Poster # 1 **Poster Session: 13:30 - 15:00**

Title: Signs and Symptoms of Opiate/Methadone Overdose: Deadly Treatment Needed!
Presenter: Donna Collins, Crystal Clear Transitional Care Inc., Education, Quality Improvement, Patient Safety, Symptom Translation, Saint John, New Brunswick, Canada.

Introduction: There is an alarming rise in opiate-related deaths in Ontario (Kahan, Wilson, Milias-Gagnon, & Srivastava, 2011) and the United States (Fingerhut, 2008). In 2011 Canadian physicians set forth to try to reduce the number of deaths, first by establishing Canadian guidelines for the safe and effective use of opioids for chronic noncancer pain (Kahan et al.). Unfortunately these Canadian guidelines appear to have failed drastically. Trends in high-dose opioids has increased. In a recent article published by Gomes et al. (2014), there are staggering upward trends in opioid prescribing in Canada with pockets in Alberta, Ontario and Newfoundland & Labrador. Getting an accurate number of deaths is difficult owing to identification of opiate overdose versus another diagnosis.

Objectives: The objective is two-fold. First, to raise awareness of the alarming increase in opioid prescribing so that healthcare providers can react in a timely manner to the potential of opiate overdose. Second, by extension of this education, to raise ALARM of the need for education to stop premature and preventable opioid overdose through education of the general public, to healthcare professionals, and to prescribers of opiates. Opiate overdose is taking people's breath away. Treatment is simple and highly preventable. Putting stop-gap measures into place to quickly identify the signs and symptoms of opiate overdose, its treatment and necessary course of action is ABSOLUTELY needed.

Methods: Through peer death review methodology, interviews with patient's families who have died from opiate overdose, clinical research, and literature reviews, it is apparent that there are several gaps that need to be filled as initial steps towards reducing premature death from opiate overdose. The documents reviewed include: The Canadian Diabetes Association (2013) guidelines for the management of diabetes. The College of Physicians & Surgeons of New Brunswick's Opioid Manager (2011); The Canadian Nurses Association Drug Information: Naloxone; The Registered Nurses Association of Ontario's Methadone (2009) methadone guidelines; The College of Physicians & Surgeons of Alberta's (2014) methadone guidelines; The College of Physicians & Surgeons of Nova Scotia's (2014) methadone guidelines; Audit of Canadian First/Aid CPR Course; Advanced Cardiac Life Support Algorithm review; Four patient chart reviews: CODE BLUE - opiate overdose; The Government of New Brunswick's (2009) methadone policy and procedures; The Dakota Rose Linfield Youtube Video Anthony Linfield Court Brief Jeffrey Hood (2007) Coroner's Inquest

Results: After reviewing the literature, it is clearly apparent that there are SIGNIFICANT gaps in articulating the signs and symptoms of opiate/methadone overdose. There are myths that people take too much medication (i.e. intentional overdose) when in fact opiate overdose is a side effect of the medication. Further opiate overdose may be a result of drug-drug interactions, dehydration, respiratory illness, etc. It is clear that many people die in their sleep. Using evidence-based research, it is clear that more can and should be done to prevent opiate overdose. Let's try a fridge magnet.

Conclusion: Opiates can cause severe respiratory depression. Recognizing that there is 'an opiate on board' prior to reading chest x-rays will help eliminate lethal drug-drug interactions with opiates. Healthcare professionals need to be able to articulate the signs and symptoms of opiate overdose and provide a fridge magnet (tool). The rationale for the tool is to compensate for people who may miss the teaching session (i.e. friends, neighbors, etc.). It is also needed because people typically believe "this won't happen to me." First responders definitely need to know what to do to treat opiate overdose. To facilitate treatment of opiate overdose in the field will be done with one-time medical alert devices (Methadone, opiate, etc.). We need to re-evaluate the Canadian CPR/First aid guidelines as they do not contemplate what to do with an unconscious victim who is not breathing but not choking (i.e. opiate overdose). To put the victim in a recovery position is the WRONG directive as opiate overdose is a severe respiratory depressant. What is needed is rescue breathing, narcan, chest compressions and transport to a Level 1 Trauma center.

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Poster # 2 **Poster Session: 13:30 - 15:00**

Title: Extubation Checklist - A call for 'Mandatory' Implementation

Presenter: Donna Collins, Crystal Clear Transitional Care Inc., Quality Risk Management, Critical Care Education, Saint John, New Brunswick, Canada.

Introduction: There are a large number of extubation failures that could be prevented. According to leading American authors, an extubation checklist is required to improve extubation success (Cavallone, & Vannucci 2013; Howie & Dowie, 2012; Tobin, 2006). With this many deaths, it is critical that we improve patient outcomes by perhaps using a different system (i.e. checklist) to improve patient outcomes and to pull people back from the brink of death.

Objectives: The objective of the research is to identify gaps in clinical practice so as to improve patient outcomes pertaining to extubation failure (i.e. reduce preventable premature death) in intensive care units. Improvement in patient outcomes and ensuring that clinicians have done all that we can to improve patient outcomes will lead to increased confidence in healthcare delivery. It may also reduce litigation and contribute to the sustainability of the Canadian healthcare system.

Methods: Using a clinical case review coupled with evaluation of current research in the field of extubation (Tobin, 2006), gaps in clinical service were identified. While Hutton and Dowie (2012) provide a template to assist with extubation, this is clearly not comprehensive enough and would have missed gaps identified in the clinical case reviewed.

Results: It is clear, based on the evidence that an extubation checklist needs to be implemented in critical care units as a matter of patient safety. To my knowledge, there is currently no checklist in Canada. Further the mandatory checklist implemented by Hutton & Dowie is clearly not comprehensive enough and would not have overlooked gaps in extubation failure. It is also clear, based on the evidence, that opiate overdose is being mismanaged in the ICU. Specifically, the signs and symptoms of opiate overdose are being overlooked. The reversible causes checklist needs to include "Opiate" and narcan as the treatment option. Further the ACLS algorithm needs to be reviewed and updated to consider 'respiratory failure' as the precursor to cardiac arrest.

Conclusion: There is a clear need for an extubation checklist to improve patient outcomes in the intensive care units in Canada. While the checklist submitted may be extensive, it begs the question: is your life worth it? This added safety tool is intended to provide a double-check list system before extubation is initiated. ICU NPs may be able to further 'tailor' the checklist to make it more user-friendly and efficient. Other tools need to be reviewed and revised to prompt and signify changes in the treatment of opiate overdose. Clinicians need to be informed of deadly drug-drug interactions and patients need to be assured that clinicians are double checking for lethal drug-to-drug interactions (i.e. www.qtdrugs.org).

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Poster # 3 **Poster Session: 13:30 - 15:00**

Title: Proposed Changes to ACLS Algorithm

Presenter: Donna Collins, Crystal Clear Transitional Care Inc., Quality Improvement, Patient Safety, Saint John, N.B., Canada.

Introduction: There is a high incidence of opiate overdose deaths in Canada and the United States. Addressing gaps in service delivery may have a profound effect on clinical outcomes and life-altering consequences for patients and their families.

Objectives: To have a significant impact on improving opiate overdose outcomes by changing the ACLS Algorithm.

Methods: Review ACLS Algorithm. Understand how opiates work (i.e. respiratory depressant). Determine what if any changes need to be made to the ACLS algorithm using clinical case studies and critical thinking.

Results: Changes should be made to the ACLS algorithm in keeping with the treatment of opiate overdose. The current Adult cardiac arrest algorithm: 2010 ACLS guidelines contemplate cardiac arrest and cardiac arrhythmias. This algorithm does not contemplate respiratory arrest secondary to opiate overdose and leaves out the life-saving medication Narcan. Further for people sustaining an opiate overdose with methadone, treatment with Amiodarone constitutes a drug-to-drug interaction which may lead to further adverse outcomes (i.e. death) by lengthening the QTc interval.

Conclusion: By changing the Adult cardiac algorithm: 2010 ACLS guidelines, perhaps we will have a positive impact which will result in life-saving results. Further research is desperately needed to determine if other opiates (i.e. fentanyl, hydromorphone, oxycodone, etc.) produce the same drug-drug interactions that prolong the QTc interval as methadone. In the few clinical cases reviewed, there is every indication that other opiates are also implicated in drug-drug interactions that prolong the QTc interval resulting in sudden cardiac death.

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Poster # 4 **Poster Session: 13:30 - 15:00**

Title: Changing Practice: Management of Delirium in Critical Care

Presenter: Alanna Cunningham, Alberta Health Services, Allied Health, Rehabilitation, Calgary, Canada.

Introduction: In Calgary's adult intensive care units (ICU) there was no standardized assessment tool for delirium screening and there is a need for implementation of standardized Delirium Prevention and Management Strategies. The incidence of delirium in critically ill adults is reported to be up to 80%. Patients who have had a delirium have increased mortality and morbidity, including physical and cognitive impairments.

Objectives: The purpose was to develop and implement a Practice Standard that facilitates the prevention, early recognition and treatment of delirium. The overall goal is to reduce the incidence and the subsequent impact it has on patients and their families. In addition, to decrease the number of critical care patients who develop delirium; decrease the number of days of delirium; mitigate the effects of delirium on long-term cognitive and physical outcomes; decrease length of stay; decrease number of days on mechanical ventilation; decrease use of sedatives and analgesics. Literature has established that a successful approach includes both pharmacological and non-pharmacological strategies: awakening and breathing trial coordination, choice of sedatives and analgesics, delirium monitoring, early mobility and exercise (ABCDE Bundle).

Methods: An interdisciplinary committee was formed to adapt the ABCDE bundle for Calgary's adult ICUs. The following approach was undertaken to implement this Practice Standard: 1. Identified current practices and practice gaps. 2. A literature review was completed of best practices within Canada and internationally. 3. Practice audits conducted pre-education and implementation. 4. The standardized assessment to identify delirium, Intensive Care Delirium Screening Checklist (ICDSC), was adapted to the local context by developing a worksheet and the ICDSC was formatted into the electronic documentation system. 5. An evidence-based guideline for the non-pharmacological strategies was developed as a tool to be used by unit nursing staff. Strategies included: bed mobility, early mobilization, exercises, environment, sensory stimulation and activities of daily living. 6. Guidelines for spontaneous awakening and breathing trials as well as a sedation and analgesia protocol were adapted for Calgary's ICUs. 7. Identified barriers to implementation through frontline staff focus groups. 8. Utilized the knowledge to action cycle to guide the education plan and a step-wise approach to implementation. 9. Practice audits conducted post-education and implementation. 10. Currently evaluating the efficacy of delirium management practices. The assessment and non-pharmacological strategies with be the focus of this presentation.

Results: This presentation will review the outcome of the focus groups and barriers to implementation. The results of the practice audits and metrics with are currently being compiled, will be presented. The direction for future evaluation to support sustainability will also be discussed.

Conclusion: Changing practice to recognize delirium as a medical emergency that requires

assessment, prevention and management strategies takes time and the ongoing efforts of an interdisciplinary team. This presentation will discuss the lessons learned regarding the strategies to facilitate education, implementation and to the barriers to changing practice. Best practice in critical care should extend beyond to survival to include thriving beyond the walls of the ICU.

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Poster # 5 **Poster Session: 13:30 - 15:00**

Title: The Impact of Using Physiotherapy Self-Referral in the Medical–Surgical Neurological Intensive Care Unit

Presenter: Lisa Muc, University Health Network, Toronto, Canada.

Introduction: Physiotherapy (PT) is an integral component of critical care treatment. Evidence in the literature supports the importance of early implementation of PT interventions, especially in the intensive-care unit (ICU), to prevent the sequelae of immobility while decreasing overall length of stay (LOS) and financial burden. Initiation of PT service in Canadian ICUs is not standardized; some units use "blanket referrals," whereby all patients automatically receive a referral for PT, while others require a written requisition from a physician. Regardless, there is little evidence in the literature outlining the benefits of one referral method over another. Historically at University Health Network (UHN), a written physician requisition is required to initiate PT services in all areas of clinical practice. However, In January 2012, a medical directive was created and implemented in the medical–surgical neurological intensive care unit (MSNICU) that permits physiotherapists to initiate self-referral to any patient within the MSNICU, providing the patient does not have any contraindications to therapy. To date, no study has evaluated the impact of using PT self-referral in critical care areas

Objectives: The purpose of our study was to gather evidence on PT referral practice for patients at Toronto Western Hospital in the MSNICU. We evaluated the impact of PT self-referral in the MSNICU, specifically measuring (1) any differences in time to access PT service, (2) time to access PT service, and (3) referral volume from before to after implementation of PT self-referral.

