed, and Web of Science) to find 2,162 articles. After removing duplicates and non-English articles, we reviewed 1,113 unique articles. Inclusion criteria were: systematic review, meta-analysis, or review article; delirium as the primary outcome; and discussing at least two delirium instruments. Exclusion criteria were: alcohol-related delirium (delirium tremens), pediatric, or animal studies; articles without literature reviews; or a single instrument reviewed.

**Results:** After applying inclusion and exclusion criteria, we found 153 eligible articles, yielding 48 different delirium identification instruments. Next, we excluded instruments strictly for the intensive care

unit, which lowered the total to 41 instruments. We searched Google Scholar and Scopus to rank our list by citation count. The top 5 instruments by citation count were the Confusion assessment method, Delirium rating scale, Memorial delirium assessment scale, Neelon and Champagne confusion scale, and Delirium observation screening scale. Our next steps will include rating instruments on: internal consistency, reliability, measurement error, content validity, construct validity, and criterion validity. We will collect information on the intended study population, level of training to administer the instrument, number of questions, and time for administration. We will use these criteria to select our final list of the 4-5 instruments that are most commonly used or well-validated.

**Conclusions:** Once selected, we will harmonize these instruments using item response theory to put them on the same metric. These steps will allow the direct comparison of study results (e.g., delirium rates) across populations, and facilitate quantitative meta-analysis and synthesis of study results, which is essential for the development of clinical guidelines and establishment of clinical practice standards. Clinically, development of a unified delirium instrument would greatly advance delirium identification across settings.

#### **42: Impact of Intensive Care Unit (ICU) diary on delirium occurrence in the ICU and prevalence of distressing and delusional memories one week following discharge**

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**Objective:** To examine whether caregiver use of diaries during an Intensive Care Unit (ICU) admission modifies patient delirium or self-reported distressing and/or delusional memories at 7-days post-ICU discharge.

**Methods:** Using data collected in a previously published pilot randomized controlled trial of ICU diaries and psychoeducation, we compared the prevalence of distressing or delusional memories at one-week post ICU discharge using the ICU Memory Tool (ICU-MT). In the diary intervention, families and staff contributed to the diary, then the diary was offered to patients 30-days post-ICU discharge. Delirium was assessed twice/day using the Confusion Assessment Method-ICU. We used chi-square analysis to compare the presence of delirium in patients receiving the diary intervention vs. those who did not, and the relationship between presence of delirium and distressing and/or delusional memories. A p-value of <0.05 was considered significant.

**Results:** Forty-five of the 58 randomized participants survived their ICU admission and completed the ICU-MT; 27 randomized to a diary and 18 randomized to no diary. Overall 75% (34/45) participants experienced ICU delirium for a mean of 3.8 days (SD 3.5) with delirium prevalence in 67% of diary participants compared to 89% of participants not receiving diary intervention (p=0.09). At one week post ICU discharge, almost all participants (95.6%) recalled some aspect of their ICU stay, while 91% reported distressing memories. Presence of ICU delirium was not associated with difference in self-reported distressing memories (delirium 91.2% vs no delirium 90.9%, p=1.0) or delusional memories (delirium 55.9% vs no delirium 36.4%, p=0.3). There was also no difference between diary and non-diary participants in self-reported distressing memories (diary 88.9% vs non-diary 94.4%, p=0.5) or delusional memories (diary 55.6% vs non-diary 44.4%, p=0.5).

**Conclusions:** Caregiver participation in ICU diaries does not appear to impact ICU delirium occurrence or the prevalence of distressing or delusional memories in patients one week following ICU discharge.

### **43: Epigenetic Mechanism of Delirium Pathophysiology: Hypothesis and Evidence from Preliminary Data**

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**Objective:** Delirium in elderly patients is common and dangerous. Major risk factors include aging and exogenous insults, such as infection or surgery. In animal models, aging enhances pro-inflammatory cytokine release from microglia in response to exogenous insults. The epigenetic mechanism DNA methylation (DNAm) regulates gene expression and changes with age. Older individuals may have methylation changes that influence the increased cytokine upon insult, but the degree to which aging affects DNAm of cytokine genes is not fully understood.

**Methods:** The relationship between DNAm and aging of pro-inflammatory cytokine genes (TNF-alpha, IL1-beta, IL-6) was investigated using methylation array data in two cohorts. Brain and blood samples were collected from a neurosurgery cohort (NSG) of 21 subjects who underwent brain resection. A second cohort, the Grady Trauma Project (GTP), included blood samples from 265 subjects.

**Results:** In the NSG cohort, a significant negative correlation between age and DNAm in brain was found at a CpG in IL-6. With the GTP dataset, significant negative correlations between age and DNAm were seen at most of the CpGs in TNF-alpha. Also, TNF-Alpha expression increases with age. These GTP DNAm correlations were also nominally significant in NSG blood samples. In neuronal negative NSG brain tissue, a similar negative trend was observed.

**Conclusions:** With aging, a decrease in DNAm of cytokines gene CpGs in glia and blood was seen. As this can affect their expression, additional research is needed to fully elucidate the role of DNAm in aging and how it may influence the pathogenesis of delirium.

### **44: Using Machine Learning Algorithms to Identify Neurological Status of Critically Ill Adult Patients—Cerebral Oxygenation and Narcotic Dosing During the First 24-Hours Substantially Contribute to Neurological Status**

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**Objective:** To classify patient neurological trajectory using physiological variables and clinical characteristics captured within the first 24 hours of intensive care unit (ICU) admission.

**Methods:** A single-centre prospective observational study enrolled medical/surgical ICU adult patients with respiratory failure and/or shock. Immediately following enrolment, patients underwent noninvasive regional cerebral oxygenation (rSO<sub>2</sub>) monitoring with the FORESIGHT cerebral oximeter and we concurrently recorded patient vital signs (e.g., heart rate, arterial oxygen saturation). Arterial blood gases and hemoglobin were collected when ordered clinically. Delirium was assessed daily throughout the ICU stay using the CAM-ICU; participants were grouped into delirious (≥1 positive assessment) or intact (0 positive assessments). Patients were considered comatose if they had a Richmond Agitation and Sedation Score ≤ -4 throughout the majority of their ICU stay. Vital sign and rSO<sub>2</sub> data were classified using a support vector machine (SVM) approach. Data were divided into training (80% of group), testing (10%), and validation (10%) sets. We analyzed all pairs of clinical groups: delirious/intact, comatose/intact, and comatose/delirious.

**Results:** 52 intact, 19 delirious, and 14 comatose patients were included. The comatose/delirious pairing yielded the greatest classification accuracy out of all comparisons (71.0%  $\hat{\pm}$ 1.0% vs majority class probability of 57.1%). Sensitivity and specificity were 65.9% and 79.3%, respectively. Variables leading to the greatest increase of classification accuracy above chance when included in the model were: minimum rSO<sub>2</sub> levels (4.7%), narcotic dosing (2.3%), and standard deviation of rSO<sub>2</sub> (1.9%).

**Conclusions:** Classification analysis was only possible when comparing the two most severe clinical groups despite the inclusion of the many clinical features captured. Accuracy was largely attributed to cerebral oxygenation and narcotic dosing, which may suggest possible modifiable risk factors attributing to patient neurological trajectory. However, larger sample sizes across groups are required to validate the current classification analysis.

#### **45: Clinical management of delirium: The response depends on the subtypes. An observational cohort study in 602 patients**

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**Objective:** The hypoactive, hyperactive and mixed subtypes of delirium differently impact patient management and prognosis; yet, the evidence remains sparse. We examined the outcome of varying management strategies in delirium patients in a tertiary general hospital.

**Methods:** In this observational cohort study, 602 patients were managed for delirium over the course of 20 days with the following four strategies: supportive care alone or in combination with psychotropics, either single, dual or triple+ psychotropic drug regimens. Cox regression models were calculated for time to remission and benefit rates of management strategies (BR).

**Results:** Generally, the mixed subtype of delirium caused more severe and persistent delirium, and the hypoactive subtype was more persistent than the hyperactive subtype.

The subtypes of delirium were similarly predictive for mortality ( $P = 0.697$ ) and transfer to inpatient psychiatric care ( $P = 0.320$ ). In mixed subtype, psychotropic drugs were administered more often overall ( $P = 0.016$ ), and particularly triple+ regimens were observed more often than in hypoactive delirium ( $P = 0.007$ ). Patients on supportive care benefited most, whereas those on triple+ regimens did worst in terms of remission in all groups of hypoactive, hyperactive and mixed subtypes (BR: 4.59, CI 2.01-10.48; BR: 4.59, CI 1.76-31.66; BR: 3.36, CI 1.73-6.52; all  $P < 0.05$ ).

**Conclusions:** The management of delirium remains controversial and generally, supportive care benefited patients of all subtypes the most. Psychopharmacological management for delirium requires careful choosing of and limiting the number of psychotropics.

#### **46: Simple delirium screening tools for delirium detection in older hospitalized medical patients**

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**Objective:** To evaluate diagnostic performances of Thai delirium screening tool and the CAM-ICU compared to DSM-5 criteria in older hospitalized medical patients.

**Methods:** A prospective study was conducted at Siriraj Hospital. Patients aged 70 years or older admitted to general medical wards during October to December 2018 were enrolled. The DSM-5 criteria for delirium diagnosis and two delirium screening tools; the CAM-ICU and Thai Delirium Screening Tool (TDST), were independently assessed in all participants for 7 consecutive days. TDST was a novel test developed by a group of geriatricians comprising 11 questions to simplify the assessment of inattention and common delirium features. All diagnostic characteristics of two screening tools were analyzed compared to the DSM-5 criteria performed by geriatricians.

**Results:** Of 36 patients enrolled, 164 episodes of paired-assessment were performed. The sensitivity of the CAM-ICU was 60% (95% confidence interval [CI], 45.9-72.9), while the specificity was 97.2% (95% CI, 92.1-99.4). The sensitivity of the TDST was 70.9% (95% CI, 57.1-82.3), while the specificity was 95.4% (95% CI, 89.6-98.4). In order to explore a suitable set of questions to achieve high sensitivity, selected questions from TDST was analyzed. Any error to questions ‘What day is today?’ and ‘Which symptoms brought you to hospital?’ increased a sensitivity to 94.5% (95% CI, 84.8-98.8), and had a specificity of 65.1% (95% CI, 55.4-74.0). Furthermore, adding the feature ‘memory/perception changes from baseline’ increased the specificity to 89.0% (95% CI, 81.5-94.1) while the sensitivity remained reasonable at 90.9% (95% CI, 80.0-96.9).

**Conclusions:** The sub-test of TDST using 2 or 3 questions are promising tests that could be selected depending on available resources to confirm diagnosis. TDST could be a novel screening tool for delirium in hospitalized older patients given its simplicity and high-sensitivity.