Methods: Charts were reviewed for MSNICU patients who received PT Pre (n = 90) and Post (n = 100) to collect data on timeliness, number of referrals, and MSNICU length of stay (LOS); t-tests were conducted to determine group differences.

Results: The mean age of MSNICU patients referred to PT was 60.6 (SD 18.6) years; 59.5% were male. PT treatment consisted of cardiorespiratory (39% Pre, 51.1% Post), mobility (22% Pre, 28.8% Post), and combined interventions (39% Pre, 20% Post). Overall, the number of days between MSNICU admission and PT initiation, and MSNICU LOS did not differ significantly from Pre to Post. However, for patients (n = 50) receiving early (within 7 days of MSNICU admission) PT self-referral Post versus physician referral only patients (n = 83) Pre, there was a significant decrease ($p = 0.01$) in time to PT initiation of 1.4 days (3.2 Pre, 1.8 Post).

Conclusion: PT self-referral increased both the number of patients receiving more timely access to PT and the provision of treatment for a deferred group of patients previously not referred. Future studies need to evaluate the impact of referral methods across a variety of clinical populations.

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Poster # 6 **Poster Session: 13:30 - 15:00**

Title: Characterization of psychotropic drug use surrounding physical restraint application in mechanically ventilated, critically ill adults.

Presenter: Melanie Guenette, Mount Sinai Hopsital, Pharmacy, Toronto, Canada.

Introduction: Chemical restraint with psychotropic medications (e.g. benzodiazepines, non-benzodiazepine sedatives i.e., propofol and ketamine, opioids, and antipsychotics) is preferred over physical restraint (PR) for the management of agitation and for prevention of interference with medical devices. However, limited data exist describing the use of such drugs preceding and during PR application for critically ill adults.

Objectives: To characterize psychotropic drug use (i.e., alterations to drug regimens) both preceding and during PR application in critically ill, mechanically ventilated adults.

Methods: Prospective single centre observational study of all patients physically restrained during invasive mechanical ventilation. Drug data were collected for three time intervals: 1) baseline, 120 to 61 minutes prior to PR application, 2) pre-PR, 60 to 0 minutes preceding PR application, and 3) post-PR, up to six hours after PR application. Types of psychotropic drug interventions (e.g. initiation, increase, decrease, and/or cessation) were recorded, as were the total time of PR use and Intensive Care Delirium Screening Checklist (ICDSC) scores.

Results: Fifty-nine patients met inclusion criteria (31 male, 28 female), with a mean age of 59.5 (SD = 18.7) years. Twenty-nine percent of patients screened positive for delirium, either during the nursing shift in which PR was applied, and/or the shift immediately following PR application. All patients were restrained using two-point Posey soft restraints, for a mean duration of 42.2 (SD = 51.3) hours. During the pre-PR period, 16 (27%) patients received no psychotropic drugs, 11 (19%) had no changes to their existing drug regimen, and 32 (54%) had a drug intervention. Twenty-seven (46%) patients had at least one drug initiated and/or increased in dosage during the pre-PR period, representing 41 prescriptions: 11 (27%) opioids, 15 (37%) benzodiazepines, two (5%) antipsychotics, and 13 (32%) non-benzodiazepine sedatives. During the post-PR period, five (8%) patients continued to receive no psychotropic drugs, four (7%) had no changes to their existing regimen, and 50 (85%) had a drug intervention. Forty-two (71%) patients had at least one drug initiated and/or increased in dosage during the post-PR period, representing 71 prescriptions: 29 (41%) opioids, 19 (27%) benzodiazepines, seven (10%) antipsychotics, and 16 (23%) non-benzodiazepine sedatives.

Conclusion: These data suggest that most patients receive psychotropic drugs immediately prior to, or early in the application of PR. Most interventions were new drug initiations, and/or increases in existing regimens, suggesting efforts are made to improve chemical restraint.

References: N/A

Poster # 7 **Poster Session: 13:30 - 15:00**

Title: Jump Start your Heart; Advancing Early Mobility in the Coronary Intensive Care Unit

Presenter: Claire Holland, University Health Network, CICU, Toronto, Canada.

Introduction: Early mobility (EM) is an accepted and promoted practice in medical-surgical intensive care units (ICU). EM, defined as initiation of patient activity upon achievement of hemodynamic and respiratory stability, typically begins within 24-48 hours after ICU admission (Zanni, 2010). The benefits of EM in critical care have been well documented: improvements in lung function; decreased pressure ulcer formation; decrease in delirium days; improved cardiovascular fitness; less muscle atrophy and improved psychological wellbeing (McAnaw, 2012). However, the role of EM has not been well documented in coronary intensive care units (CICU) partly due to the lack of level three (1:1 nursing ratio) CICUs. Evidence supports the use of EM by establishing protocols easily implemented by bedside nurses as a standard practice (McAnaw, 2012).

Objectives: Our unit, a tertiary combined level two (1:2 nursing ratio) and three CICU, undertook an evidence informed quality improvement initiative directed at increasing nursing staff's comfort with EM in CICU and to allow frontline nursing staff to become independent in assessing and mobilizing their patients.

Methods: A literature review was conducted to determine EM best practice. Frontline staff and physician stakeholders were engaged to determine patient safety criteria and identify barriers to implementation of EM. These barriers included femoral lines, ventilators, sedation, lack of knowledge around use of equipment and delayed patient activity due to lack of physician orders. An inter-professional committee of nurses, a physiotherapist (PT) and a respiratory therapist (RT) collaborated to create an evidence-informed algorithm to be utilized at the bedside. An education program was delivered to all CICU nursing staff. Equipment required to facilitate EM was purchased. The algorithm was promoted and implemented in August of 2013.

Results: The algorithm was gradually utilized more by frontline nurses, who no longer required physicians' orders for mobilization provided patients met the safety criteria. EM bullet rounds were developed by the PT and the Patient Care Coordinator to encourage the use of the EM assessment tool, and coordinate inter-professional EM interventions for complex patients on a daily basis. This practice proved useful for increasing the comfort of nurses mobilizing ventilated patients, and improving inter-professional collaboration. Recently allied health disciplines, such as occupational therapists (OT) have become involved in EM bullet rounds. We are now linking the EM rounds to delirium and skin integrity. To motivate staff, a contest was held where frontline staff could recognize colleagues who were implementing EM. Informal audits were used to provide feedback to staff on EM. The development of a guide for mobilization of patient's with femoral lines, as well as a critical care PICC program, removed an identified barrier to EM in CICU.

Conclusion: Within one year of implementation, frontline nursing staff is more actively engaged with EM in the CICU and independently mobilizing a variety of patients. Future directions for

our unit include developing a standardized exercise program for heart failure patients and facilitating cardiac rehabilitation for acute coronary syndrome patients. Exercise for CICU patients on inotropes would also be an area for future research.

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Poster # 8 **Poster Session: 13:30 - 15:00**

Title: The Impact of Enhanced Critical Care Weekend Physiotherapy Service Provision
Presenter: Megan Hudson, University Health Network, Physiotherapy, Allied Health, Toronto, Canada.

Introduction: Physiotherapists (PTs), essential members of the interdisciplinary critical care team, routinely provide care on weekends (WE), albeit, at reduced capacity. One year ago at 2 sites of our facility, an acute care quaternary academic hospital, WE staffing was increased from 1 (PRE) to 3 (POST) PTs for patients in the Medical-Surgical Intensive Care (MSICU), the Cardiovascular and Coronary Intensive Care Units (CVICU) and on the wards.

Objectives: Volumes treated, new referrals, types of treatment, and conditions treated before (PRE) and after (POST) implementation of increased PT WE coverage were compared. PTs' perspectives of the new WE coverage model were also studied.

Methods: A retrospective chart review was conducted on all patients receiving WE PT during two time periods: PRE: January 1-May 5 2013 (40 days) and POST: May 11-December 31 2013 (74 days). An electronic survey distributed to all PTs (23) working at the study sites during both PRE and POST periods evaluated PTs' perspective of the changed model regarding types of treatments, workload, impact on outcomes, and what works/needs improvement. Demographic characteristics and perception ratings were computed as frequencies. Number, types of patients and treatments provided in each clinical area per treatment day were calculated as mean ± standard deviation. To test for differences between PRE and POST, independent t-tests (continuous data) or c2 tests (categorical data) were conducted (α=0.05).

Results: Survey respondents (n=17) were primarily female (82.4%), baccalaureate trained (58.8%) and had worked more than 10 years (64.7%). Greater than 85% of PTs provided a combination of chest/mobility treatments and felt adequately trained to provide coverage on assigned areas. Between 50-70% agreed WE PT was value-added and patients benefitted from PT-specific treatment with improved function and decreased complications. Less than 50% felt increased WE PT decreased ICU length of stay. There was a significant increase in the average number of patients per treatment day receiving treatment PRE vs POST in all 3 clinical areas (MSICU PRE=1.2±1.4, POST=3.4±3.1; CVICU PRE=1.4±1.2, POST=2.8±2.0; wards PRE=1.6±1.4, POST=4.1±2.8, p=0.00) and number of new patients in MSICU only (PRE=0.3±0.5, POST=1.0±1.1, p=0.04). Enhancing WE PT service resulted in a significant increase in number of mobility treatments (MSICU, PRE=0.4±0.6, POST=3.9±2.4; CVICU PRE=0.4±0.6, POST=2.7±1.6; wards PRE=1.1±1.1, POST=4.4±2.9, p=0.00), screenings (MSICU, PRE=0.7±1.0, POST=2.9±1.7; CVICU PRE=0.9±0.8, POST=1.7±1.3; wards PRE=0.7±1.0, POST=2.3 ±1.5, p=0.00) and numbers of patients treated post-surgically (MSICU, PRE=1.2±0.6, POST=3.0±1.5; CVICU PRE=3.5±1.8, POST=7.2±2.4; wards PRE=4.2±2.3, POST=6.1. ±2.7, p=0.00) and post-transplant (MSICU only, PRE=2.0±1.2, POST=5.1±2.2, p=0.00). There were no significant differences PRE-POST in the number of chest treatments, combination of chest/mobility treatments or discharges in any of the clinical areas.

Conclusion: Results from the current study provide evidence that enhancing PT coverage on

WE allows more critically ill patients to receive care, in particular, mobility treatments. The majority of PTs in our organization supported the changed model of care and felt it was of benefit for patient function/outcome and continuity of care. Future studies will need to focus on measuring the impact of the increased PT WE service provision on outcomes, preventing complications and length of ICU stay.

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Poster # 9 **Poster Session: 13:30 - 15:00**

Title: Checking All the Right Boxes: The Development of a Checklist for Prone Positioning of the Adult Critical Care Patient

Presenter: Beth Linseman, Sunnybrook Health Sciences Centre, Critical Care Unit, Toronto, Canada.

Introduction: Prone positioning of critically ill patients with Acute Respiratory Distress Syndrome (ARDS) has been used as a treatment option for a number of years with mixed results on mortality and benefit (4). Current research has shown decreased mortality in those with severe ARDS when applied early (2). Checklists used in high intensity environments integrate best practices, standardize protocols to reduce human error and improve quality of care (3).

Objectives: To develop a comprehensive checklist to standardize practice, improve overall staff comfort and patient safety when placing a patient in the prone position.

Methods: A survey was sent to the interdisciplinary staff in to assess comfort and knowledge about prone positioning for patients with ARDS. Based on the low level of comfort and varied level of knowledge from the surveys a quality improvement project using PDSA cycles was initiated by the members of the Education and Practice Council. A review of current literature, review of other health care facilities' guidelines, practices in the operating room, as well as viewing on-line videos on prone positioning were done. A draft guideline and checklist were developed and revised with input from the interdisciplinary team. The checklist was trialed on patients with severe ARDS for a total of 20 prone sessions during its development and further revisions were made. Simulation training was utilized for staff to practice the technique of positioning a patient, interventions to mitigate common complications and what to do in the event of a cardiac arrest.

Results: Prior to simulation training using the checklist staff were able to list an average of 2.4 complications. Following the simulation training staff listed an average of 4 complications. Those who could correctly identify what to do in the event of a cardiac arrest with a patient in the prone position increased from 41% to 92%. Staff overwhelmingly endorsed the checklist for its usefulness and practicality

Conclusion: A checklist for placing the adult patient with severe ARDS into the prone position is a practical tool for use at the bedside. This tool provides standardization of the procedure and addresses safety issues and potential complications of placing and caring for a patient in the prone position.

References: 1. Balas, M.C. (2000). Prone positioning of patients with acute respiratory distress syndrome: Applying research to practice. Critical Care Nurse 20(1), 24-36. 2. Guerin, C., Reignier, J., Richard, J.C., Beuret, P., Gacouin, A., Boulain, T., . . . Ayzac, L. (2013). Prone positioning in severe acute respiratory distress syndrome. New England Journal of Medicine, 386(23), 2159-2168. 3. Hales, B., Terblanche, M., Fowler, R., & Sibbald, W. (2008). Development of medical checklists for improved quality of patient care. International Journal for Quality in Health Care, 20 (1), 22-30. 4. Kopterides, P., Siempos, I.I., & Armaganidis, A. (2009).

Prone positioning in hypoxemic respiratory failure: Meta-analysis of randomized controlled trials. Journal of Critical Care, 24, 89-100. 5. Messerole, E., Peine, P., Wittkopp, S., Marini, J.J., & Albert, R.K. (2002). The pragmatics of prone positioning. American Journal of Respiratory and Critical Care Medicine, 165(10), 1359-1363.

Poster # 10 **Poster Session: 13:30 - 15:00**

Title: Nutrition Support Practices in a Medical-Surgical Intensive Care Unit: A Prospective Study on Nutrition Adequacy and Adherence to Clinical Practice Guidelines

Presenter: Michele McCall, St. Michael's Hospital, Medical/Surgical Intensive Care Unit, Toronto, Canada.

Introduction: Successful nutrition support (NS) delivery is associated with reduced infectious-related complications, morbidity and mortality. A gap exists between Clinical Practice Guidelines (CPGs) and bedside practice in Intensive Care Units (ICUs).

Objectives: This study's purpose was to a) compare NS practices to selected CPGs, b) determine if nutritional adequacy was met (defined as >80% delivery of daily energy and protein goals) and c) examine feeding practices in patients receiving vasopressors, in the Medical Surgical ICU (MSICU) at St. Michael's Hospital (SMH).

Methods: A prospective observational study on 98 consecutive MSICU patients who were given nutrition support was carried out over two 4-month periods. Data sheets were designed to measure adherence to CPGs, nutritional adequacy and routine nutrition support practices. Data was collected from patient charts, clinical software, daily flow sheets, patient observation, and interactions with the health care team. Patients were followed for a maximum of 14 days. Nineteen CPG recommendations from the Canadian Clinical Practice Guidelines for Nutrition Support in Adult Critically Ill Patients (1,2) and the Society of Critical Care Medicine/American Society of Parenteral and Enteral Nutrition Guidelines (3) were evaluated.

Results: Mechanical ventilation was required in 94% of the subjects, and the mean ICU length of stay was 19 +/- 15.4 days. Enteral feeding was used in 92.8% of patients, which was initiated within 24 – 48 hours in 85.7% of patients. Nutrition adequacy was met for calories provided (81.1% of goal) and was very near adequacy for protein provided (79.3% of goal). The most common reasons for not meeting nutritional goals included feeding interruptions from airway management issues, tests and procedures, and errors in feeding orders and rates. Nine CPG guidelines were followed >80% of the time.Norepinephrine was used in 59% of patients, and 60% of these patients started enteral nutrition while already receiving norepinephrine.The dose of norepinephrine at the start of enteral feeding ranged from 0-0.8 mcg/kg/min. Enteral feeding was well tolerated while patients received norepinephrine.

Conclusion: The nutrition support practices in the MSICU at SMH result in excellent delivery of energy and protein goals in a timely manner. The results from this study revealed which NS guidelines have poor to excellent adherence in our ICU and provided baseline data for subsequent quality assurance assessments.

References: 1. Critical Care Nutrition. (2013) Canadian Clinical Practice Guidelines: Updated Recommendations www.criticalcarenutrition.com. Accessed September 25, 2013. 2. Heyland, D.K., Dhaliwal, R., Drover, J.W., Gramlich, L. & Dodek, P. Canadian Clinical Practice Guidelines for Nutrition Support in Mechanically Ventilated, Critically Ill Adult Patients. J Parent Enteral Nutr. 2003;27:355-372. 3. McClave, S.A., Martindale, R.G., Vanek, V.W.,

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Poster # 11 **Poster Session: 13:30 - 15:00**

Title: Using Lean Methodology to Improve the Process of Transporting Critically Ill Paediatric Patients to Magentic Resonance Imaging (MRI)

Presenter: Andrea McCormick, The Hospital for Sick Children, Critical Care, Toronto, Canada.

Introduction: Anecdotally, Critical Care (CCU) and MRI staff reports the transport of CCU patients to and from MRI is a time consuming and unclear process. Teams from both areas report that it is often fraught with miscommunication and/or increased wait times that can culminate to represent a safety risk for patients. A multi-disciplinary team formed to examine the issue from both CCU and MRI perspectives.

Objectives: To understand the various steps of the current process and create a multidisciplinary team to discover strategies to streamline and enhance the process to result in less time spent in CCU/MRI transport.

Methods: The Lean Methodology DMAIC model was used to analyze contributing factors. A value stream mapping exercise and GEMBA observations were conducted. Time studies were conducted to measure patient preparation in CCU and handover time in MRI. Staff was also surveyed to understand barriers and common issues in transport.

Results: Time studies indicate that the timing and quality of patient preparation in CCU is inconsistent and handover time in MRI can be lengthy. We implemented a safe transport package for staff with profession and test specific indicators and a “time out” prior to leaving the unit to specifically target increased time spent in handover and delays related to patient preparation.

Conclusion: Implementing the transport package checklist along with a coaching model for knowledge translation resulted in a 300% earlier prep time of patients in the CCU. This allowed CCU staff to be more flexible for add on cases for MRI. As well, there was a 50% reduction in handover time in MRI. We concluded that using the safe transport sheet was associated with significantly less time spent in transport and safer transports of CCU patients.

References: Johnson, P.M., Patterson, C.J, O'Connell, M.P. (2013). Lean methodology: an evidence based practice approach for healthcare improvement. Nurse Practitioner, 38(12). 1-7.

Poster # 12 **Poster Session: 13:30 - 15:00**

Title: Decreasing Mislabeled Specimens in Paediatric Critical Care by Using a Positive Deviance Methodology and Standard Work Audits

Presenter: Andrea McCormick, The Hospital for Sick Children, Critical Care, Toronto, Canada.

Introduction: Mislabeled specimens are a high risk patient safety concern in acute care. The rate of mislabeled specimens in the Critical Care Unit (CCU) at The Hospital for Sick Children was persistently higher than the organizational goal. A team of front line staff was formed to understand contributing factors and brainstorm innovative solutions.

Objectives: To engage front line staff in creating a solution for a high risk but low prevalence event and to understand the current process and contributing factors to mislabelling in a critical care environment and to see a 50% decrease in mislabelled specimens by December 2014.

Methods: In January 2014, the implementation team utilized a positive deviance methodology to gain front line staff engagement. Staff were encouraged to brainstorm ways to fail at specimen collection and then asked to adjudicate how many of those failure modes existed in our current process. Front line staff felt that too many individuals were involved in specimen collection and that this was the major contributor to mislabelling specimens in the critical care environment. Thus, they chose to implement the "One Person Process' when collecting specimens, where one individual completes the entire process to minimize error. One to one coaching, marketing signage and peer/self audit cards were utilized. Pre and post audits of specimen collection were completed by the implementation team and University of Toronto graduate healthcare students.

Results: Comparing pre and post data, one person completed specimen collection 75% of the time, up from 52%. However, audits indicated that patient identification (ID) verification was not consistent at 30%. Staff then chose to implement a second rapid improvement cycle where patient ID labels were placed on IV access where blood draws occurred to improve the health care providers work flow and ability to rapidly locate the patient ID and check it against the specimen labels. This resulted in improved compliance of ID verification from 30% to 70%. As a sustainability measure, the quality team created standard work audits of the "One Person Process" every other day. This has helped maintain behaviour and cultural change and promoted front line staff understanding of risk. These audits also allow for one to one coaching regarding risk and processes at the bedside for maximal retention and uptake by front line staff. Finally, the unit tracks success with this measure by publicly tracking a "days since last" on the improvement boards in the hallways, allowing staff to visualize their success as well as promote accountability.

Conclusion: Staff engagement in solutions is imperative to successful quality improvement. Theoretical underpinnings of Just Culture are inherent in the standard work audit by enabling staff to visualize success and promote accountability. Audit/ feedback mechanisms are pivotal to ongoing cultural change and sustained improvements. Bedside coaching for risk is important to engage with staff and garner their feedback. The CCU has seen a sustained decrease of mislabeled specimens by 50% since implementation.

References: Gardem et al, (2011) Reducing the transmission of methicillin resistant staphylococcus aureus and clostridium difficile in the canadian healthcare system by enabling front line healthcare worker behavioural change using positive deviance. Canadian Patient Safety Institute: retrieved from http://www.patientsafetyinstitute.ca/English/research/cpsiResearchCompetitions/2008/Documents/Gardam/Report/Gardam%20and%20Reason%20Full%20Report.pdf Lindberg, CD, Clancy, T. (2010) Positive deviance: an elegant solution to a complex problem. Journal of Nursing Administration, 40 (4), p 150-153

Poster # 13 **Poster Session: 13:30 - 15:00**

Title: Motivators and Stressors for Canadian Research Coordinators in Critical Care: The MOTIVATE Survey

Presenter: Ellen McDonald, McMaster University, Critical Care Research, Hamilton, Canada.

Introduction: Critical Care Research Coordinators (CCRCs) implement study protocols in the complex setting of the intensive care unit (ICU). Retention of CCRCs is pivotal to research productivity, as years of experience correlates with consent rates and the rapidity of study completion. The diverse skills, breadth of knowledge, and range of responsibilities of CCRCs underscore how crucial they are to the research enterprise.

Objectives: The aim of this survey was to identify the stressors, motivators, responsibilities and job satisfaction of CCRCs in Canada.

Methods: We conducted a self-administered survey (1) of CCRCs in the Canadian Critical Care Trials Group (CCCTG). Our multidisciplinary research team generated items in 5 domains (stressors, motivators, responsibilities, job satisfaction and demographics(2)). Response options were grounded in 5 point Likert scales. The instrument was pre-tested by 9 RCs and underwent Clinical Sensibility testing. The survey was administered in hard copy at a CCRC Workshop in November 2012. An email invitation was sent to those CCRCs not present at the workshop, and email reminders were sent to non-responders. Responses were de-identified to ensure anonymity.

Results: The response rate was 66/85 (77.%). Overall, 48.5% of respondents were nurse CCRCs and 71.2% were employed full time. Respondent CCRCs were engaged in an average of 9 ongoing studies (7 academic, 2 industry) at the time of survey participation. Clinical Sensibility score was 4.5 out of 5.The highest rated stressors were unrealistic workload and deadlines, scoring 3.2 and 3.0, respectively out of 5. The highest rated motivators were a positive work environment and team spirit, scoring 4.5 and.4,4 respectively out of 5. CCRCs reported an average of 18 responsibilities, most frequently REB applications (89%), data entry (89%) and meetings (87%). Interestingly, remuneration factored fairly low as a motivator, ranking 13th on the list with a score of 3.8 out of 5. The overall job satisfaction was rated as 3.9 on a 5 point satisfaction scale.