#### **47: Feasibility of Implementation of a Cognitive Vital Sign on an Acute Care of the Elderly Unit**

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**Objective:** Although there are several delirium screening tools validated in different settings, it is not clear which is best to use by frontline staff for screening. We aimed to investigate the feasibility of daily delirium screening on an Acute Care of the Elderly Unit.

**Methods:** We developed a delirium screening tool based on RADAR (Recognising Acute Delirium As part of your Routine) and MOTYB (Months of the Year Backwards). We trained nursing staff, implemented the tool for use daily during vital signs, and monitored refusal rates, assessment duration, and staff adherence. Participants, caregivers, and nursing staff were also surveyed on their opinion of the screening.

**Results:** Of 125 participants, median age was 84 years (IQR 9.5), 56.0% (70/125) were women, and 509 of a possible 553 assessments were conducted. Eighty-five (68.0%, 85/125) had all assessments completed correctly. Fourteen refused MOTYB at least once, five of whom screened positive using RADAR. A further 31 patients had at least one assessment missed, 18 of whom had screened positive previously. One-hundred and three (82.4%, 103/125) had effective screening during their time on the ward. The median screening duration was 70 seconds (IQR 44.5). The majority of patients (n=45/59) and caregivers (n=47/51) rated the screening favourably.

**Conclusions:** Despite training, adaptations based on staff feedback and regular reinforcement, this short, simple screening test was challenging to implement daily. It was well-received by patients and caregivers.

Our next step involves interviewing nursing staff to help understand their perceptions of the tool and the barriers that need to be overcome to implement daily.

#### **48: Are biomarkers of neuronal damage associated with delirium severity and subsyndromal delirium in mechanically ventilated intensive care unit patients with sepsis?**

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**Objective:** Objectives: Delirium etiology may involve pathways that increase blood-brain barrier permeability and cause neuronal damage. This ongoing study aims to evaluate if biomarkers of neuronal damage (S-100 $\beta$ , neuron-specific enolase, and ubiquitin carboxyterminal hydrolase L1, and brain-derived neurotrophic factor) are related to delirium severity and subsyndromal delirium (SSD) in mechanically ventilated intensive care unit (ICU) patients with sepsis.

**Methods:** Methods: Consecutive adult patients were recruited from a 28-bed general systems ICU (Calgary, Canada). Inclusion criteria were: (a) Sequential Organ Failure Assessment score  $\geq 2$ , (b) Richmond Agitation and Sedation Scale score  $\leq -3$ , (c) no primary direct brain injury, and (d) mechanically ventilated. Serum samples were collected upon enrollment (0800h-1200h) and stored for batched analysis using Addressable Laser Bead Immunoassay (ALBIA). Delirium severity/SSD were assessed daily for a maximum of five days using the Confusion Assessment Method for the Intensive Care Unit 7 (CAM-ICU-7) (range 0-7). Descriptive statistics will be calculated for all study variables. We will use non-parametric or log-transformation of serum biomarker concentrations and evaluate associations between serum biomarker concentrations and CAM-ICU-7 scores, adjusting for potential confounders, including age, sex, illness severity, inflammation, and endothelial activation.

**Results:** Results: Of eight eligible patients, five (5/8, 62.4%) patients were enrolled between August and December, 2019 (target sample size n=40). The interim sample includes four males and one female with a mean age of  $53.4 \pm 23.7$  years. Delirium and SSD prevalence were 20% (1/5) and 80% (4/5), respectively. The median CAM-ICU-7 score was 2. Batched ALBIA and statistical analyses will be conducted in February, 2019.

**Conclusions:** Conclusions: The results of this study will provide exploratory evidence of neuronal damage in ICU delirium. The results from this study may support a larger prospective study with daily biomarker and delirium measurements to determine the temporal relationship between delirium severity/SSD and neuronal injury.

#### **49: Computational Phenotyping of Delirium Using Bispectral EEG**

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**Objective:** The purpose of this study was to assess whether two channel frontal EEG activity could be used to quantitatively characterize delirium and predict outcomes including fall risk and mortality.

**Methods:** A single center, prospective design was used to collect frontal EEG activity (Fp1 and Fp2 EEG locations) from patients after admission or at the time of an emergency room visit. Subjects were assessed for the clinical presence of delirium and the primary outcomes measured were hospital length of stay

(LOS), discharge disposition, mortality, and fall history. EEG features (band powers and different combinations of low to high frequency activity) were calculated for both channels and averaged. K-nearest neighbors, logistic regression, support vector machine (SVM), kernelized SVM, and neural network approaches were used to assess the ability of EEG features to predict delirium status, survival, and falls with 5-fold cross-validation.

**Results:** EEG features and outcome data for 274 inpatients were available for analysis. The top 9 EEG-derived predictive features were selected using Random Forest, and the same features were replicated from a dataset consisting of 50 patients with post-ictal delirium following electroconvulsive therapy. Of all the classification methods, kernelized SVM yielded the highest prediction accuracies of 69%, 81%, 89% for delirium status, mortality, and falls respectively.

**Conclusions:** We showed that frontal EEG has promise in objectively measuring delirium from a variation of clinical causes, and can predict pertinent clinical outcomes including fall risk and mortality.

## **50: Instituting an Evidence-Based, Nurse-Driven ICU Mobility Protocol for an Adult Medical Intensive Care Unit**

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**Objective:** The risk of developing delirium is greater in the ICU. Non-pharmacological interventions, commonly, early mobilization have been incorporated into clinical practice guidelines for ICU patients to attenuate incidences of delirium. Several studies with nurse-driven mobility protocols looked at mobility, knowledge, length of stay, however, its effect on delirium has not been studied. The purpose of this project was to increase nurses' recognition and participation in early, frequent mobilization in ICU.

**Methods:** Based on PDSA framework, the planning phase involved key facilitators reviewing and identifying feasible protocol as well as gaps/barriers. During the doing phase, all ICU nurses received education then facilitated the protocol. Data collection and analysis would occur during the study phase. Key measures were identified as (1) staff education participation, (2) incidence of CAM scores, (3) incidence of protocol eligibility, and (4) incidence of mobilization. In the act phase, nurses and key ICU personnel were to either adopt the activities tested to improve mobility, or identify new activities for testing.

**Results:** Incorrect delirium assessment, staffing, and patients' condition were identified as likely barriers to protocol implementation. Baseline CAM scores (n=188) were collected: 77% (n=145) negative, 15.4% (n=29) positive, 6.4% (n=12) incorrect. A total of 56 nurses (100%) received protocol and delirium assessment education. To date, 372 patients have been evaluated using the CAM: 82% (n=304) negative, 13.2% (n=49) positive, 0.3% (n=1) incorrect. In addition, 93% (n=346) patients to date were eligible for mobility protocol: more than 75% patients were mobilized at least twice daily according to their level of mobility.

**Conclusions:** PDSA cycle application and data collection is in progress, however early evaluation demonstrates higher rate of accurate identification and documentation of CAM, greater incidence of mobility protocol implementation, and in anecdotal evidence of nurse satisfaction with updated documentation and communication processes.

## 51: DELIRIUM SIMULATION ON AN ACUTE CARE FOR ELDERS UNIT

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**Objective:** Simulation was used to train Acute Care for Elders (ACE) Unit staff in recognition and management of delirium.

**Methods:** Prior to the simulation, staff received a 1-hour didactic on delirium. During the simulation, paired participants were given a case description, an ACE Tracker report for the simulated patient, and blank copy of the Nursing Delirium Screening Scale (NuDESC). After the encounter, participants calculated the NuDESC score and wrote down next steps in evaluation and management. Observers graded participants on non-pharmacologic delirium interventions done during the encounter (score 0-2: 0=not done; 1=partial; 2=complete). Participants completed a self-assessment pre-post survey and a post-simulation survey on the educational experience.

**Results:** Seventeen nurse and patient care technician (PCT) pairs completed the simulation. NuDESC scores ranged from 2-6, with a mode of 5 (score  $\geq 2$  is a positive screen). During the simulation, participants consistently used sensory device, confirmed the acute change with the caregiver, and educated the caregiver about delirium. The following delirium management strategies were done less consistently: filled cup with water, opened blinds, turned lights on, put patient in a chair. Participant pairs wrote the following next steps: review/remove offending medications (14/17; 82%); use sensory aids (13/17; 76%); assess/treat constipation (12/17; 71%); remove urinary catheter (11/17; 65%); turn lights on/open blinds (10/17; 59%); mobilize out of bed (9/17; 53%); and assess/treat pain (9/17; 53%). Participants rated the overall educational value of the simulation as a mean of 4.2 out of 5. Compared to pre-simulation, post-simulation participant self-confidence in delirium assessment and perception of having enough time to assess delirium were significantly improved ( $p=0.015$  and  $p=0.017$ , respectively).

**Conclusions:** ACE Unit Nurses and PCTs rated the delirium simulation as a positive learning experience. Observation of participants during the simulation identified areas for further training and reinforcement, including mobilization, to manage delirium.

## 52: Variability in Delirium Rates in Older ED Patients Enrolled in a National Multicenter Trial

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**Objective:** This study aims to describe the variability of Emergency Department (ED) Delirium among centers included in a multicenter trial across Canada.

**Methods:** This is a secondary data analysis of a clinical trial designed to assess recognition of ED Delirium by MDs using novel tablet technology. The detailed objectives and methodology of this trial are described elsewhere. We reviewed data from 5 participating sites across Canada (Nova Scotia, Calgary, Quebec City, Ottawa and Toronto). Data collected from every site included total number of patients: screened, excluded, and enrolled. The primary outcome was ED delirium defined as a positive Confusion Assessment Method (CAM).

**Results:** A total of six hundred and twenty-seven participants were enrolled across all sites; thirty-eight (6.1%) had a positive CAM. Out of the five, 2 sites did not recognize delirium. One hundred and twenty-nine participants were enrolled in these sites; no delirious participants were included (0% (95% CI 0,

2.8)). Among the remaining three sites, a total of four hundred and ninety-eight participants were enrolled and thirty-eight (7.6%) were delirious (95%CI 5.4, 10.3).

**Conclusions:** Results from this secondary analysis indicates there is a variability of ED delirium between sites. This variability may be due to a selection bias. It may also be explained by a true variability of the disease, perhaps related to differences in patient vulnerability or care processes. Further research is needed to elucidate the cause of ED Delirium variability.

### **53: A Multi-Centre Feasibility Study Investigating the Impact of Cerebral Oxygenation on Delirium Development in the Early Stages of Critical Illness**

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**Objective:** Intensive care unit (ICU) patients frequently develop delirium, for which the etiology is poorly understood. There is preliminary evidence that impairment may be associated with cerebral hypoperfusion, however recording regional cerebral oxygenation (rSO<sub>2</sub>) as a proxy for cerebral perfusion during critical illness has remained challenging. Therefore, we aimed to assess the feasibility of using a multimodal data collection platform in a multi-site prospective observational study across Canada.