Conclusion: Unrealistic workload and deadlines were identified as the major stressors for CCRCs of the CCCTG. However they are motivated by a positive work environment and team spirit, reporting their job satisfaction as high.

References: 1. Griffith LE, Cook DJ, Guyatt GH, Charles C. Comparison of open versus closed questionnaire formats in obtaining demographic information from Canadian general internists. J Clin Epidemiol 1999;52(10):997-1005. 2. Cook DJ, Guyatt GH, Juniper E et al. Interviewer versus self-administered questionnaires in developing a disease-specific, health related quality of life instrument for asthma. J Clin Epidemiol 1993;46(6):529-534.

Poster # 14 **Poster Session: 13:30 - 15:00**

Title: Introducing an Enteral Feeding Algorithm to Optimize Nutritional Support for Critically Ill Patients

Presenter: Karen Meredith, University Health Network, Critical Care, Toronto, Canada.

Introduction: Current research identifies the inadequacy of nutritional support for critically ill patients and the sub-optimal outcomes associated with poor nutrition in this patient population. In 2013 and 2014 the critical care units at the University Health Network (UHN) - Toronto Western Hospital (TWH) and Toronto General Hospital (TGH) - studied the state of nutritional support provided to their critically ill patient population to identify opportunities to optimize nutritional support. Using information from a literature review and the Critical Care Nutrition 2013 guidelines, an evidence based Enteral Feeding Algorithm was developed to standardize and optimize the delivery of nutritional support.

Objectives: 1. To collect and analyse data to measure the current state of nutritional support delivered to patients in critical care units at TWH and TGH with respect to: Initiation of enteral feeds within 24-48 hrsDelivery of 80% of required calories within 72 hrsTime to reach prescribed caloric intake 2. To introduce an evidence –based Enteral Feeding Algorithm to optimize nutritional support. Provide staff education on the Enteral Feeding Algorithm with a focus on: obtaining a doctors order to initiate the Enteral Feeding Algorithm within 24-48 hrs, caloric –debt catch-up, introduction of pro-kinetic agents, and management of gastric residual volumes (GRV) guidelines. 3. Utilize the Enteral Feeding Algorithm for a 4 month period. 4. Re-collect and analyse data after a 4 month implementation period to determine if there was an improvement in the 3 key areas measured.

Methods: Retrospective chart reviews were conducted for a 7 day period on 48 critically ill patients at TWH and 20 patients at TGH that met the following Inclusion criteria: Age 18 years or olderIntubated and ventilated for 7 d Patients that met the following exclusion criteria were eliminated from the data base. Patients in the ICU > 14 days. Patients who underwent abdominal surgery during the current admission Staff Education In-services on the new Enteral Feeding Algorithm were provided to both day and night staff RNs as well as one-on-one sessions for RNs caring for patients admitted for > 24 hrs to ensure that they were aware of the new Enteral Feeding Algorithm. The algorithm is introduced to new medical residents during their ICU orientation and it has been placed conveniently at every bedside for easy access. .

Results: TWH collected data for a 7 day period on 48 patients: 76% had feeds initiated within 48 hrs., 33% received 80% of prescribed calories within 72 hrs. and 60% reached prescribed calories within 7 days. TGH collected data on 20 patients: 55% had feeds initiated within 48 hrs., 5% received 80% of prescribed calories within 72 hrs. and 60% reached prescribed calories within 7 days.

Conclusion: Data analysis indicates there are opportunities to optimize the nutritional support provided to our critically ill patients. An Enteral Feeding Algorithm that standardizes the delivery of nutritional support may help critically ill patients reach optimal nutritional support

earlier in their ICU stay than is currently experienced. Another area to consider for further evaluation is the adequacy of protein intake.

References: Bankhead, R. et al., Enteral Nutrition Practice Recommendations JPEN J Parenter Enteral Nutr. March-April 2009 Volume 33. Critical Care Nutrition: Canadian Clinical Practice Guidelines 2013. Retrieved from http://www.criticalcarenutrition.com/docs/cpgs2012/Summary%20CPGs%202013%20vs%202009_2July2013.pdf Hegazi, R.A., Wischmeyer, P.E. Clinical review: optimizing enteral nutrition for critically ill patients - a simple data-driven formula. Critical Care 2011, 15:234 doi:10.1186/cc10430 Heyland, D.K. Impact of Enteral Feeding Protocols on Enteral Nutrition Delivery: Results of a Multicenter Observational Study JPEN J Parenter Enteral Nutr. November 2010 34: 675-684. Heyland, D.K. et al., Enhanced protein-energy provision via the enteral route in critically ill patients: a single center feasibility trial of the PEP uP protocol. Critical Care 2010, 14:R78. Doi:10.1186/cc8991 Stewart, M.L. , Interruptions in Enteral Nutrition Delivery in Critically Ill Patients and Recommendations for Clinical Practice. Crit Care Nurse 2014, 34:14-22. doi: 10.4037/ccn2014243

Poster # 15 **Poster Session: 13:30 - 15:00**

Title: Sepsis Now a Priority: Development and Implementation of a Sepsis Algorithm in the Emergency Department of an Academic Hospital Using an Integrated Knowledge Translation Approach

Presenter: Sara West, Mt. Sinai Hospital, Toronto, Canada.

Introduction: Sepsis is a leading cause of in-hospital mortality, and is growing in incidence. The crude mortality rate for all patients presenting to hospital with sepsis is approximately 30%. Recognizing the importance of sepsis, Mount Sinai Hospital (MSH) has been interested in improving sepsis recognition and management for several years. We undertook a retrospective audit of 364 charts of patients diagnosed with sepsis at MSH in 2010-2011 to understand existing management practices and opportunities for improvement.

Objectives: The aim of the sepsis algorithm project was to improve sepsis management and outcomes by identifying patients as early as possible, and to provide them with rapid, protocolized care in the MSH emergency department (ED).

Methods: The prior chart audit was the basis for the development of the SNAP recognition and management algorithm, and allowed for gaps or deficiencies in care to be addressed within the algorithm. The practice changes that were then implemented in the ED were: 1) employment of the SNAP algorithm into the ED with aggressive timelines for clinicians in order to quickly identify and treat septic patients; 2) pre-printed order sets for initial and ongoing management of sepsis; 3) development of a patient tracking board sepsis symbol with linked data collection reports; 4) revised electronic order set for sepsis symptoms; and 5) revised nursing medical directives that align with the algorithm.

Results: The SNAP algorithm was implemented on July 21st, 2014. Data collected to date has demonstrated that the timelines of the algorithm are being met and that septic patients are being flagged at triage and treated swiftly. On the first week of implementation there were a total of twelve cases of sepsis of which ten met the algorithm blood work timelines (83%). Ongoing post-implementation review that evaluates the algorithm usage by assessing patient outcomes: mortality, morbidity, length of stay and process measures (i.e. time to diagnosis, time to appropriate antibiotic, etc.) will continue to occur.

Conclusion: The ability to recognize sepsis early is essential to improving outcomes. Sepsis can be easily missed, as there is no single lab parameter or symptom cue to the health care team for sepsis. The intent of the SNAP algorithm is to allow for early recognition of septic patients, early intravenous fluids and early antibiotics. By implementing this concise quality improvement tool that optimizes diagnosis and treatment, we hope to improve outcomes for patients with sepsis.

References: N/A

Poster # 16 **Poster Session: 13:30 - 15:00**

Title: A Traffic Light Algorithm Based Approach to Managing Difficult Airways

Presenter: Tony Raso, William Osler Health System - Brampton Civic Hospital, Respiratory Therapy Department, Brampton, Canada.

Introduction: Primary responsibility for intubating outside of the operating room is done by non-anesthesia providers such as physicians, intensivists and respiratory therapists. Management of an unpredictable and difficult airway can have devastating consequences. The reduction of these consequences can be mitigated by preparation and management of potential risk, including when to call for assistance. Utilizing a colour coded algorithm with a matching difficult airway cart (DAC) will encourage providers to recall, anticipate and follow a structured approach to difficult airway management.

Objectives: The goal was to standardize the DAC in critical care and the emergency departments at both hospital sites within our organization and develop an efficient algorithm that could be easily navigated by physicians and respiratory therapists when facilitating or assisting with a difficult adult/pediatric airway in a stressful, emergency situation.

Methods: An extensive literature search identified numerous difficult airway algorithms and a broad range of airway adjuncts. Advanced airway equipment for both the adult and pediatric populations was evaluated. Each step of the difficult airway algorithm was linked to the difficult airway cart, drawer by drawer in a colour coded sequence. A specific colour both identified the algorithm step and the associated cart drawer and its contents. To identify a difficult airway in increasing order of acuity, the colours green, yellow and red were used. Yellow signified caution and a call for assistance. Prior to implementation, education was provided targeting physicians in critical care and the ED departments as well as respiratory therapy, highlighting the new process and airway adjuncts now available.

Results: We now have standardized DAC's across both sites in critical care and the ED departments. The final algorithm is simple, easy to remember and is coloured coded with matching DAC drawers. This approach emphasizes algorithm based thinking and is designed to follow a sequence of steps in managing a difficult airway. The many presentations to physicians and respiratory therapy have led to an increased level of awareness and a new respect for the difficult airway among the various providers. Both physician and respiratory therapy staff have been receptive to this new approach.

Conclusion: To ensure availability of equipment the DAC's are restocked and resealed by respiratory therapy utilizing a weekly check-off list. To ensure success and sustainability of our practice, the DAC & associated algorithm is being integrated into simulation scenarios with both physicians and respiratory therapists taking part. All respiratory therapy & physician assisted intubations are recorded and tracked monthly using an RT Meditech Intervention, including difficult intubations. These occurrences are then reviewed by a quality care committee. With introduction of the new system we have shifted from an equipment based focus to one where the algorithm dictates the level of response. All staff now approach a difficult airway with an increased level of confidence towards advanced airway adjuncts. The operationalization of this

algorithm has led to a culture of safety in airway management in keeping with our organizations focus on continuous quality improvement.

References: Hagberg, C.A (2010) Current Concepts in the Management of The Difficult Airway; Anesthesiology News, May: 1-24

Poster # 17 **Poster Session: 13:30 - 15:00**

Title: Follow-up Point Prevalence Survey of Antimicrobial Use in the Cardiac and Paediatric Critical Care Unit

Presenter: Charisse De Castro, The Hospital for Sick Children, Toronto, Canada.

Introduction: Blinova et al. (2013) conducted a point prevalence survey in 2008 within the Critical Care Unit (CCU) at SickKids® and found a high rate of antimicrobial use (70-79%), with up to 62% of antimicrobials deemed as inappropriate. Since 2008, initiatives implemented to promote appropriate use of antimicrobials and to reduce infections include the Antimicrobial Stewardship Program, various educational initiatives, and a mouth care protocol to prevent ventilator-associated pneumonias. Current literature supports ongoing surveillance of antimicrobial use to evaluate the effectiveness of such initiatives and to monitor trends over time.

Objectives: Primary: To determine the prevalence of infections and antimicrobial use among paediatric patients admitted to the Critical Care Unit (CCU), and to assess the appropriateness of antimicrobial prescribing. Secondary: To describe differences in the primary objectives between the cardiac critical care unit (CCCU) and paediatric intensive care unit (PICU), fall and winter seasons, and compare results with a previous point prevalence study.

Methods: All patients in the CCU during one week in October (Period A) and February (Period B) receiving systemic antimicrobials were followed until completion of antimicrobial therapy or discharge. Data about antimicrobials prescribed, indications, infection types, and recommendations by antimicrobial stewardship and infectious disease teams were collected. Five blinded clinician assessors rated appropriateness of antimicrobials prescribed according to 9 pre-defined criteria. Disagreements on overall appropriateness were resolved during a consensus meeting.

Results: Fifty-nine of 71 patients (83%) in Period A and 52 of 68 patients (77%) in Period B received antimicrobials. A definite infection was diagnosed in 12% of CCCU patients, compared to 39% of PICU patients. A presumed infection was diagnosed in 17% of CCCU patients and 21% of PICU patients. Presumed sepsis, bloodstream infections and pneumonia were the most prevalent infections. Empiric therapy was the most common indication. The most frequently prescribed antimicrobials were cefazolin, vancomycin, ceftriaxone, piperacillin-tazobactam, and gentamicin. Inappropriate antimicrobial use ranged from 15.4 to 52.5%, varying by assessor and survey period. The most common reasons for inappropriate use were inappropriate duration, unnecessary use, and overly broad spectrum. Compared to the previous study, there were variations in infection types and antimicrobial use, but overall inappropriateness rates were similar.

Conclusion: Prevalence of antimicrobial use in CCU patients remains high with a significant proportion still considered inappropriate. Further research to evaluate and resolve factors associated with inappropriate antimicrobial use in critically ill children is needed.

References: Blinova et al. Point prevalence survey of antimicrobial utilization in the cardiac and pediatric critical care unit. Pediatr Crit Care Med. 2013 Jul;14(6):e280-8.

Poster # 18 **Poster Session: 13:30 - 15:00**

Title: Inhaled Nitric Oxide Stewardship Program at SickKids

Presenter: Christina Sperling, The Hospital for Sick Children, Respiratory Therapy, Toronto, Canada.

Introduction: Inhaled nitric oxide (iNO) is used medically to lower the pulmonary vascular resistance of infants with acute respiratory failure and has become a common treatment for patients with respiratory disease. The Respiratory Therapy (RT) Department at SickKids observed a gradual increase in the use of iNO over five years and decided to review hours utilized with patient clinical indicators. The review focussed on adherence to the iNO guidelines in regards to indications, response to therapy and weaning, and opportunities were identified for enhanced iNO utilization. Based on the findings and a comprehensive literature review, both iNO guidelines from the Critical Care Unit and the Neonatal Intensive Care Unit were updated, and strategies were developed for the implementation and adherence to these guidelines. The RT leadership team recognized that mutual engagement in this initiative by physicians, respiratory therapists, nurses and other inter-professional colleagues was essential to be successful. This work led to the creation of the iNO Stewardship Program which was implemented in April 2013.

Objectives: The iNO Stewardship Program was established based on the necessity to optimize clinical practices. It was clear that the development of evidence based guidelines would not be enough and a creative way of influencing change needed to be identified. A multi-facetted strategy was developed, with engagement from stakeholders at all levels; including technicians, clinicians and leadership. The iNO Stewardship Program aimed at ensuring quality care, enhancing patient safety, minimizing variations in practice, and promoting efficient utilization of iNO.

Methods: The initial data collection occurred in 2012/2013, retrospectively reviewing all patients who received iNO in 2011/2012. Implementation of the iNO Stewardship Program and the new guidelines occurred in April 2013 with key metrics monitored over the 2013/2014. The number of hours of iNO utilized was captured on a weekly basis by the RT Techinical Division. Each iNO cylinder is fitted with a tracking device and information was manually downloaded onto a memory stick. This data was translated into graphs for presentation with hours monitored weekly, monthly and yearly, per unit and as a total. Monthly targets, based on total hours purchased for the year divided by 12 months, were set and compared to actual data collected. Each patient started on iNO had qualitative data manually collected on a standardized form. This data was then collated into a shared database and trends in utilization were analyzed and shared with key stakeholders

Results: In the first year of the iNO Stewardship Program, we were able to demonstrate its valuable effectiveness. The iNO contract for the 2012/2013 fiscal year was for 13,000 hours. With this stewardship as a key focus, we were well positioned to commit to purchasing a significantly lower number of hours. Therefore, for the 2013/2014 contract, SickKids purchased only 7,600 hours. This stretch goal of 7,600 hours influenced an elevated accountability by the clinicians and was necessary to drive change and best practice. Results: In 2012/2013 SickKids

actually utilized 11,254.04 hours of iNO, depite purchasing 13,000 hours. In 2013/2014 SickKids purchased 7,600 hours but actually utilized 6,563.43 hours . Overall use from 2012/2013 to 2013/2014 in iNO utilization decreased by 4690.61 hours, with the implementation of the iNO Stewardship Program.

Conclusion: This decrease in iNO utilization is primarily attributed to the appropriate weaning of patients off iNO when clinically indicated and also to the alignment of our weaning practices with the guideline recommendations. The iNO Stewardship Program has proven to be successful, with an exceptional decrease in the number of iNO hours utilized. The final number of hours utilized for the 2013/2014 fiscal year proved that the iNO Stewardship enhanced awareness of appropriate utilization of the inhaled medication. We feel confident that these positive results can be maintained with continued collaborative engagement.

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Poster # 19 **Poster Session: 13:30 - 15:00**

Title: CONTINUOUS RENAL REPLACEMENT THERAPY: ADDING COMPLEXITY TO THE NURSING CARE OF THE CRITICALLY ILL CHILD

Presenter: Ruth Trinier, Hospital for Sick Children, Paediatric Intensive Care Unit, Toronto, Canada.

Introduction: Acute kidney injury is a common occurrence in critically ill children, frequently seen as a result of complications from other disease treatments or processes. Children who require intensive care as a result of sepsis, cardiopulmonary bypass, acute respiratory distress syndrome or inborn errors of metabolism, may develop acute kidney injury requiring prompt intervention to prevent further deterioration. With its gradual removal of fluids and toxins minimizing the hemodynamic instability seen in more rapid methods of fluid removal, continuous renal replacement therapy (CRRT) is often considered the treatment of choice.

Objectives: This presentation will include a case-based approach to the nursing care of critically ill children requiring CRRT. Scenarios will review the nursing care needs of emergent, life-threatening situations as well as conditions requiring a prolonged course.

Methods: Recent developments in equipment for use in lower body weight patients have addressed concerns of adapting equipment designed and tested in adults for pediatric use. Morbidity and mortality remain high, and complications of therapy are frequent.

Results: Although treatment plans are initiated and guided by physicians, the addition of a highly invasive therapy to the nursing care of children requires a solid understanding of the critically ill child, continuous renal replacement therapy and the potential for complications. Complex case scenarios in paediatric CRRT therapy will be reviewed.

Conclusion: Expert nurse CRRT clinicians anticipate, monitor, assess and intervene appropriately thus positively impacting patient outcomes and minimizing complications.

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Poster # 20 **Poster Session: 13:30 - 15:00**

Title: St. Mary's General Hospital Progressive Weaning Program: A Non Traditional, Non Intensive Care Unit based Weaning Model

Presenter: Danny Veniott, St Mary's General Hospital, Progressive Weaning Program, Kitchener, ON, Canada.

Introduction: One of Ontario's provincial strategic imperatives is to reduce Alternative Level of Care (ALC) days, those defined as days in which patients are in "acute care" beds awaiting "chronic/complex care" facility beds. It focuses on recognizing the system waste and the direct correlation to the Emergency Department performance targets. A small group of patients who contribute to significant ALC stays are those patients waiting for specialized complex care beds for long-term ventilation. These patients often wait in Intensive Care Unit (ICUs) beds with negative effects on their quality of life, risk for pneumonia, and healthcare costs. The Waterloo-Wellington LHIN Progressive Weaning Program (PWP) was developed, delivered and launched by St. Mary's General Hospital (SMGH). Initiated in fall 2011 as a pilot project and confirmed in January 2013 as an ongoing fully funded program by WWLHIN, it provides an evidence-based proactive model and strategies for this patient population.

Objectives: The PWP aims to minimize ICU ventilation days and decrease the number of patients who become dependent on ventilators. Doing so will reduce the number of patients waiting in hospital ICUs to eventually be transferred to specialized long term ventilation complex continuing care beds. The clinical/staff/organizational improvement goals are Transfer of patients to a PWP that uses evidence-based strategies Improve collaboration and continuity of care Develop knowledge and expertise in ventilator weaning Use critical care resources effectively and efficiently by maximizing throughput and increase availability of existing ICU beds by liberating patients from ventilation outside of the ICU Optimize respiratory status and minimize interventions Improve quality of life•Reduce complications related to prolonged ventilation

Methods: The outcomes/process/balance measures are: Patients completely weaned from mechanical ventilation Patients successfully discharged home with long-term assisted ventilation•Hospital Length of stay and days ventilated•Complications Discharge information Impact on ICU beds in the WWLHIN Economic impact.

Results: In preparation for the PWP, a review of all relevant best practice surrounding weaning from mechanical ventilation was undertaken. The best recommendations from the available literature were combined with new and emerging ventilator modalities such as Proportional Assist Ventilation (PAV+) into the SMGH weaning model. Educational material was presented to the members of the internal allied health care team as well as the referring centers during education sessions. SMGH initiated evidence-based, best-practice protocols for ventilation weaning no matter which ICU the patient is being cared in. This allowed for the implementation of progressive weaning protocols in an environment where there is existing clinical expertise, skills/resources and facilitated relationship building, capacity building and integration with partner ICUs in the WWLHIN.In the SMGH's PWP, patients are cared for by an interdisciplinary care team (doctors, nurses, respiratory therapists, a physiotherapist, an

occupational therapist, dietician, speech therapist, social worker, pharmacist and spiritual care representatives). Weaning takes place outside of the ICU in carefully monitored steps focused on rehabilitation, including early mobilization (sitting, standing and walking) and physiotherapy. Ventilator weaning is done using PAV+ instead of historical modes of ventilation as it allows for improved strengthening of the muscles involved in spontaneous breathing and improved patient synchronization with the ventilator during weaning.

Conclusion: PWP has allowed SMGH to strengthen its strategic focus as a Respiratory Centre of Excellence by enhancing the quality of care provided. Timely, progressive weaning by a specialized interdisciplinary team and enhanced practice related to ventilation weaning at all other LHIN hospitals prove beneficial for patients, staff and the entire health care system. PWP demonstrates that (1) weaning from mechanical ventilation can be performed safely and efficiently in a highly specialized, weaning focused, non-intensive care environment; (2) a non-physician directed meaning model is successful; and (3) we have the ability to build on existing resources within our LHIN, to achieve desired outcomes. PWP has allowed for the implementation of an improved care pathway for ventilation weaning thus improving quality of life for the identified population. Staff throughout critical care units in the WWLHIN, are provided with tools and support to practice more autonomously in the management of ventilated patients. Overall system savings are achieved through reduced ICU stays, improved access to existing ICU beds, reduced acute days of stay, avoided ALC days in hospital, and admission avoidance to long-term or complex care settings.

References: Progressive Weaning Program Pilot Project Report, St Mary's General Hospital October 2012

Poster # 21 **Poster Session: 13:30 - 15:00**

Title: The Impact of an In Situ Simulation Intervention on Interprofessional Collaboration in Critical Care: A Study Protocol.

Presenter: Catherine Villemure, Centre de santé et de services sociaux de Trois-Rivières - Centre hospitalier affilié régional AND Université du Québec à Trois-Rivières, Intensive Care Unit // Nursing Sciences, Trois-Rivières, Canada.

Introduction: Patient safety is a fundamental health care principle (WHO, 2014). Due to potentially life-threatening conditions, critical care frequently requires a prompt team intervention (Reader, 2007). There are potentially high risks of errors. Miscommunication among professionals during critical events may affect the patient outcomes (Rothschild, 2005). On the other hand, improved teamwork can prevent adverse events (Manser, 2009). Effective communication and teamwork are central components of interprofessional collaboration (IPC) (Chiocchio, 2012). For patient safety improvement, developing strategies to enhance IPC among critical care workers should be prioritized (Kohn, 2000). In Situ Simulation (ISS) is an emerging strategy mostly used in health care for competencies development enhancing patient safety. It's a simulation-based training taking place in the actual patient unit environment. However, ISS' literature is mostly at descriptive and exploratory levels.

Objectives: The primary aim of this study is to evaluate the impact of an ISS intervention on IPC during critical events among a professional care team. Professionals' satisfaction and self-efficacy will be evaluated as secondary outcomes.