**Methods:** This study was performed in 4 ICUs. Adult patients (>17 years) were eligible if admitted to the ICU within the previous 24 hours without a primary central nervous system admitting diagnosis and required mechanical ventilation and/or vasopressor support. During the first 72 hours, near-infrared spectroscopy (NIRS) was used to continuously capture rSO<sub>2</sub> levels, and vital signs (e.g., heart rate) and peripheral oxygenation saturation were concurrently captured. Additionally, arterial and central venous gases were sampled every 12 hours. Participants were screened daily for delirium in the ICU with the Confusion Assessment Method (CAM)-ICU, or with the brief-CAM (bCAM) when on the ward.

**Results:** 567 patients were screened between January 5th 2018 and December 27th 2018 across 4 sites. Of 164 eligible patients, 60 consented and were enrolled. Data has only been uploaded from the leading site to date (n=24). 83%(20/24) of rSO<sub>2</sub> data and 96%(23/24) of delirium status data was captured. 46%(11/24) patients were excluded due to missing vital sign(8/24), rSO<sub>2</sub>(4/24), or blood gas data(2/24). Patients ranged from 41-88 years. 18 patients were delirious, and 5 were non-delirious during their stay.

**Conclusions:** Multi-centre recruitment and monitoring is feasible, with high rates of rSO<sub>2</sub> and delirium data captured. Additional training sessions and documentation of missing data will be implemented to decrease loss of vital sign, rSO<sub>2</sub> and blood gas data. Overall, this study will help to improve our understanding of the relationship between cerebral oxygenation and delirium.

### **54: Adherence and implementation to the ABCDEF bundle in a tertiary care hospital in Buenos Aires (Argentina)**

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**Objective:** Evaluate the adherence and implementation to the ABCDEF bundle in a tertiary care hospital in Argentina.

**Methods:** Retrospective observational study. Adherence to the bundle of measures was evaluated through the analysis of clinical records (CR) of patients with ICU admission greater than 24 hours.

**Results:** During the period (3/26/18 - 4/5/18), we analyzed 122 days of ICU stay for 53 patients. A: Everyday pain was assessed at 100% of the patients with numerical scale or CPOT. 20% of the pain registers there was no indication of analgesia within 60 min posterior to the diagnosis, and in the 30% of the registers there was no re-evaluation within the first hour. B: 15 patients were under sedation, adding 38 days, 32% of days (12 days) not having a sedation stop, because of proper contraindication by the treating team. 31 patients received mechanical ventilation (MV), for a total of 60 days of MV. Of those, 40% (25 days) didn't have a spontaneous breathing trial and 25% hadn't specific contraindication. C: The first choice for sedation was dexmedetomidine (40%), the second was propofol (35%), followed by opiates and benzodiazepines (remifentanyl 20%, midazolam 5%). D: Delirium was evaluated with CAM-ICU in 100% of the days, was positive in 29%, only in 15% was evaluated as a relevant problem by physicians. E: 38 days of the total (33%) the patients didn't start early mobilization, only the 63% had contraindications. F: We have open visiting hours for the family. No specific tool was used to evaluate this item.

**Conclusions:** We have proved that it is feasible to evaluate bundle adherence in our context. We feel this may be reproducible by other teams in Argentina. Regarding our hospital, we will use this measurement as the reference for future measurements after an implementation trial.

## **55: Improving the journey for people with dementia in the acute hospital setting – a collaborative approach**

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**Objective:** A person with dementia in hospital should be cared for in the right place at the right time. Late and multiple moves increase a person's risk of developing delirium which is further risk to those with dementia. Delirium as we know is associated with increased lengths of stay, a reduction in functional ability and increased mortality. Local audit data within NHS Forth Valley revealed evidence of late and multiple moves for this patient group. The aims of this project were to: Increase the number of people transferred before 8pm; Reduce the number of multiple moves (where avoidable); Increase staff awareness of potential the risk to the person; Encourage collaborative working between a wider multi-disciplinary team; Deliver person centred care through an enhanced inpatient/carer experience

**Methods:** The Liaison Psychiatry team worked in collaboration with the bed management team in the Acute Medical Unit to identify those at risk. A simple signifier was added to the admissions board. Scoping work was carried out to identify and explore themes behind these bed moves with all moves after midnight investigated. A whole systems approach was undertaken to improve flow across the Medical Directorate. Focus on earlier discharges from downstream wards to facilitate earlier transfers and improvement in the discharge lounge facilities were developed. In order to break down inter-professional barriers education sessions for all staff members were delivered.

**Results:** There were significant improvement in identified outcomes. The project has increased the number of patients transferred to inpatient wards before 8pm (from 52% to 95%) and reduced the number of moves between different wards after patients have been admitted (from 34% to 6%). Qualitative data has demonstrated significant and sustained improvement in both of these areas resulting in positive patient, carer and staff experiences.

**Conclusions:** Significant and sustained improvement in desired outcomes achieved through collaborative working.

### **56: Alterations in Resting-State Functional Connectivity following Delirium in Cardiac Surgical Patients**

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**Objective:** Delirium is a disorder of fluctuating attention and cognition affecting up to half of patients following major cardiac surgery. Despite evidence linking delirium to deleterious long-term outcomes such as dementia, the neurobiological sequelae of delirium are poorly characterized. Resting-state networks (RSNs) are collections of distributed brain regions linked by correlations among low frequency oscillations in the blood oxygen level dependent (BOLD) magnetic resonance imaging (MRI) signals. In particular, the default mode network (DMN) and ventral attention network (VAN) are RSNs that are implicated in delirium given their putative functions in internally- and externally-directed attention. This study assessed relationships between delirium and functional connectivity (FC) within these RSNs in patients recently undergoing major cardiac surgery.

**Methods:** We recently-completed an investigation of postoperative delirium (NCT03110185) in patients undergoing major cardiac surgery requiring cardiopulmonary bypass. Forty-four English-speaking patients, at least 60 years of age, were enrolled for postoperative fMRI scans. Delirium was assessed using the Confusion Assessment Method (CAM) for three consecutive days after surgery. MRI structural and functional images were acquired within 30 days of surgery using a Siemens 3T scanner. Data from three 6-minute BOLD sequences were analyzed for the strength of FC in the DMN and VAN.

**Results:** As target recruitment was just met in January 2019, full group-level quantitative comparisons are not yet complete. Preliminary individual-level data validation methods suggest robust data despite rigorous procedures employed or censoring motion artifact. Full quantitative analyses will assess for correlations between RSN FC and delirium incidence and peak severity.

**Conclusions:** Our findings will contribute to a limited body of literature suggesting a role of DMN structures (e.g., precuneus) in delirium pathogenesis by examining relationships between FC and delirium outcomes of cardiac surgical patients. These findings will highlight network disruptions underlying functional deficits in delirium, suggesting investigational target markers for future trials.

### **57: Sub-Clinical Brain Failure: Identification of High Risk Mortality Patients and Prediction of Patient Outcomes Associated with Delirium with a Novel Bispectral Eeg Device**

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**Objective:** We aim to develop an efficient and reliable point-of-care bispectral EEG (BSEEG) device for high-throughput screening of delirium. We hypothesized that BSEEG scores can detect delirium and predict patient outcomes, including mortality.

**Methods:** This is a prospective study, conducted between January 2015 to October 2017 at the University of Iowa Hospitals and Clinics (UIHC), to measure BSEEG from elderly inpatients and correlate with

outcomes. A BSEEG score was defined based on the distribution of 2938 BSEEG recordings from the 428 subjects, who were clinically assessed for delirium. To investigate the potential role of brain wave signals associated with delirium and patient outcomes, our analysis focused on an age group 55 years of age or older. Single center study at a tertiary care academic hospital in the Midwest region of USA. 428 patients were enrolled, and 337 were 55 years old or older. Among them, 274 patients had BSEEG data available for analysis. Primary outcomes measured were hospital length of stay (LOS), discharge disposition, and all-cause mortality.

**Results:** Delirium and BSEEG score had a significant association ( $P < 0.001$ ). Higher BSEEG scores were significantly correlated with increased LOS ( $P < 0.001$ ) as well as with discharge not to home ( $P < 0.01$ ). Hazard ratio for mortality, controlling for age, gender, Carlson Comorbidity Index, and clinical delirium, was 1.35 (95% confidence interval = 1.04 to 1.76,  $P = 0.025$ ).

**Conclusions:** We have developed an efficient and reliable device that provides an objective measurement of risk for delirium. This BSEEG score is significantly associated with pertinent clinical outcomes of mortality, hospital length of stay, and discharge disposition. The BSEEG score better predicts mortality than clinical delirium status. We identified a previously unrecognized sub-population of patients without clinical features of delirium who are at increased mortality risk.

## **58: Cognition Clinical Lead: A Role for Allied Health**

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**Objective:** Management of delirium and dementia in hospital has been a long-standing challenge for health services in Australia, and as the population ages, this challenge is growing. Monash Health has developed a Dementia and Delirium Initiative to ensure safe and high-quality care is received. The aim of the initiative focuses on implementing non-pharmacological strategies as first line management for people with cognitive impairment in hospita

**Methods:** To achieve this the Cognition Clinical Lead provided education, role modelling and resources to allied health to be key members in the management of patients with cognitive impairment. Two communication tools were also imbedded into the patient's admission. The sunflower and Top 5 are designed to identify person centred information and carers tips to engage with patients at the bedside. Allied Health are uniquely positioned to be the leaders in this area as their expertise lie within non-pharmacological interventions.

**Results:** Three Geriatric Evaluation Management Units were selected to participate initially as they have a higher staff ratio of allied health than acute medical wards. The communication tools for patients with an identified cognitive impairment were used over 86% of the time in a three-month period. A focus group was completed with themes including patient engagement, role modelling for nurses and promotion of the allied health disciplines in the area of delirium and dementia.

**Conclusions:** Delirium and dementia is often seen as a medical and nursing lead field in relation to ward based care. This initiative highlights the value that allied health can have in this area. Clinical implications for future practice include allied health access for all patients with a cognitive impairment across the health service and allied health feeling confident that they can be a leader and take initiative in improving outcomes for this cohort of patients.

### **59: Validation and transcultural adaptation of the Delirium Motor Subtyping Scale 4 (DMSS-4) in a Brazilian cohort of hospitalized older adults: preliminary results**

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University of Sao Paulo Medical School, Sao Paulo, Brazil

**Objective:** To analyze the performance of the Delirium Motor Subtyping Scale 4 (DMSS-4) as a method to assess the psychomotor profile of acutely ill older adults with delirium.