Methods: A quasi-experimental study, pretest and posttest design with a paired control group. Variables. The independent variable consists of a 5.5-hour team training intervention based on the crisis management principles, given by simulation experts. The scenarios will be composed of typical deteriorating cases encountered in critical care settings, and followed by a debriefing period. IPC, professionals' satisfaction and self-efficacy are dependant variables, which will be evaluated by a self-reported questionnaire. The participants of both experimental and control groups will have to answer the questionnaire at three periods of time: before the intervention, immediately after, and 6 to 8 weeks later. Population and Sample. A convenience sample will be recruited among the operative room and recovery unit teams of two university Hospitals. The intervention is addressed to healthcare professional of the regular perioperative team: beneficiary attendant, nurses, respiratory therapists, residents and anesthesiologists. The anticipated total of participants is 42 per group. The control group will receive the training after the study. Statistical Analysis. Data analysis will be quantitative, using the SPSS analysis software. Descriptive analyses will be used to present the sample's characteristics and repeated measures ANOVA will be used to compare both groups. A linear mixed model will also be used to evaluate the interaction between groups and time.

Results: The results of this study should be available by fall 2015. We hypothesis that the experimental group will have an improved IPC immediately after the training, compared with the control group. They will also be more satisfied at work and improve their self-efficacy. Finally, we believe the training will still have positive effect at the long-term evaluation (after 6 to 8 weeks).

Conclusion: Potential Implications. This study aim to evaluate the impact of an ISS intervention on IPC during critical events. It will contribute to the body of knowledge on IPC and the results will justify the use of ISS for professional development among critical care workers, in order to enhance patient safety.

References: - Chiocchio F, Grenier S, O'Neill TA, Savaria K and Willms JD. The effects of collaboration on performance: A multilevel validation in project teams. International Journal of Project Organisation and Management. 2012;4:1-37 - Kohn LT, Corrigan J and Dona

Poster # 22 **Poster Session: 13:30 - 15:00**

Title: Sepsis Now a Priority: Development and Implementation of a Sepsis Algorithm in the Emergency Department of an Academic Hospital Using an Integrated Knowledge Translation Approach

Presenter: Sarah West, Mount Sinai Hospital, Antimicrobial Stewardship Program, Toronto, Canada.

Introduction: Sepsis is a leading cause of in-hospital mortality, and is growing in incidence. The crude mortality rate for all patients presenting to hospital with sepsis is approximately 30%. Recognizing the importance of sepsis, Mount Sinai Hospital (MSH) has been interested in improving sepsis recognition and management for several years. We undertook a retrospective audit of 364 charts of patients diagnosed with sepsis at MSH in 2010-2011 to understand existing management practices and opportunities for improvement.

Objectives: The aim of the sepsis algorithm project was to improve sepsis management and outcomes by identifying patients as early as possible, and to provide them with rapid, protocolized care in the MSH emergency department (ED).

Methods: The prior chart audit was the basis for the development of the SNAP recognition and management algorithm, and allowed for gaps or deficiencies in care to be addressed within the algorithm. The practice changes that were then implemented in the ED were: 1) employment of the SNAP algorithm into the ED with aggressive timelines for clinicians in order to quickly identify and treat septic patients; 2) pre-printed order sets for initial and ongoing management of sepsis; 3) development of a patient tracking board sepsis symbol with linked data collection reports; 4) revised electronic order set for sepsis symptoms; and 5) revised nursing medical directives that align with the algorithm.

Results: The SNAP algorithm was implemented on July 21st, 2014. Data collected to date has demonstrated that the timelines of the algorithm are being met and that septic patients are being flagged at triage and treated swiftly. On the first week of implementation there were a total of twelve cases of sepsis of which ten met the algorithm blood work timelines (83%). Ongoing post-implementation review that evaluates the algorithm usage by assessing patient outcomes: mortality, morbidity, length of stay and process measures (i.e. time to diagnosis, time to appropriate antibiotic, etc.) will continue to occur.

Conclusion: The ability to recognize sepsis early is essential to improving outcomes. Sepsis can be easily missed, as there is no single lab parameter or symptom cue to the health care team for sepsis. The intent of the SNAP algorithm is to allow for early recognition of septic patients, early intravenous fluids and early antibiotics. By implementing this concise quality improvement tool that optimizes diagnosis and treatment, we hope to improve outcomes for patients with sepsis.

References: N/A

Poster # 23 **Poster Session: 13:30 - 15:00**

Title: Investigating the Occupational Therapy Role in Critical Care: Development of a Scoping Review

Presenter: Michelle Kho, McMaster University, Hamilton, Canada.

Introduction: Survivors of critical care often face residual disabilities with long term consequences, challenging their resumption of pre-injury/illness roles. Occupational therapists (OTs) have expertise in facilitating recovery from such conditions. However, the OT role is infrequent in many critical care settings and, when present, is inconsistent and not clearly defined. In-depth, interdisciplinary exploration is required to establish the role of the OT on the critical care team to optimize patient outcomes.

Objectives: To describe the interdisciplinary process used to design and execute a scoping review illustrating the current and potential OT role in critical care.

Methods: We searched MEDLINE, CINAHL, Web of Science, Scopus, Cochrane Library, ERIC, Social Science Citation Index, and SSRN (Nov 2013). We sought a range of document types (quantitative and qualitative original research, reviews practice guidelines, editorials, commentaries) that mentioned current or potential OT roles in critical care. We used no language restrictions. Three OTs, one physiotherapist (PT), and one critical care methodologist reviewed citations to identify relevant reports. Independently, and in duplicate, pairs of review team members screened study titles, abstracts, and full text for eligibility; similarly, an interdisciplinary team of three OTs and one PT abstracted data from included studies. At all review stages, discrepancies were resolved by consensus.

Results: Our initial search yielded 32,707 citations; thus, for practical considerations, we modified our inclusion/exclusion criteria. We prioritized our selection criteria to citations reporting or suggesting a possible OT role in direct patient care interventions within the critical care setting published in English. Based on the titles, 4 reviewers identified 3,624 abstracts for further review (requiring 90 h in total). Of these 1,222 reports were selected for full-text review (requiring 34 h in total). To date, we have retrieved 1,048 full-text documents with 353 meeting our revised inclusion criteria (requiring 34 h in total). . Data have been abstracted from 242 reports by four reviewers (requiring 83 h in total). Preliminary data analysis finds that documents on OT in critical care are varied in document publication type, study design, and methodological quality; limited in number; and, explore a breadth of traditional and emerging OT roles.

Conclusion: Instrumental in distilling the large volume of citations, defining key concepts, and collegially resolving conflicts, our interdisciplinary teams of reviewers and data abstractors have been invaluable in capturing the existing state and potential contributions of OT in critical care. Emerging results indicate a need for further research into both the utility of current OT roles in critical care (e.g. mobilization, splinting, positioning) and role growth to support recovery from disability for patients during and following receipt of critical care, particularly in cognitive and psychosocial services. The iterative and dynamic interdisciplinary process described here may serve as an exemplar of how other disciplines can explore their role in emerging facets of health

care. An earlier version of this work was presented at the 2014 Technology Evaluation in the Elderly Network (TVN) Annual Conference & Scientific Meeting.

References: N/A

Poster # 24 **Poster Session: 13:30 - 15:00**

Title: Comparing APACHE Scores Collected at Randomization versus ICU Admission in the OSCILLATE trial

Presenter: Brooke Fraser, University Health Network, Toronto, Canada.

Introduction: Acute Physiology and Chronic Health Evaluation (APACHE) scores are commonly used in clinical trials to compare baseline severity of illness between randomized groups. However, the manner in which these scores are calculated vary among studies or are not reported.

Objectives: We set out to examine the differences between APACHE II scores collected at randomization versus at ICU admission for patients enrolled in the Oscillation for ARDS Treated Early (OSCILLATE) Trial, an international randomized control trial of early high frequency oscillation (HFO) in patients with moderate to severe Acute Respiratory Distress Syndrome (ARDS).

Methods: APACHE II scores were calculated for the time period 24 hours prior to randomization in the Oscillate Trial. After study completion, participating centres were later requested to retrospectively calculate APACHE II scores from the time of ICU admission. We report mean and median differences between randomization and admission APACHE II scores for all patients and by treatment group. We performed two multivariable logistic regression analyses to estimate the strengths of association within hospital for each score, accounting for age, treatment group, length of stay before randomization, and sepsis.

Results: Of the 548 patients randomized in the trial, a corresponding admission APACHE score was available in 525 (96%). Randomization APACHE II was a mean (SD) of 2 (8.0) ($p < 0.0001$) points higher than at admission, and with 56% of patients having a higher randomization APACHE score (Figure 1). In terms of absolute values, the mean (SD) difference between scores was 6.6 (5.1). These comparisons were all similar when considering patients by treatment group. A 5-point increase in APACHE II at randomization was independently associated with an odds ratio (95% CI) of hospital death of 1.57 (1.45-1.71), whereas the same increase in admission APACHE II had an odds ratio of 1.25 (1.17-1.35).

Conclusion: Average differences between randomization and admission APACHE II scores were small but for some patients, significant changes occurred. We call for more explicit reporting of APACHE documentation in randomized controlled trials.

References: Niall D. Ferguson, Deborah J. Cook, Gordon H. Guyatt, Sangeeta Mehta, Lori Hand, Peggy Austin, Qi Zhou, Andrea Matte, Stephen D. Walter, Francois Lamontagne, John T. Granton, Yaseen M. Arabi, Alejandro C. Arroliga, Thomas E. Stewart, Arthur S. Slutsky, and Maureen O. Meade. High-frequency oscillation in early acute respiratory distress syndrome. N Engl J Med 2013; 368:795-805.

Poster # 25 **Poster Session: 13:30 - 15:00**

Title: The iPad® and TalkRocket Go™ Application as a Communication Strategy for Patients With Endotracheal or Tracheostomy Tubes in the Medical Surgical Intensive Care Unit: A Pilot, Feasibility Study

Presenter: Darcy Roza, St. Michael's Hospital, Specialized Complex Care, Toronto, Canada.

Introduction: Critically ill patients commonly require mechanical ventilation through an artificial airway such as an endotracheal or tracheal tube. Although some patients with artificial airways are still able to communicate through mouthing words, gesturing, or writing, many are unable to do so effectively as a result of weakness, fatigue, or attachment to devices that restrict movement. Difficulties in communication can result in unmet needs and communication breakdowns, which are frustrating for patients, families, and clinicians.

Objectives: The objective of this pilot study was to explore the feasibility and usefulness, from the perspective of bedside clinicians in the intensive care unit (ICU), of using an iPad® equipped with TalkRocket Go™, a communication aid for patients who are unable to communicate using verbal speech.

Methods: Pilot, observational, single-centre study in a 24-bed Medical-Surgical Intensive Care Unit (MSICU). The study was approved by the local Research Ethics Board. Awake, alert, English-speaking and medically stable patients with endotracheal or tracheal tubes were identified by ICU clinicians and referred to the speech language pathologist (SLP) to assess for study eligibility. Structured cognitive testing was conducted by the SLP to determine eligibility. Patients who passed the cognitive screen were asked to consent to use of the iPad®. Clinicians caring for enrolled patients received structured training on the use of the iPad® from the SLP. Following training, the clinician was given the iPad® to use with the patient for a maximum of 60 minutes. At the end of the trial period, clinicians were asked to complete a self-administered, structured questionnaire with items relating to device training, performance, and utility to facilitate communication, and overall satisfaction with the device. Demographic and clinical data on the patient was abstracted from the medical chart.

Results: Forty patients were referred for SLP and 24 patients (60%) were deemed eligible and passed the cognitive screen. Twenty patients were enrolled in the study and used the iPad®. The majority (75%) used the device for 10 minutes or less after training. Mean patient age was 46 (SD 21.37); 50% were female and 75% had medical diagnoses. At the time of use, 11 patients (55%) had an endotracheal tube in situ and 9 (45%) had a tracheostomy. Mean duration of ventilation prior to use was 21.95 days (range 2 - 79 days). Twenty clinicians completed an evaluation form. The majority agreed/strongly agreed that: they received sufficient training (90%); the application was easy to learn (95%); the application was easy for the patient to learn (84%); the application facilitated the patient’s ability to communicate (80%); and using the iPad® to communicate was relevant to their practice (95%). The majority reported that it took less than 5 minutes for them to learn how to use the application (89%) and less than 10 minutes for patients to learn how to use the application (95%). Most were somewhat or very satisfied (80%) with the use of the iPad® as a communication tool and perceived that patients were

somewhat or very satisfied with it (63%). On a scale of 0 – 10, 75% of staff rated the usefulness of the iPad® for communication as 7 or greater.