**Methods:** Prospective study including acutely ill older adults aged 60 years or over, consecutively admitted to a geriatrics ward in Brazil from August 2018 to January 2019. Comprehensive geriatric assessments were performed at baseline and throughout hospitalization. Trained physicians evaluated eligible patients up to 48 hours of admission and every 24 hours until death or discharge. Delirium was determined by daily assessments using the long version of the Confusion Assessment Method (Long-CAM). The adapted Portuguese version of DMSS-4 was used to categorize the psychomotor subtype of each delirium episode as follows: no subtype, hyperactive, hypoactive or mixed. The primary outcome was the identification of delirium motor subtype according to DMSS-4. Our main secondary outcome was in-hospital mortality. Multivariate analyses were performed using logistic regression models adjusted for possible confounding factors.

**Results:** We included 94 patients, with a mean age of 81 years and 60% of women (N=56). Delirium was detected in 45 (48%) patients. A total of 1164 psychomotor evaluations were performed, of which 641 (55%) were considered normal, 430 (37%) hypoactive, 44 (4%) hyperactive, and 49 (4%) mixed. In-hospital mortality was higher for mixed and hypoactive subtypes, as compared to hyperactive and normal profiles (39% vs. 21% vs. 10% vs. 2%;  $P < 0.001$ ). The hypoactive and mixed psychomotor subtypes were independently associated with mortality, with an adjusted relative risk (RR) of 2.4 (95%CI=1.97-3.07) and 3.09 (95%CI=2.23-4.28), respectively. Hyperactivity alone was not a predictor of death (RR=1.24; 95%CI=0.68-2.28).

**Conclusions:** The DMSS-4 is a practical tool which allows rapid and effective assessment of delirium motor subtypes. Clinicians and researchers should use this instrument to determine motor activity as a marker of negative outcomes in patients with delirium.

### **60: The SANDMAN Study: Sleep Apnea, Neuroinflammation, and Cognitive Dysfunction Manifesting After Non-cardiac surgery**

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**Objective:** One possible risk factor for postoperative cognitive decline (POCD) and delirium is obstructive sleep apnea (OSA), a frequently undiagnosed disorder characterized by repetitive interruptions in breathing (apneas and hypopneas) during sleep. OSA is prevalent in elderly patients undergoing surgery and can be diagnosed with home sleep apnea tests (HSAT), which estimate the apnea-hypopnea index (AHI). Here, we aim to determine the extent to which OSA severity is associated with POCD, postoperative delirium, and neuroinflammation.

**Methods:** The SANDMAN study is a sub-study of the larger INTUIT study. In INTUIT, 200 patients age  $\geq 60$  years undergoing major non-cardiac/non-neurologic surgery will undergo blood and cerebrospinal

fluid (CSF) sampling and cognitive testing before, and 24 hours and 6 weeks after surgery. Postoperative delirium will be assessed with 3D-CAM or CAM-ICU. CSF interleukin-8, interleukin-6, monocyte chemoattractant protein-1, and granulocyte colony stimulating factor will be measured with multiplex ELISA assays. In the SANDMAN study, 80 INTUIT patients will also complete preoperative HSAT to diagnose OSA. The association of AHI with postoperative cognition, delirium and CSF cytokines will be assessed via multivariable regression models adjusting for preoperative cognition and relevant background characteristics.

**Results:** 23 patients have enrolled in the SANDMAN study and undergone HSAT. Of the 21 patients who successfully completed HSAT (mean AHI 10.4; SD 12.3), 62% tested positive for OSA (AHI > 5), with 20% positive for moderate OSA (AHI 15-29.9) and 5% positive for severe OSA (AHI > 30).

**Conclusions:** The ongoing SANDMAN study is assessing the relationship between OSA severity, neuroinflammation, POCD and postoperative delirium. The prevalence of OSA in our study is high, consistent with prior estimates. We hypothesize that OSA will be associated with increased preoperative neuroinflammation, postoperative delirium and POCD. Our findings could provide important data to guide potential interventions to prevent POCD and postoperative delirium, including preoperative treatment of OSA.

### **61: Delirium Prevention Toolbox Supplies: The Journey to Sustainability**

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**Objective:** Evidence supports the use of multicomponent interventions including cognitive stimulation/distraction to prevent or manage delirium. At our hospital, geriatric team members purchased supplies and created a delirium ‘toolbox’ for staff. However, there was a not a sustainable process for replenishing these items.

**Methods:** Our first delirium prevention toolbox was piloted on one unit in Fall 2014 as part of a Virtual Acute Care of Elders (ACE) initiative and implemented on seven additional units over the next year by having members of the geriatric team purchase toolbox items using grant funding. In Spring 2015, our Chief Nursing Officer requested each nursing unit have a toolbox, and funding for delirium toolbox item was added to the nursing budget for the upcoming fiscal year. Based on initial implementation on eight units, we knew that our small department could not sustainably manage toolbox supplies for 52 nursing units. In June 2015, we met with our supply chain team to discuss a better process to order supplies for the toolboxes. By June 2016, we had a process for units to special order some toolbox items in bulk from online vendors via our materials management system; however, external sourcing proved to be ineffective due to extended lead times from the vendor. A recommendation from our Restraint Summit (April 2017) was for our supply chain to have items more readily available at the bedside for delirium prevention/management as restraint alternatives.

**Results:** By July 2017, we had a process for toolbox items to be ordered by unit staff through Central Supply inventory, charged to unit accounts, and available for pickup within 15 minutes.

**Conclusions:** What seemed like a simple process was actually very complicated and involved multiple departments and over 3 years of work. Support from hospital leadership was the key to developing a sustainable process.

## **62: Asenapine Causing Anticholinergic Delirium: A Case Report and Literature Review**

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**Objective:** Objectives: Asenapine has been purported to be an antipsychotic medication with no capacity for muscarinic cholinergic antagonism. However, it is structurally similar to other anticholinergic antipsychotics such as loxapine and, to a lesser degree, quetiapine, olanzapine, and clozapine.

**Methods:** Methods: This case report describes the development of delirium and anticholinergic toxidrome in a patient treated with paroxetine, a selective serotonin reuptake inhibitor with anticholinergic properties; and benztropine, an anticholinergic agent, with emergence of the toxidrome only after an increased daily dose of asenapine.

**Results:** Results: Mr. X, approximately 50 years of age, presented to a hospital emergency department with a two day history of confusion, disorientation, visual hallucinations, and word finding difficulties. He had last been seen well on the day that asenapine had been increased from 5mg once daily to 5mg twice daily. He was admitted to the general internal medicine, with consultation requested from the neurology and psychiatry services. The differential diagnosis for delirium included: stroke, serotonin syndrome, neuroleptic malignant syndrome, and anticholinergic toxicity. Stroke was eliminated as a cause through neuroimaging, and the symptoms improved following discontinuation of paroxetine, benztropine, and asenapine, which all have anti-muscarinic receptor activity.

**Conclusions:** Conclusions: The temporal relationship of asenapine titration with symptom emergence and symptom resolution with discontinuation of all anticholinergic agents in this case suggest that asenapine likely has more antimuscarinic activity than previously reported. Its chemical homology with other antipsychotic medications is consistent with this conclusion. In cases of delirium in patients treated with asenapine, anticholinergic toxicity should be included on the differential. Physostigmine may be a useful antidote to consider in these cases and would also assist in determining whether anticholinergics has contributed to the development of delirium.

## **63: Delirium in the ICU and medium-term cognitive outcome: a prospective-feasibility cohort study**

Federico Carini, Sergio Giannasi, Juan Eduardo San Roman  
Hospital Italiano de Buenos Aires, CABA, Argentina

**Objective:** Establish delirium prevalence in our unit and evaluate cognitive and emotional outcome. Determine the feasibility of performing a medium term follow up research project with in-site prolonged.

**Methods:** Tertiary care-teaching hospital, mixed ICU, 38 beds with windows and access to day light and a free visiting policy for family members. We included all patients admitted to the ICU and with a LOS larger than 48 hours between July 2012 and November 2014. The exclusion criteria were: 1) prior cognitive impairment; 2) severe head trauma defined; 3) MPM II > 80 %. The follow up visit was in person. Calculated sample size of 114 patients per arm. Approved by the IRB.

**Results:** Delirium incidence was 48% (181/378) and persistent > 48 hs was 26%. 127 invited to follow up, 65 attended at first follow-up and 48 at the second one. Persistent delirium >48 hs had significantly greater probability of not being discharged home (OR 3.55; CI 95 % 1.2 to 10.2), longer ICU-LOS and LOS (13.5 days for the ICU stay and of 19 days for the overall hospital stay) 51.2 % of patients were

evaluated after ICU discharge. Those who attended were younger, less delirious during ICU stay and were less sick. In the cognitive evaluation, we did not find any significant differences between the groups. We did find a high prevalence of memory impairment and depression.

**Conclusions:** Delirium was prevalent and had a negative impact on LOS, LOS-ICU and return to home. Due to loss to follow up it was not possible to properly evaluate long term cognitive outcome. However, we did find some spheres that were compromised, consistent with PICS. We proved that it is feasible to perform in site long term evaluation in our context. We did had some severe difficulties with adherence, that should be addressed in future research.

#### **64: Development and outcomes of a nurses-driven initiative for prevention and treatment of delirium in hospitalized elderly**

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**Objective:** Purpose of this quality improvement project was to develop an evidence-based nurses-delivered delirium prevention and treatment program for hospitalized elderly in a community hospital.

**Methods:** after brief education about delirium, nurses at a designated unit were screening elderly hospitalized patients at risk of developing delirium using CAM (Confusion Assessment Method). Selection included patients aged 65 years and older, with history of dementia, with or without change in mental status on admission. Multiple interventions based on HELP (Hospital Elder Life Program) and hospital geriatrician's input were applied to all screened patients as to either prevent (e.g. for CAM negative) or alleviate symptoms and prevent worsening of delirium in CAM positive patients. In a 12 months period, 294 patients were screened and 284 were analyzed and compared to a group of 152 patients with same selection criteria who, received care in a different medical unit. Data were obtained from hospital data base and analyses on various outcome measures were done by an analyst and a statistician.

**Results:** there were no significant differences between groups (intervention vs. control) in age distribution (66-75 years: 26.4% vs. 28.9%, 76-85 years: 32.4% vs. 34.9%, >86 years: 41.2% vs. 36.2%, p=0.59), gender (e.g. female: 45.1% vs. 44.1%, p=0.84), comorbidities (Elixhauser comorbidities index: 4.9 vs. 5.0, p=0.89), DGR (diagnosis-related group) weight (1.5 vs. 1.5, p=0.70) and hospital readmissions (21.5% vs. 20.4%, p=0.79). Although patients in intervention group had longer length of stay (6.1 $\bar{i}$ , $\pm$ 3.7 vs. 5.4 $\bar{i}$ , $\pm$ 3.9, p=0.05), there were less ICU transfers (13.4% vs. 20.4%, p=0.07). They also received less sedative medications (overall: 37.7% vs. 45.4%, p=0.11; for patients >86 years: 22.2% vs.47.3%, p=0.001) and had more pain-treatment (31.7% vs. 21.1%, p=0.02).

**Conclusions:** nurses-delivered delirium prevention and treatment program using CAM is feasible and improves overall quality of care and outcomes in hospitalized elderly.

#### **65: Investigation of Sleep in the Intensive Care Unit**

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**Objective:** Our central hypothesis is that sleep deprivation substantially mediates both short- and long-term cognitive outcomes in critical illness. We aim to compare the burden of delirium in ICU patients receiving placebo vs. biomimetic sleep induced by continuous overnight low- or very-low-dose dexmedetomidine (Dex). This study will help determine whether Dex reduces delirium by improving sleep, whether delirium incidence is reduced more by low-dose or very-low-dose continuous Dex infusion, and the relationship of sleep deprivation to long-term cognitive decline.

**Methods:** This single-center, phase II, double-blind, placebo-controlled, three-arm, parallel-group, mechanistic, randomized trial will enroll 750 ICU patients over a period of 5 years. Non-ventilated patients over the age of 50, admitted to medical and surgical ICUs, are randomized into three arms to receive either very-low-dose (0.1 mcg/kg/h) or low-dose (0.3 mcg/kg/h) continuous infusion of Dex or placebo. Delirium-free days are calculated via in-person patient interviews and chart review. Delirium assessments are conducted twice daily via the Confusion Assessment Method (CAM-S score/CAM-ICU) while the patient is in the ICU and 7 days following movement out of the ICU. A neuropsychiatric assessment of cognitive speed, attention, and short-term recall is performed on the day after the patient leaves the ICU to assess sleep debt. Long-term neuropsychiatric outcomes in ICU survivors will be assessed via telephone at 3, 6, and 12 months following enrollment. To measure the relationship between sleep and delirium, we monitor and statistically analyze blood pressure, electrocardiography, electroencephalography, respiration, ambient noise and light.

**Results:** The trial was approved by the institution's Human Research Committee in January 2018. Trial recruitment is ongoing.

**Conclusions:** There exists a critical unmet need to understand how sleep physiology relates to delirium and long-term brain health. To meet this need, we will perform a rigorously-controlled longitudinal study to determine interventions for delirium prevention and the improvement of sleep in the ICU.

## **66: HELP: A quality improvement project of a delirium prevention program**

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**Objective:** The Hospital Elder Life Program (HELP) is an evidence-based program aimed at preventing delirium and functional decline among hospitalized elderly adults. Patients with delirium may be prescribed antipsychotics/benzodiazepines, which may lead to adverse effects and other associated complications. HELP prevents the potential use of these pharmacologic interventions. The study aimed to assess the prevalence of newly prescribed antipsychotic/benzodiazepine medication, as well as 30-day readmission, among HELP-enrolled patients.

**Methods:** Retrospective quality improvement study of patients  $\geq 65$  years of age (n=518) who were enrolled into one of eight HELP units at a large Eastern Wisconsin medical system during January-September, 2018. Antipsychotic/benzodiazepine medications were pulled from EPIC. History of chronic mental illnesses were classified by ICD10 codes. Basic descriptive statistics were used to analyze patient characteristics and comorbidities. Chi-squared and T-tests were performed to detect statistical differences as appropriate.

**Results:** Prevalence of newly prescribed antipsychotics/benzodiazepines was 11.6%(n=60) upon hospital admission. Patients with history of other chronic mental illness (n=158) were more likely to receive

newly prescribed antipsychotics/benzodiazepines upon hospital admission( $p<0.0001$ ). When examining sex differences, female patients ( $n=49$ ) were more likely to receive a new antipsychotics/benzodiazepine prescription upon hospital admission( $p=0.0115$ ). From all patients diagnosed with delirium in the HELP program ( $n=18$ ), none receive a new antipsychotic/benzodiazepine prescription after being admitted to the HELP program. Overall, the 30-day readmission rate was 21% and there was no association with newly prescribed (Rx) antipsychotics/ benzodiazepines (79%[ $n=408$ ] no new Rx at admission vs. 77%[ $n=362$ ] new Rx at admission;  $p=0.67$ ).

**Conclusions:** In line with previous HELP studies, there was a relatively low 30-day readmission rate (21%;  $n=110$ ) among HELP enrolled patients. Newly prescribed antipsychotics/benzodiazepines were relatively high. Prompt recognition and differentiation of psychiatric disorders, delirium, and neuropsychiatric symptoms related to dementia are needed in order to create non-pharmacological strategies to prevent or limit the use of antipsychotics/benzodiazepines for management of these conditions.

### **67: Ranitidine-Induced Delirium in a 7-Year-Old Girl: A Case Report.**

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**Objective:** Our aim is to reinforce that a wide variety of clinical conditions can trigger delirium and that the best therapeutic approach is to minimize risk factors.

**Methods:** Case report using the CARE guidelines.

**Results:** We present the first case of a child presenting delirium possibly caused by anticholinergic toxidrome secondary to the use of ranitidine, resolving after drug discontinuation

**Conclusions:** Ranitidine is a histamine-2 blocker commonly prescribed in PICUs for the prophylaxis of gastrointestinal bleeding and stress ulcers. However, it can be associated to central nervous system side effects, such as delirium, in adults. We present the first case of a child presenting delirium possibly caused by anticholinergic toxidrome secondary to the use of ranitidine, resolving after drug discontinuation. With this case report, we reinforce that a wide variety of clinical conditions can trigger delirium and that the best therapeutic approach is to minimize risk factors.

### **68: The Impact of Delirium and Impaired Consciousness on Withdrawal of Life-Sustaining Treatment After Spontaneous Intracerebral Hemorrhage**

Michael Reznik, Scott Moody, Kayleigh Murray, Samantha Costa, Brian Mac Grory, Jonathan Drake, Richard Jones, Karen Furie  
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**Objective:** Established predictors for outcome after intracerebral hemorrhage (ICH) may be subject to self-fulfilling prophecy, as studies examining their effects on mortality have not considered their impact on withdrawal of life-sustaining treatment (WLST). Given the prominence of impaired consciousness in many prognostic scores, we aimed to determine the impact of delirium on WLST after ICH.

**Methods:** We performed a single-center retrospective cohort study using data from consecutive ICH patients admitted from February-November 2018. Delirium was diagnosed by an expert neurologist using DSM-5 criteria, either prospectively (as part of clinical care or a separate research study) or retrospectively (using established chart-based methods). ICH-related clinical factors were prospectively adjudicated, while timing of WLST was recorded retrospectively. Using Cox regression models adjusting for demographics and ICH severity, we compared the rate of WLST between patients who were never delirious, those who had delirium on admission (early delirium), those who had delirium that first occurred at some point after admission (later delirium), and those who were comatose for their entire hospitalization.

**Results:** Of 222 patients in our cohort (mean age 70.4 [SD 16.1], median ICH score 1 [IQR 1-2]), 50% had delirium and 37% were assessed prospectively. WLST occurred in 24% (including 14/15 comatose patients), with median time to WLST 3 days (IQR 1-7). In adjusted models, patients with both early and later delirium had higher rates of WLST compared to those who were never delirious (HR 18.8 [95% CI 2.5-142.1]; HR 16.7 [95% CI 2.1-131.3], respectively), associations that were markedly stronger than those of other established predictors (age >80: HR 2.1 [95% CI 1.1-3.8]; size >30 cc: HR 3.1 [95% CI 1.6-6.1]; ICH location and intraventricular hemorrhage: not significant).

**Conclusions:** Delirium is strongly associated with WLST after ICH. However, whether this phenomenon is due to effects on clinician or surrogate decision-making remains unclear.

### **69: The predisposing and precipitating risk factors for delirium in neurosurgery: An observational cohort study of 949 patients**

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**Objective:** To identify predisposing and precipitating factors for delirium in patients hospitalized in neurosurgery.

**Methods:** In total, 949 neurosurgical patients, 307 with and 642 without delirium, were included. Demographic factors, neurosurgery-related, neurological and medical clusters were tested as predictors of delirium in multiple logistic regression analyses.

**Results:** The incidence of delirium in this cohort of neurosurgical patients was 32.4%. Compared to patients without delirium, those with delirium were significantly older, more cognitively and neurologically impaired, transferred from hospitals and nursing homes, admitted as emergencies, longer hospitalized (16.2 vs. 9.5 days), in greater need of intensive care management and more frequently transferred to rehabilitation. Predisposing factors of delirium were stroke (OR 5.45, CI 2.12-14.0,  $p < 0.001$ ), cardiac insufficiency (OR 4.59, CI 1.09-19.26,  $p = 0.038$ ), cerebral neoplasm (OR 1.53, CI 0.92-2.54,  $p = 0.019$ ), and age  $\geq 65$  years (OR 1.47, CI 1.03-2.09,  $p = 0.030$ ). Precipitating factors of delirium were acute cerebral injury (OR 3.91, CI 2.24-6.83,  $p < 0.001$ ), hydrocephalus (OR 3.10, CI 1.98-4.87,  $p < 0.001$ ), intracranial haemorrhage (OR 1.90, CI 1.23-2.94,  $p = 0.004$ ), previous neurosurgical interventions (OR 1.64, CI 1.15-2.34,  $p = 0.007$ ), intensive care management (OR 1.95, CI 1.13-3.38,  $p = 0.013$ ), and requirement of ventilation (OR 1.95, CI 1.15-3.34,  $p = 0.015$ ).

**Conclusions:** Delirium in acute neurosurgical patients was associated with longer hospitalization. Whereas common etiologies of delirium like infections and dementia, did not predict delirium, pre-existing neurovascular and traumatic diseases, as well as surgery-related events seem important risk factors contributing to delirium in neurosurgery.

## **71: Improving caregiver education about delirium**

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**Objective:** In the prevention and treatment of delirium, patient caregivers play a crucial role. However, many caregivers do not know what delirium is and are unfamiliar with delirium precaution measures. Because health literacy and caregiver engagement influence patient care, we aimed to engage caregivers and improve their awareness of delirium risk and prevention using an educational handout about delirium in the surgical ICU.

**Methods:** Our plan-do-study-act (PDSA) cycle included 20 surgical ICU patient caregivers (family member/friend). We administered a pre-survey and provided an educational handout about delirium, and later returned to administer a post-survey. Process measures included how helpful the participants found the pamphlet (measured by a Likert-type question). Outcome measures included caregiver comfort and knowledge regarding delirium (measured by Likert-type scale questions). Balance measures included time taken to complete the intervention.