Conclusion: It is feasible for ICU clinicians to learn and use an iPad® enabled communication tool to communicate with patients with artificial airways. The iPad® is a useful adjunct to current communication techniques in this population of patients.

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Poster # 26 **Poster Session: 13:30 - 15:00**

Title: Understanding Patient Flow: Admission, Discharge, and Family Involvement in the ICU

Presenter: Janet Alexanian, University of Toronto, Faculty of Medicine, Toronto, Canada.

Introduction: Scarcity of ICU resources and related processes for resource allocation have had significant impacts on patient outcomes (1, 2). While the rationing process, and in particular, medical criteria for admission, have been well studied in critical care research, non-medical factors that influence these decisions have not been examined to the same degree (3-7). Additionally, the impact and involvement of patient family members in these processes has remained unexamined. These aspects can provide a more complete picture of the process of patient care and related consequences on both clinicians and family members.

Objectives: This study aims to examine the patient flow process from a holistic, sociologically-informed perspective that takes into account the broader non-medical factors that influence these decisions, including the organization context, political and legal factors, and involvement of family members of ICU patient.

Methods: This ethnographic study was conducted across 4 ICU sites in Canada and the US. Over 500 hours of marginal participant observation, 50 semi-structured interviews with clinicians and 40 interviews with family members of ICU patients were conducted over one year. Observations recorded a range of interactions involving clinicians and family members during a range of formal and informal meetings and activities related to patient care issues.

Results: In-depth analysis of field notes and interview transcripts from one of the Canadian sites revealed key findings regarding patient flow. These were centred around: (1) A patient care process involving a host of professionals with wide-reaching impacts on the work of these clinicians; (2) The fact that patients' family members are often involved in the decision-making process about the delivery of care, which often led to frustration for both clinicians and family members; (3) Patient care negotiations, which shed light on clinician discourses of "appropriateness" of patients to the ICU setting and related discussions of "chronic patients."

Conclusion: This study provides a rare sociologically-informed examination of patient care in an ICU, revealing a complex process that impacts family members of patients and healthcare providers across professions. It has also highlighted the influence of political and organizational factors on resource allocation decisions.

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Poster # 27 **Poster Session: 13:30 - 15:00**

Title: Accuracy of Delivered Airway Pressure During Proportional Assist Ventilation (PAV+). A Bench Study.

Presenter: Nuttapol Rittayamai, Keenan Research Centre and Critical Department, St. Michael's Hospital, Toronto, Canada.

Introduction: Proportional assist ventilation with load adjustable gain factors (PAV+) is a partial ventilatory support mode delivering airway pressure (Paw) in proportion to patient effort, enhancing patient-ventilator interactions. The ventilator estimates muscular pressure (Pmus) by 1) using the respiratory system equation of motion with the instantaneous volume (V) and flow (V') and 2) the automatically calculated compliance and resistance through end-inspiratory occlusions randomly performed every 4-10 breaths. PAV+ has been shown to preserve breathing variability, improve comfort, decrease work of breathing and improve patient-ventilator interaction. The mode gains in popularity but the accuracy of the delivered Paw by PAV+ is unknown.

Objectives: To assess the accuracy of PAV+ by comparing the delivered Paw by the ventilator (actual Paw) to the theoretical Paw as defined by the equation of motion (PawTh) and to examine the factors influencing this accuracy.

Methods: An active servo lung (ASL5000) was programmed to generate Pmus during 4 conditions of respiratory mechanics: normal (Compliance (C) = 60 mL/cmH2O, Resistance (R) = 10 cmH2O/L/sec), obstructive (C = 60, R 20), restrictive (C = 30, R = 10), and mixed (C = 30, R = 20). A Puritan-Bennett 840 ventilator with PAV+ was used. PAV+ was tested varying gain (30 and 60%), inspiratory trigger (IT) (0.8, 5 and 15 L/min), muscular pressure (Pmus) (10 and 15 cmH2O), positive end-expiratory pressure (PEEP) (0 and 5 cmH2O), and respiratory rate (RR) (10 to 30 breath/min) to simulate intrinsic PEEP (PEEPi). PEEPi was measured using the Pmus curve. PawTh was calculated as follows: PawTh = [(V/C) + (R*V') * Gain + total PEEP]. We calculated the difference between the mean actual Paw and the mean PawTh during inspiration and between actual Paw and PawTh at 25, 50, 75 and 100% of the inspiratory time. The percentage of difference between actual Paw and PawTh was calculated as follows: % of difference = (actual Paw - PawTh)/PawTh * 100.

Results: Irrespective of respiratory mechanics and gain, mean actual Paw was always lower than mean PawTh, table 1, on average around 75% of the PawTh. This underassistance by the ventilator was greater at the beginning of the inspiratory cycle and decreased towards the end of in inspiration. These finding were replicated under different IT, Pmus or PEEP settings. A high IT led to greater underassistance versus a low IT. A high versus low Pmus was associated with a greater underassistance. A decrease in PEEP was associated with an underassistance at the start of the inspiration. A higher RR resulted in a higher PEEPi and increased total trigger delay, and affecting PAV+ accuracy, figure 1. Combining the data from all conditions, PEEPi was correlated with % of difference of meanPaw ($R2 = 0.61$, $p < 0.001$).

Conclusion: PAV+ assistance is reasonably accurate compared to PawTh, but with a constant underassistance, by around 25% on average and especially at the beginning of inspiration. PEEPi

leading to increased trigger delay is a major factor contributing to PAV+ inaccuracy. Clinical recommendations should include using a high trigger sensitivity and a careful PEEP titration when PEEPi is suspected.

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Poster # 28 **Poster Session: 13:30 - 15:00**

Title: Comparison of Pro-inflammatory and Pro-coagulant Effects of Nuclear, Mitochondrial, and Bacterial DNA

Presenter: Vinai Bhagirath, McMaster University, Department of Medicine, Hamilton, Canada.

Introduction: Sepsis is a syndrome in which infection triggers a systemic inflammatory and pro-coagulant response, with a prevalence of up to 3 cases per 1000 and a mortality rate of up to 40%. Cell-free DNA (cfDNA) is elevated in sepsis, and correlates with mortality. This DNA may come from nuclear, mitochondrial, or bacterial sources. CpG motifs on bacterial and mitochondrial DNA can stimulate inflammatory responses via TLR9, which is present on neutrophils, monocytes, and recently shown to be expressed on platelets. Nuclear cfDNA can activate coagulation via the intrinsic pathway. cfDNA may thus play an important pathogenic role in sepsis. This study elucidates the relative effects of nuclear, mitochondrial, and bacterial DNA on inflammatory and pro-coagulant pathways.

Objectives: To compare the pro-inflammatory and pro-coagulant properties of nuclear, mitochondrial, and bacterial DNA.

Methods: Nuclear and mitochondrial DNA concentrations were measured by PCR using plasma samples from septic patients. Nuclear and mitochondrial DNA were purified from human embryonic kidney 293 cells, and bacterial DNA was from E. coli. Neutrophils from healthy donors were cultured with purified nuclear, mitochondrial, or bacterial DNA at 1 or 15µg/mL. IL-6 levels in the supernatants were measured by ELISA at 16h, and neutrophil viability was measured at 20h by flow cytometry for annexin-V binding and propidium iodide exclusion. The three types of DNA were added at 1 or 10µg/mL to citrated human platelet-poor plasma, and continuous thrombin generation was measured (Technothrombin, Vienna, Austria). Washed platelets were treated with 1 or 10µg/mL of DNA and markers of platelet activation were measured by flow cytometry for P-selectin and activated integrin αIIbβ3. All reagents contained less than 0.06EU/mL of LPS by limulus amoebocyte lysate assay.

Results: Mitochondrial DNA as well as nuclear DNA are elevated in plasma from septic patients compared to healthy controls. Bacterial, but not mitochondrial or nuclear, DNA increased neutrophil IL-6 secretion. Both mitochondrial and bacterial DNA increased neutrophil viability. Nuclear, mitochondrial, and bacterial DNA increased thrombin generation in both platelet-poor plasma and platelet-rich plasma to a similar degree. This effect was reduced by addition of corn-trypsin inhibitor and in FXII-depleted plasma, and abolished in FXI-depleted plasma, indicating dependence on the intrinsic pathway of coagulation. The effect was not masked by incubation with TFAM, the major mitochondrial DNA-binding protein. Independently of coagulation, DNA from all three sources was capable of causing activation of platelet integrin αIIbβ3, but not surface expression of P-selectin or aggregation.

Conclusion: Both mitochondrial and nuclear DNA are elevated in sepsis. Bacterial DNA can stimulate neutrophil IL-6 release, while both mitochondrial and bacterial DNA, but not nuclear DNA, prolonged neutrophil viability. All three types of DNA can activate coagulation via the

intrinsic pathway, and can also stimulate platelet activation. Thus, nuclear, mitochondrial, and bacterial DNA may play distinct roles in the pathogenesis of sepsis.

References: N/A

Poster # 30 **Poster Session: 13:30 - 15:00**

Title: Human mesenchymal stem/stromal cells enhance Fcg receptor mediated phagocytosis of Escherichia coli in human monocyte derived macrophages

Presenter: Linda Garces-Ramirez, Keenan Research Centre for Biomedical Science of St. Michael's Hospital, University of Toronto, Toronto, Canada, Anesthesia Research, Toronto, Canada.

Introduction: Human Mesenchymal Stem/Stromal Cells (hMSCs) constitute a promising therapeutic strategy for sepsis and the Acute Respiratory Distress Syndrome. MSCs modulate the immune response to reduce lung injury, and enhance the clearance of bacteria, in murine and rodent Escherichia coli pneumonia {Gupta et al, 2012}, and in the isolated human lung {Lee et al, 2013}. The mechanisms by which MSCs exert beneficial effects are complex, and include their ability to modulate macrophage phenotype and function. A key function of macrophages (Mf) is to phagocytose and clear invading microorganisms.

Objectives: To explore if hMSCs are capable of enhancing IgG mediated FcgR Mf phagocytosis.

Methods: Bone marrow hMSCs and peripheral blood monocytes were isolated from healthy donors. Monocytes were differentiated to Mf over 5 days. We assessed the ability of Mf, co-cultured for 3 days with hMSCs or fibroblasts, to ingest E. coli using two methods. In the first assay live E. coli was added to Mf and 15 minutes later extracellular bacteria were washed. Intracellular E. coli, released from Mf by lysis, were plated and colonies (CFU) counted at 24h. In the second assay we tested Fcg receptor mediated phagocytosis, by adding opsonized E. coli bioparticles (tagged with green fluorophore) to Mf. Cells were fixed with 4% PFA, and streptavidin conjugate (tagged with red fluorophore) was added to enable visualization of extracellular bacteria. Images were captured using a confocal microscope. Counting of phagocytosed (green) or non-phagocytosed (red) E. coli was done at 7 randomly chosen fields/slide using Image-J software.

Results: In both assays, Mf co-cultured with hMSCs engulfed significantly more E. coli than Mf alone (control group) or Mf co-cultured with fibroblasts. In the first assay (n=3) Mf co-cultured with hMSCs (on inserts or directly) engulfed approximately 2x more live bacteria than Mf alone ($P<0.05$). Confocal microscopy of PFA fixed Mf demonstrated a significant increase in phagocytosed E. coli bioparticles (n=4) in macrophages co-cultured with hMSCs versus macrophage alone (300,299 ± 9229 particles in hMSC co-culture group vs. 206,149 ± 11043 in Mf alone, $p < 0.001$). Mf co-cultured directly in contact with hMSCs did not further enhance phagocytosis. Fibroblast co-culture had no effect on Mf phagocytosis. Our results, therefore, suggest that factors secreted from hMSCs enhance Fcg receptor mediated Mf phagocytosis.