**Results:** At baseline, the average comfort score was 4.48 (89.6%, when adjusted for a denominator of 5), the average gap between the measured comfort score to a perfect score of 5 was 0.52 (10.4%, denominator of 5), and the average knowledge score was 5.10 (42.5%, denominator of 12). Post-intervention, the average comfort score was 4.74 (94.8%), a 6.5% relative increase from baseline. The average change in comfort score per individual was 0.29 (5.8%). The average gap between the measured comfort score to a perfect score of 5 was 0.26 (5.2%), a 50% relative decrease from baseline. The average knowledge score was 9.12 (76.0%), an 80.8% relative increase from baseline. The average change in knowledge score per individual was 4.12 (34.3%). The average time to complete each intervention was 1.25 hours.

**Conclusions:** Caregiver education about delirium improves caregiver's comfort and knowledge regarding delirium. Health literacy and education influence patient outcomes, and engaging caregivers through education can address disparities in health education, creating a more equitable environment of shared knowledge.

## **72: Effectiveness of occupational therapy (OT) services as a non-pharmacologic, multicomponent intervention in the prevention and treatment of delirium in hospitalized patients.**

Emma Monaghan, Christine Feeley, Gary Blanchard  
Saint Vincent Hospital, Worcester, MA, USA

**Objective:** To assess for a reduction of typical and atypical antipsychotic usage, through the use of cognitively and sensory stimulating activities in patients who have or are at high risk of developing acute delirium

**Methods:** Retrospective cohort study with a sample size of 247 patients in an acute care hospital (154 new onset delirium, 93 with baseline cognitive deficits) who received OT services for a delirium evaluation. Prior to starting the project, a hospital-wide, multidisciplinary education on delirium was initiated. Pertinent staff were educated on how to order an OT delirium prevention consult and the importance of following through with recommendations. OTs now perform rapid assessments on patients with delirium and those at risk to aid in delirium prevention. Chosen interventions include cognitively

stimulating activities and/or sensory based approaches. Examples include word puzzles, reminiscence books, weighted blankets and fidget items. OTs complete a 'Head of Bed' form during the evaluation which aims to promote communication between all staff. Communication is also made to the family and/or living facility to determine prior level of function. Pertinent information is added to the form to standardized care.

**Results:** Preliminary data shows a trending reduction in the use of antipsychotics and restraints in patients who have had an OT delirium assessment. Individualized interventions were more effective in patients who had hyperactive delirium rather than the hypoactive form. We also noticed that the development of delirium in the 'at risk' patient was lowered when an OT consult was completed and interventions were put in place.

**Conclusions:** Data is promising for the use of OT delirium consults to prevent and/or lessen the need for medications/restraints and the adverse long term effects of delirium. Further study, robust data abstraction, and data analysis is currently being planned.

### **73: Infant Delirium: Validation of a Bedside Tool and Meeting Challenges in Diagnosis**

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**Objective:** Delirium in critically ill children is associated with worse outcomes including longer length of stay, higher costs, and mortality. The epidemiology of delirium among young infants has not been delineated as early neurobehavioral development may complicate routine screening. The objectives of this study are to validate the Preschool Confusion Assessment Method for the Intensive Care Unit (psCAM-ICU) in neonates and young infants, 2) determine the prevalence of ICU-delirium, and 3) the frequency of motoric delirium subtypes in this population.

**Methods:** This was a prospective study of patients aged less than 6-months in a tertiary pediatric ICU, independently assessed daily for delirium by the research team (psCAM-ICU) and the psychiatry team, less than 30 minutes apart. The key psCAM-ICU assessments of arousal and attention were developmentally appropriate for neonates and infants. The reference standard designated motoric subtypes including: hyperactive, hypoactive, or mixed, based on the pattern of observed behaviors. We determined specificity, sensitivity, negative predictive value (NPV), and positive predictive value (PPV) using clustered bootstrapping given multiple delirium assessments on individual patients.

**Results:** A total of 198 paired delirium assessments were completed among 49 patients with a median age of 1.8 months (IQR 0.7, 4). Delirium prevalence was 41% with rates of 61% in neonates (< 30 days) and 35% in young infants (1-6 months). Compared with the reference standard, the psCAM-ICU performed with a sensitivity of 95% (95%CI 89, 100), specificity of 81% (68, 90), NPV of 97% (94, 100) and PPV of 69% (55, 79). The hypoactive subtype was common (55%), versus the mixed (36%) and hyperactive (9%) subtypes.

**Conclusions:** ICU-delirium is prevalent among neonates and young infants, with the hypoactive subtype the most widespread. The psCAM-ICU was valid in assessing for delirium in this fragile population, promoting further study of potential risk factors and related outcomes.

## 74: Enhancing the Detection of Delirium by Nurses in Acute Care

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**Objective:** Delirium is an acute brain failure commonly experienced by hospitalized patients with serious consequences when it is not recognized and treated. Little is known about why difficulties occur or what can be done improve delirium detection. The study objective was to increase our understanding of how experienced nurses use clinical reasoning to detect, diagnose, and respond to delirium symptoms and identify improvement opportunities.

**Methods:** Ten focus groups were conducted with experienced staff nurses at three diverse medical centers in the Midwest. Sessions were audio-recorded, transcribed, reviewed, and coded using NVIVO-12 software. Dimensional analysis was used to identify concepts, conditions, and processes.

**Results:** Participants (N=39) ranged in age from 18-65 (59% <40 yrs), were female (97%), Caucasian (87%) and worked on medical (42%), surgical (31%), and intensive care (28%) units. Most were BSN-prepared or higher (81%), certified (28%), worked 12-hour shifts (51%), and managed delirium more than 1-2 times per week (84%). Nurses describe having knowledge to identify and manage delirium, prioritizing care to maintain patient safety. Nurses use a variety of nonpharmacological strategies to address changes in patient status. The nurses described that the diagnosis of delirium is not necessary to manage symptoms and behaviors. Nurses reported negative consequences to discussing or making a diagnosis of delirium. Both the clinical and social aspects of the nurse's approach are related to the nature of delirium and their experience with delirium, the environment, the family, and interprofessional communication. Navigating both the clinical and social aspects of delirium is essential for successful management.

**Conclusions:** Nurses use clinical reasoning processes to manage delirium symptoms. These processes and their subsequent actions are influenced by social factors. The nurse work within social structures that impact their thinking and actions. A larger study examining social factors that influence staff nurse clinical reasoning regarding delirium is recommended.

## 75: Enhancing Delirium Detection Through Improved APRN-RN Communication

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**Objective:** Delirium is a type of an acute brain failure, characterized by an acute change in cognition and consciousness resulting in prolonged hospitalization, increased health care costs, cognitive impairment and functional decline. Despite its importance, health care professionals often fail to recognize delirium. A recent qualitative study involving registered nurses (RNs) found that hospital-based Advanced Practice Registered Nurses (APRNs) were described as instrumental to delirium identification and management. The purpose of this study was to further understand the detection and management of delirium in the inpatient setting by exploring the clinical reasoning processes and interprofessional communication between RNs and APRNs.

**Methods:** APRNs working in an inpatient setting in a tertiary or quaternary hospital were recruited. A semi-structured interview format with one facilitator and one observer was followed. All focus groups

were audio-recorded and transcribed verbatim. Focus group transcripts were analyzed to identify an emergent framework. NVivo facilitated coding and data management.

**Results:** Nine APRNs with an average of eight years of experience were interviewed. The APRNs described a process of ‘diagnosis by exclusion’. Underlying acute diseases processes were ruled out before and after making a diagnosis of delirium. Communication between the RN and APRN was described as verbal, lacked a standardized reporting format and was enhanced by the APRN’s understanding of RN practice. The APRNs' recommendations to improve RN recognition of delirium included the integration of an at-risk screening tool into the nursing workflow, documentation in the EHR, education, and organizational support.

**Conclusions:** This study highlighted the unique interprofessional relationship between APRNs and RNs and its influence on delirium detection in the inpatient setting. APRNs bring knowledge and experience to the detection and management of delirium. Future investigations need to determine how to foster these relationships across the interprofessional team to improve delirium detection and management.

## **76: National Trends in Delirium Prevalence in Hospitalized Older Adults with Heart Failure in the United States (1998-2014).**

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**Objective:** Delirium is common (17% - 38%) in older adults with heart failure (HF). The rate of delirium associated with HF may have reduced over the past few years as a result of improvement in quality of care. However, delirium is often under recognized and extensive efforts to improve delirium diagnosis are expected to increase documentation of delirium. This study was performed to investigate the prevalence of delirium over 16 years’ study period in older adults with HF.

**Methods:** This study was conducted using the National Inpatient Sample (NIS) which is a representative sample of 20% of the national hospitalizations. ICD 9 diagnostic codes were used to identify HF and delirium.

**Results:** A total of 1,820,818 patients with a diagnosis of HF and age > 64 years were identified from 1998 to 2014. Overall, 61% were white, 56 % female, mean age was 75 years and mortality 5%. Delirium was identified in 28,987 (1.6%) patients. Delirium rate was 1.8% in 1998 and 1.6% in 2014. Patients with delirium when compared with those without delirium were older (mean age 81.6 years vs. 79 years); with longer length of stay (7.1 vs. 5.3 days) and higher mortality (13% vs 4.8%). Variables associated with delirium in multivariate analysis included female sex (OR=0.87; 95% CI 0.848-0.889), black race (OR 0.73;95% CI 0.69-0.78), Hispanic ethnicity (OR 0.79; 95% CI 0.75-0.84), white race (OR 0.96; 95% CI 0.94-0.99), in-patient mortality (OR 2.6; 95% CI 2.5-2.7), age (OR 1.04; 95% CI 1.04-1.04), length of stay (OR 1.015; 95% CI 1.014-1.016).

**Conclusions:** The overall prevalence of delirium was much lower than expected and declined over the 16 year time. Most importantly those with delirium had 2.6 times higher risk of inpatient mortality as compared to those who did not have delirium.

## **77: Impact of Delirium Education on a Post-Surgical Unit**

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**Objective:** This quality improvement project aimed to evaluate the effect of the education program on nurses'™ knowledge of delirium management and prevention

**Methods:** A quasi-experiment with pre-test and post-test design was used to evaluate the effect of the intervention. A convenience sample of 65 nurses who work on two medical-surgical units at a large urban hospital participated in this study. Thirty-one participants worked on the control unit while 34 participants were from the intervention unit. The intervention group received a 30-minutes education session while the control group continued the routine care

**Results:** At baseline, both groups had some knowledge of delirium, but the difference was not statically significant. After the education program, the intervention group's mean score was statistically significant ( $p < 0.00$ ) and continued to retain the knowledge 3 months post-intervention ( $p < 0.038$ ). Multiple linear regression was used to analyze confounding variables including NICHE training, education level, and years of nursing experience, which showed NICHE training was the only variable that was statically significant ( $p < 0.23$ ). As for the qualitative finding, three themes were identified including understand the risk factors, use non-pharmacological prevention and treatment strategies, and advocate for patients. Overall, the nurses felt that this program has improved their skills in identifying early signs and symptoms of delirium, risk factors associated with delirium, and apply multicomponent intervention strategies.

**Conclusions:** The finding supported the use of delirium education as a mean to improve nurses' knowledge of delirium prevention and management. However, continued education is essential to help nurses stay abreast with the information. Further investigation is needed to correlate of such program with clinical practice outcomes such as delirium incidence, hospital length of stay, and hospital-acquired complications

## **78: Incidence rates of CNS drug-induced delirium: Results of AMSP -a drug surveillance program between 1993 and 2016**

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**Objective:** Successful treatment of patients suffering from delirium depends on identifying the reversible factors which contribute to delirium. Still, drugs are the most prevalent reversible cause of delirium

**Methods:** This observational study is based on data of AMSP (Arzneimittelsicherheit in der Psychiatrie), a multicenter drug surveillance program in Austria, Germany and Switzerland recording severe drug reactions (ADR) in psychiatric inpatients. Information on severe ADRs is collected from clinicians on a regular basis and evaluated by psychiatrists as drug monitors who use a standardized questionnaire to document cases. Furthermore, the number of prescriptions of each substance was annualized by systematic sample. The present study focusses on psychotropic drug-induced delirium.

**Results:** During the observation period from 1993 to 2016, 462.661 psychiatric inpatients monitored in the AMSP program at 80 hospitals were treated with psychopharmacological drugs. 279 cases (=0.08% of all patients treated with CNS drugs) of drug-induced delirium were detected. Imputed in combination and alone (in 66% of all cases a combination of drugs was responsible for delirium), maprotiline (10 times imputed in 3139 prescriptions of maprotiline; incidence rate=0.32%), clomipramine (15 times imputed in 6174 patients; 0.24%) and amitriptyline (29 times imputed in 14.089 prescriptions; 0.21%) showed highest incidence rates. When imputed alone (94 cases overall and 13 of them caused by tricyclic ADs), clozapine (41 times imputed in 38.349 prescriptions; 0.11%), followed by maprotiline (3 times imputed alone; 0.096%) and amitriptyline (7 times; 0.05%) were likely to be responsible for the occurrence of delirium.

**Conclusions:** Tricyclic antidepressants and clozapine are predominantly involved in the incidence of delirium within this large naturalistic sample. These psychotropics have anticholinergic and antihistaminergic properties. Inhibition of the histamine H1 receptor explains sedative actions and interacts with the orexin- as well as with the noradrenergic system, all lately discussed as being possibly engaged in the general pathophysiology of delirium.

## 79: Neuroimaging in delirium

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**Objective:** To review and analyze the available literature on neuroimaging modalities utilized in delirium.

**Methods:** Searches were conducted in PubMed, the Cochrane Library, ScienceDirect, ClinicalKey, and Embase. Only the following types of studies were included: controlled clinical trials, observation studies, systematic reviews, meta-analyses, and clinical reviews and guidelines.

**Results:** A small, yet growing number of studies have implemented structural and functional neuroimaging modalities for the purposes of studying delirium. MRI, CT, and diffusion tensor imaging have demonstrated findings such as ventricular atrophy, increased white matter hyperintensities, loss of white matter integrity in regions including the corpus callosum, fronto-thalamic, cerebellar and limbic systems, and their associations with an increased risk and prolonged duration of delirium. Transcranial Doppler, near infrared spectroscopy, functional-MRI, single photon emission computed tomography, proton MRI spectroscopy, and FDG positron emission tomography have discovered a number of functional outcomes including reduced cerebral blood flow, abnormal dorsal prefrontal and subcortical activity, and decreased overall metabolism pre and post delirium.

**Conclusions:** Although the current literature shows only a modicum of neuroimaging applications, the findings thus far have proven to be promising in terms of offering advancements in understanding the pathophysiology of delirium. Structural imaging has offered insights into the relationship between burden of atrophy and white matter dysregulations and the severity and risk of delirium. Functional neuroimaging outcomes have highlighted cerebrovascular and microvascular abnormalities not previously observed pre and post delirium. In particular, lower preoperative cerebral oxygenation saturations and cortical blood flow reductions were associated with increased rates of post-operative delirium. The implications of this being the potential for modern imaging techniques to be used as predictive and monitoring tools in patients. Future directions may include using neuroimaging to identify quantitative and objective risk factors, utilizing other techniques (eg, voxel based morphometry, optical imaging, other MRI modalities), and new studies with larger sample sizes.

## **80: Delirium incidence at a large academic hospital**

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**Objective:** Delirium screening using the bCAM was initiated across all adult patients admitted to our large academic hospital as part of a quality improvement project. Prior to this project it had validated delirium screening had only been done in the ICU setting. The impact of delirium on our hospital was unknown. Implementing the use of a validated screening tool in the non-ICU setting and documenting the results in the medical record allowed for a more detailed analysis of incidence and impact of delirium. Retrospective analysis of all admitted patients was then completed.

**Methods:** Nursing administered bCAM screening was initiated on the first non-ICU unit in January 2017. Additional units were systematically added over the next 18 months. Results were documented in our medical record. Patient encounter data, including results of bCAM were obtained from the medical record. Additional information included patient demographics, medications and diagnosis.

**Results:** There were 36,700 patients admitted to units after screening had been introduced. 6,998 (19.1%) of the patients screened positive by bCAM. Additional analysis is ongoing.

**Conclusions:** Nearly 1 in 5 patients admitted to our hospital screened positive for delirium. The high incidence rate of delirium reinforces the importance of systematic screening in the non-ICU setting and should be considered standard of care.

## **81: A Classification Conundrum: Delirious Mania**

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**Objective:** Delirious mania is a condition where the patient shows disturbances in attention, awareness, and cognition that is consistent with delirium along with mania and psychosis, often without any evidence of acute medical processes. It is a serious condition with a reported 75% mortality in the first cohort investigated by Bell in 1849. Due to its relatively low frequency of occurrence, there exists few case reports describing the phenomena and there continues to be no formal diagnostic criteria or treatment guidelines. This case series aims to identify cases befitting the diagnosis of delirious mania by clinical presentation as described in the literature in efforts to highlight both the diversity and the similarity of patients considered to exhibit an episode of delirious mania.

**Methods:** Systematic literature review and case series.

**Results:** Four cases identified at a single center were female patients with a known history of psychiatric illness. The ages of the four women ranged from 23 to 63. The inpatient hospitalization course was typically long, lasting at least a month except for a 23 year old patient who was identified early in the course of illness and rapidly improved on high dose benzodiazepines and risperidone.

**Conclusions:** Much like previous case reports, these cases help to illustrate the overlap of the symptoms of manic delirium with mania, catatonia, and delirium. A case series by Karmacharya et al. in 2007 found that patients with delirious mania tended to be younger, female, and had a prior diagnosis of bipolar

disorder. The cases described here were all female and had history of bipolar or schizoaffective disorder but were in an older age range. The cases reiterate the need for formal diagnostic criteria to aid in the early diagnosis of this condition. They also highlight the variability in demographics in patients diagnosed with delirious mania.

## **82: Electronic Medical Record (EHR), Can It Help Hard of Hearing (HOH) Elderly Patients?**

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**Objective:** To determine if enhancing the EHR would improve documentation and implementation of interventions among patients with hearing-impairment. This project was chosen due to the established relationship between hearing impairment and increased risk of delirium in elderly patients during hospitalization.

**Methods:** The study sample included 393 hospitalized adults aged 65 and older that were enrolled in the Hospital Elder Life Program (HELP) during 2-months (January/February) for 3 years (2017, 2018 and 2019). The EHR was revised in 2018 to include assistive devices as a prompt in the nursing flowsheet to appear if the hearing assessment screening was positive. Staff registered nurses were educated on the new updates and the process of offering a device if a patient did not have one available at the time of admission. The Joint Commission's Disease Specific Care certification in conjunction with Plan-Do-Study-Act methodology were the frameworks adopted. A system generated report identified patients who were documented as hard of hearing. A manual chart review was conducted to validate the report.

**Results:** In the 125 patients identified as HOH pre-intervention, only 24 (19.2%) received an assistive device, while in the 268 patients identified as HOH post-intervention, 190 (70.9%) received an assistive device, 117 (66.1%) in 2018 and 73 patients (80.2%) in 2019. A chi-square test of independence was calculated comparing the frequency of patients in the pre- and post-groups who were diagnosed as HOH that received intervention. A statistically significant relationship was found ( $\chi^2(1) = 91.85, p = .000$ ).

**Conclusions:** Our results suggest that EHR optimization and education can significantly improve compliance with assessment of hearing impairment and use of assistive devices for hospitalized HOH geriatric patients, an important risk factor for delirium. Future studies are needed to look at the relationship between this intervention and delirium prevention in hospitalized high risk elderly.

## **84: The Stanford Proxy Test for Delirium (S-PTD), An Innovative Delirium Screening Tool: A Large Multicenter Validation Study**

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**Objective:** Delirium is a significant psychiatric disorder secondary to significant organic disease in many hospitalized patients. The S-PTD is a nurse administered screening tool developed to address the deficiencies in current delirium screening tools and has advantages such as evaluating a patient in multiple time points, not requiring patient interaction, and being more comprehensive.

**Methods:** Methods: Using data from two previous validation studies of the S-PTD in two different medical centers (Stanford University Hospital and King Khalid University Hospital), we compared the

diagnostic sensitivity and specificity of the S-PTD with a complete neuropsychiatric assessment based on DSM-5. Both studies were performed similarly, all patients admitted to the selected clinical units were approached for recruitment and were independently screened using the S-PTD and evaluated by a psychiatrist for the presence of delirium.

**Results:** Results: A total of 194 patients from Stanford University Hospital and 282 patients from King Khalid University Hospital were included in the combined analysis of 476 patients. The follow-up resulted in a total of 167 days of delirium and 535 non-delirious days. Demographic data analysis showed that delirious patients were on average older than the non-delirious patients. The S-PTD had a sensitivity of 78% and a specificity of 93%.

**Conclusions:** Conclusion: This large multicenter validation study demonstrates that the S-PTD is superior to current delirium screening tools. Its ease of use and comprehensiveness will allow a significant improvement in delirium screening if adapted to current hospital practice.

Discussion: When compared to other delirium screening tools in real world conditions, the S-PTD has superior performance. Additionally, the S-PTD can be performed faster, on a wider range of patients, and do not require patient cooperation. We believe that adaption of this tool into electronic health system for daily performance will make delirium screening easier and more effective.

## **85: CLINICAL UTILITY OF CONSTANT OBSERVATION (ONE-TO-ONE SPECIAL) IN THE MANAGEMENT OF DELIRIUM**

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**Objective:** To evaluate at the level of the following outcomes:

Primary outcome

- The overall incidence of inpatient falls

Secondary outcome

- Delirium related outcomes: average duration of delirium, antipsychotic requirement, rate of institutionalization, admission to rehabilitation

- In-hospital adverse events: hospital acquired infection, pressure injury, malnutrition

-Average length of acute hospital stay

**Methods:** The study is a retrospective cohort observational study on 191 patients with delirium at a teaching hospital in Melbourne, Australia. The diagnosis of delirium was identified by ICD-10 coding data and validated by the investigators using DSM-5 criteria. The inclusion criteria were age 65 and older, admission to acute medical and surgical wards. The exclusion criteria were younger patients, palliative, geriatrics, and subacute patients. The baseline characteristics, outcomes of patients were compared between constant observation and non- constant observation groups. Both groups received standard delirium multicomponent care and falls prevention.

**Results:** There were 59 (N) patients in CPO group and 132 (N) in non-CPO. There was no significant difference in baseline demographic characteristics in two groups. The study did not find the associated reduction in the overall incidence of falls in the constant observation group even after adjusting the baseline falls risk factors (OR 1.3, 95% CI 0.58-3, p value 0.46). Furthermore, one-to-one special was not associated with improvement in secondary outcomes. The most common indication for CO was agitation (37%) followed by aggressive behaviour (19%) and the average duration of CO was 32.1 hours.

**Conclusions:** Constant observation has been the widely accepted non-pharmacological intervention alternative to restraint in the management of delirium patients with challenging and complex behaviour. However, the level of evidence is currently "expert opinion" for this recommendation and there has been a lack of robust data on its effectiveness. Our study demonstrated that one-to-one special was not associated with improved outcomes at the single centre setting.

### **86: Investigating the relationships among pain, opioids and next-day delirium status in older adults in the surgical intensive care unit**

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**Objective:** Analgesics are commonly administered medications to patients in the surgical intensive care unit (SICU). Both untreated pain and pain management with opioids are precipitating factors for the development of delirium. This retrospective analysis evaluated the relationships among pain severity, its management with opioids, and the onset of next-day delirium in older adult patients admitted to the SICU.

**Methods:** A convenience sample of consecutive patients aged 65 years or greater admitted to the SICU over a 5-month period were examined (n = 172). All variables were extracted from the electronic health record for analysis. Delirium was defined as one positive CAM-ICU screening in a 24-hour period calculated beginning at the time of ICU admission up to 7 days. Pain scores, using 10-point numeric rating scale, were averaged for each 24-hour period. Opioid exposure was defined as any one instance of opioid administration (any type or route) during a 24-hour period. Pain severity and opioid exposure were assessed as predictors of next-day delirium status using generalized estimating equation models.

**Results:** The final sample was comprised 56 patients who experienced delirium and 116 who did not. Opioids ( $I^2$ , 12.60,  $P = .0004$ ), but not pain ( $I^2$ , 3.61,  $P = .0573$ ) were significant in predicting next-day delirium status. When controlling for pain severity, patients exposed to opioids exhibited odds of next-day delirium that were 2.5 times those of patients not exposed to opioids (95% Confidence Interval: 0.371 - 1.485). The predictive strength of opioids in predicting next-day delirium remained when adjusted for pain severity, propofol exposure, mechanical ventilation and RASS score.

**Conclusions:** Examination of the relative roles of pain and opioid administration on the development of delirium experienced by this population provides evidence that opioid exposure may predict the onset of next-day delirium. Future research should focus on both pharmacological and non-pharmacological opioid-sparing pain management strategies.

### **87: Translation and cultural adaptation process to Spanish of the Preschool Confusion Assessment Method for the Intensive Care Unit (psCAM-ICU)**

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**Objective:** The objective is to describe the translation and cultural adaptation process of the original English psCAM-ICU into Spanish, following the Principles of Good Practice (PGP) for the Translation and Cultural Adaptation Process for Patient-Reported Outcomes Measures.

**Methods:** The translation and cultural adaptation process of the psCAM-ICU was developed according to 10 fundamental steps suggested by the PGP. including preparation, forward-translation, reconciliation, back-translation, back-translation review, harmonization, cognitive debriefing, review debriefing results, proofreading, and final report.

**Results:** The psCAM-ICU was successfully translated and adapted into Spanish through a structured process and collaborative work.

**Conclusions:** Spanish-speaking clinicians in the PICU setting now have access to a Spanish-version to enhance the early detection of delirium among infants and preschool-aged children in the PICU

### **88: Diagnostic accuracy of the 4AT for delirium detection: a systematic review and meta-analysis**

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**Objective:** Assessing older adults presenting at the acute hospital for delirium is recommended in national and international guidelines. The 4AT ([www.the4AT.com](http://www.the4AT.com)) is a short (<2 min) and practical instrument for delirium detection which is widely implemented in clinical care internationally. It does not require specific training. Primary objective: systematic review and meta-analysis of diagnostic test accuracy of the 4AT for detecting delirium in older patients in acute settings.

**Methods:** MEDLINE, EMBASE, PsycINFO, PsycARTICLES, CINAHL, and Scopus databases were searched from 2011 (year of 4AT release) until 2017. Inclusion criteria were: older adults (mean/median age ≥65y) across settings of care except for critical care; and validation study of the 4AT against delirium reference standard (DSM diagnostic criteria or Confusion Assessment Method). Screening and data extraction were conducted independently by two reviewers. Methodological quality was assessed using the Quality Assessment of Diagnostic Accuracy Studies-2 tool. Pooled estimates of sensitivity and specificity were generated from a bivariate random effects model.

**Results:** Ten studies (n = 2265) were included. Prevalence of delirium across studies was 28% (N delirium=643, prevalence range: 11%-62%). A 4AT score of 4 had a pooled sensitivity for detecting delirium of 0.87 (95% CI 0.77 to 0.93) and pooled specificity of 0.83 (95% CI 0.73 to 0.89). The Area Under the Receiver Operating Characteristic Curve was 0.91 (95% CI 0.89 to 0.94). The methodological quality of studies was moderate to good overall.

**Conclusions:** The 4AT shows good diagnostic test accuracy for delirium in the 10 available studies. These validation data support its use in routine clinical practice in delirium detection.

## **89: Detection of early-stage Alzheimer's pathology using blood-based autoantibody biomarkers in elderly hip fracture repair patients**

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**Objective:** Post-operative delirium (POD) is the most common complication following major surgery in non-demented older (>65 y/o) patients. Patients experiencing POD show increased risk for cognitive decline, including mild cognitive impairment (MCI) and Alzheimer's disease (AD) and, conversely, patients with cognitive decline at surgery show increased risk for POD. Here, we demonstrate that a previously established panel of MCI-specific autoantibody (aAB) biomarkers can be used as a blood test to detect prodromal AD presurgically in individuals admitted into the hospital for hip fracture repair (HFR) surgery.

**Methods:** Plasma from 44 STRIDE (STRIDE: A Strategy to Reduce the Incidence of Postoperative Delirium in Elderly Patients) HFR patients and sera from 25 age- and gender-matched non-demented and non-surgical controls were screened using human protein microarrays to measure expression of a panel of 44 MCI-specific aAB biomarkers. The predictive classification accuracy of the aAB biomarker panel was evaluated using Random Forest (RF).

**Results:** MCI aAB biomarkers successfully distinguished 21 STRIDE HFR patients (CDR=0.5) from 25 matched non-surgical controls with an overall accuracy of 91.3% (sensitivity= 95.2%; specificity=88.0%). The MCI aAB panel also correctly identified six patients with preoperative CDR=0 at surgery, but who later converted to CDR=0.5 or >1 at one-year follow-up as positive for MCI aAB biomarkers using presurgical blood samples. Lastly, the majority of cognitively normal (CDR=0) STRIDE HFR subjects that were positive for CSF AD biomarkers based on the A/T/N classification system were likewise classified as MCI aAB-positive using the biomarker panel.

**Conclusions:** Results suggest that presurgical detection of MCI aAB biomarkers can readily identify HFR patients with early-stage AD pathology using presurgical blood samples, opening up the potential for early, blood-based AD detection and improvements in peri- and postoperative patient management. Further work is underway to determine the relationship between the detection of MCI aAB biomarkers and postoperative delirium.

## **90. Pre-Hospital Leisure Activity is Associated with Reduced Delirium Incidence during Early Hospitalization: A Prospective Cohort Study**

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**Objective:** In hospitalized older adults, delirium is highly prevalent and associated with increased length of stay, cognitive decline, and even mortality. Cognitive reserve (CR), defined as differences in cognitive processing related to lifetime physical, intellectual and social activities, is increasingly being studied as a predisposing factor in the development of delirium but the relationship between CR and delirium remains under-explored in elderly adults. We aim to estimate the association between CR, as captured by pre-hospital leisure activity participation and delirium incidence in hospitalized older adults.

**Methods:** A prospective single center cohort of 254 adults age  $\geq 65$  admitted to the inpatient ward from the ED was identified and interviewed for self-reported physical and cognitive leisure activities. We excluded activities done by  $< 5\%$  of our sample and formulated a cognitive activity scale (CAS) and physical active scale (PAS) with one point corresponding to participating in one activity one day per week. Patients were then assessed for delirium daily with CAM-ICU for three consecutive days.

**Results:** Among 254 patients (aged  $78 \pm 8$ ), 37 (15%) developed delirium. PAS ranged from 0 to 42 with a median of 9, driven mostly by housework. CAS ranged from 0 to 51 with a median of 14, driven mostly by watching television. For both physical and cognitive domains, every 5 activity points per week reduced odds of delirium by almost 50% (OR CAS 0.55, 95%CI 0.41-0.75,  $p < 0.001$ ; OR PAS 0.48, 95%CI 0.34-0.66,  $p < 0.001$ ). This association was maintained after adjusting for clinically relevant covariates (OR CAS 0.65, 95%CI 0.47-0.92,  $p = 0.01$ ; OR PAS 0.57, 95%CI 0.40-0.83,  $p = 0.003$ ).

**Conclusions:** CR assessed by participation in pre-hospital leisure activity (both cognitive and physical activities) was significantly associated with lower incidence of delirium in older hospitalized patients. Interventions to enhance CR by participation in leisure activities may be a beneficial strategy to reduce delirium