Conclusion: Our study has shown that hMSCs enhance FcgR Mf phagocytosis. Further experiments will explore the effects of hMSCs on other phagocytic pathways.

References: Gupta N, Krasnodembskaya A, Kapetanaki M, Mouded M, Tan X, Serikov V, Matthay MA. Mesenchymal stem cells enhance survival and bacterial clearance in murine

Escherichia coli pneumonia.Thorax 2012, 67(6):533-539. doi: 10.1136/thoraxjnl-2011-201176.
Lee JW, Krasnodembskaya A, McKenna DH, Song Y, Abbott J, Matthay MA. Therapeutic effects of human mesenchymal stem cells in ex vivo human lungs injured with live bacteria. Am J Respir Crit Care Med 2013, 187(7):751-760. doi: 10.1164/rccm.201206-0990OC.

Poster # 31 **Poster Session: 13:30 - 15:00**

Title: Cell-free DNA modulates clot structure and impairs fibrinolysis in sepsis.
Presenter: Travis Gould, McMaster University, Medical Sciences, Hamilton, Canada.

Introduction: Sepsis is a life-threatening condition characterized by systemic activation of inflammatory and coagulation pathways in response to microbial infection. Sepsis remains the leading cause of death in non-coronary intensive care unit (ICU) patients and is a leading cause of morbidity and mortality in North America. There is no specific treatment available to septic patients, and clinical management remains supportive in nature. This suggests a lack of fundamental knowledge in our understanding of sepsis pathophysiology [1]. Cell-free DNA (cfDNA) has recently emerged as a link between innate immunity and coagulation. Activation of neutrophils with microbial or inflammatory stimuli results in the release of neutrophil extracellular traps (NETs) [2]. NETs consist of web-like structures comprised of cfDNA, histones, and granular enzymes that not only serve to trap and kill microorganisms, but also provide a stimulus for clot formation [2]. Furthermore, we have previously identified elevated cfDNA levels to be a predictor of ICU mortality in severe sepsis patients [3]. Thus, the aims of the present study seek to explore the potential links between cfDNA and sepsis pathophysiology.

Objectives: Although there are several studies on the effects of NETs on inflammation and coagulation, less is known about their effects on fibrinolysis. To study this we have sought to (a) investigate the relationship between elevated cfDNA levels and impaired fibrinolytic activity in septic patients; (b) recapitulate the anti-fibrinolytic properties of cfDNA in healthy plasma, and; (c) determine the mechanisms by which cfDNA mediates fibrinolysis by investigating cfDNA-mediated changes in clot structure and morphology.

Methods: Clot formation/clot lysis assays were performed using plasma samples from healthy volunteers (supplemented with or without exogenous cfDNA) and severe sepsis patients. Coagulation via the intrinsic pathway was initiated by the addition of a 15mM CaCl2 solution containing 1nM tissue plasminogen activator (tPA). Changes in clot structure were quantified by observing plasma turbidity at 450nm. Clot morphology was visualized by scanning electron microscopy on clots formed from plasma obtained from healthy volunteers and septic individuals. Fibrin diameter and fibrin density were quantified using ImageJ software.

Results: We observed an increased rate of clot formation and a delay in clot lysis in the plasma samples obtained from septic patients. In septic plasmas containing 5µg/mL or more of cfDNA, there was a complete inhibition of clot lysis, even after 5 hours. Fibrinolytic activity was restored with DNase treatment of these plasmas. This effect was recapitulated in normal plasmas supplemented with increasing concentrations of purified cfDNA, suggesting that cfDNA in itself is anti-fibrinolytic. In addition, our studies revealed a positive correlation between clot turbidity and the cfDNA concentration in septic patients, suggesting that fibrin fibers in septic patients are thicker and densely packed. Images obtained by SEM confirmed an increase in individual fibrin fiber thickness as well as an increase in overall clot density in both septic patient plasmas and normal plasmas supplemented with cfDNA.

Conclusion: Our studies are the first to suggest that cfDNA alters clot structure in sepsis,

rendering the clots resistant to fibrinolysis. Our studies identify cfDNA as a potential pro-fibrinolytic therapeutic target in sepsis treatment.

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Poster # 32 **Poster Session: 13:30 - 15:00**

Title: Human Neutrophil Peptides contributes to the development of ARDS-associated lung fibrosis

Presenter: Alice Grassi, St. Michael's Hospital, Anaesthesia, Toronto, Canada.

Introduction: Acute respiratory distress syndrome (ARDS) and ventilator induced lung injury (VILI) are characterized by neutrophil recruitment in the lung, and human neutrophil peptides (HNP) are the most abundant cationic proteins that are released into the extracellular matrix upon neutrophil activation. We have previously shown that high concentrations of HNP can lead to capillary-epithelial barrier damage in a mouse model of ARDS and VILI-associated lung fibrosis1. We hypothesized that HNP contribute to lung remodeling.

Objectives: Examine the role of HNP on lung remodeling in a mouse model of ARDS followed by mechanical ventilation (MV).

Methods: Mice endogenously expressing HNP (HNP+/+) were generated using a human neutrophil elastase promoter. The HNP+/+ and the FVB wild type (WT) mice received either HCl (pH = 1.0, 2 mL/kg) intratracheally, or vehicle solution as a control. The lung model was assessed and confirmed 48 h after HCl. In additional experiments, the mice were randomized into 3 groups 48 h after HCl: 1) no MV; 2) low pressure MV for 2h; 3) high pressure MV for 2h. The mice were weaned and monitored for 14 days for assessment of lung fibrosis.

Results: Survival rate was lower in HNP+/+ than in FVB mice (51% vs. 62%). The HNP+/+ mice showed significantly body weight loss (Fig 1A), increased neutrophil count (Fig 1B) and higher total protein concentration (Fig 1C) in lung lavage fluids associated with a trend of decreased lung compliance (Fig 1D) 48h after HCl aspiration, as compared to the FVB mice. The lung compliance remained low in the HNP+/+ mice as compared to the FVB mice at day 14 (Fig 2A).The HNP+/+ female mice had higher Ashcroft score with more severe lung fibrosis than the HNP+/+ male mice or the FVB female mice after HCl aspiration with and without receiving MV (Fig 2B). The HNP+/+ female mice showed decreased expression of the epithelial marker SP-C and increased expression of mesenchymal markers vimentin and α-SMA (Fig. 2C) than the FVB female mice.There were no differences in the fibrosis score (Fig. 2B) nor in the expression of the epithelial and mesenchymal markers between the FVB and HNP+/+ male mice (data not shown).

Conclusion: HNP amplified early exudative inflammatory phase in the mouse model of HCl-induced ARDS, which led to the development of lung remodeling at late phase. The female mice appeared to be more prone than the male mice to develop lung fibrosis in the mouse model of ARDS.

References: Zhang H, Porro G, Orzech N, Mullen B, Liu M, Slutsky AS., Neutrophil defensins mediate acute inflammatory response and lung dysfunction in dose-related fashion, Am J Physiol Lung Cell Mol Physiol. 2001 May;280(5):L947-54.

Poster # 33 **Poster Session: 13:30 - 15:00**

Title: Human mesenchymal stem cells improve survival in murine experimental sepsis via the enhancement of bacteria clearance

Presenter: Xiaolin He, The Keenan Research Centre of the Li Ka Shing Knowledge Institute, St. Michael's Hospital, University of Toronto, Interdepartmental Division of Critical Care, Toronto, Canada.

Introduction: Despite appropriate antimicrobial therapy, morbidity and mortality from sepsis remain high in critically ill patients. Moreover, there is no specific treatment strategy for the syndrome of sepsis-induced multiple organ dysfunction. Recent studies have demonstrated that the administration of mouse mesenchymal stem cells (MSCs) have beneficial effects on experimental sepsis, possibly by paracrine mechanisms (1). But, the use of human for treatment of bacterial infections, including systemic processes like sepsis, is an evolving field of investigation.

Objectives: This study was designed to investigate the potential therapeutic effects and the underlying mechanisms of human MSCs during polymicrobial sepsis induced by cecal ligation and puncture (CLP).

Methods: Sepsis was induced in C57Bl/6J mice by CLP followed 6 hours later by an intrajugular vein injection of MSCs (n=19) or phosphate-buffered saline (PBS)(n=17). For bacteria counts, 24 hours after CLP. whole blood or serially diluted blood were spread in agar plates (n=7, per group). Mouse insulin like growth factor (IGF)-1 and keratinocyte growth factor (KGF) serum levels were measured by ELISA. For survival studies, mice were monitored for 7 days with antibiotic coadministration. Body weight, temperature and glucose levels were monitored in these animals.

Results: 2.5×10(5) human MSCs administration improved 7 days survival (MSCs, 65%; PBS, 28%, p0.05). In addition, human MSCs enhanced bacterial clearance in the blood 24 h after administration of human MSCs effect that was not observed with the PBS group(figure attached). The serum IGF-1 and KGF expression levels were increased after human MSCs administration (2029.1±282.33 pg/ml and 1770.6±145.1 pg/ml) compared with PBS group (940.7±330.9 pg/ml and 952.4±172.7 pg/ml, $p<0.01$, respectively).

Conclusion: These data demonstrate that human MSCs have beneficial effects on experimental sepsis, possibly by the enhancement of bacteria clearance and the recovery of sepsis-induced reductions in IGF-1 and KGF serum expression. Further studies need be done to test the therapeutic and mechanistic effects of human MSCs.

References: (1) Mei SH, Haitsma JJ, Dos Santos CC et al. Mesenchymal stem cells reduce inflammation while enhancing bacterial clearance and improving survival in sepsis. Am J Respir Crit Care Med 2010;182:1047–1057.

Poster # 34 **Poster Session: 13:30 - 15:00**

Title: The Effects of Prone Positioning on Transpulmonary Pressures and End Expiratory Volumes in Healthy Patients

Presenter: Abirami Kumaresan, Beth Israel Deaconess Medical Center, Department of Anesthesia, Critical Care, and Pain Medicine, Harvard Medical School, Boston, United States of America.

Introduction: A recent study demonstrated a survival benefit of prone positioning in critically ill patients with Acute Respiratory Distress Syndrome (ARDS). Prone positioning was compared to a control strategy of limitation of tidal volume and plateau pressures and moderate levels of positive end expiratory pressures (PEEP). The mechanism of benefit in prone positioning is however incompletely understood. We hypothesized that one possible mechanism is a reduction in pleural pressure (Ppl), with corresponding increase in the trans-pulmonary pressure (PL), at any given PEEP. The use of esophageal pressure (Pes) as a surrogate for pleural pressure (Ppl) has been validated in previous studies in both upright and supine patients. In the supine position it has been demonstrated that the weight of the mediastinum may elevate Pes and falsely increase estimated Ppl. However, to our knowledge, the use of esophageal manometry in prone ventilated patients under general anesthesia has not been investigated.

Objectives: The objective of this study was to characterize effects of prone positioning on Pes, PL and lung volume at end exhalation in patients under general anesthesia, thereby assessing the potential utility of Pes measurements in setting PEEP in prone patients with ARDS.

Methods: Patients were healthy adults, 8 men and 5 women, undergoing elective spine surgery at a large tertiary care center. After induction of general anesthesia, an esophageal balloon catheter was passed by mouth to a distance of 30-40cm. Position of the balloon was confirmed by externally compressing the chest wall while occluding the airway and demonstrating similar spikes in Pes and airway pressure. Pes, expiratory reserve volume (ERV) and elastance were measured supine and prone position using 6cc/kg PBW tidal volumes and at PEEP levels of 0 and 7 cmH2O. The data were analyzed with Windaq software, and paired t-test was used to assess differences in measurements in the two positions.

Results: Pes in the supine position was 7.325 +/- 2.395 cmH2O and decreased when the patients were placed in the prone position to 4.072 +/- 4.161 cmH2O, ($p < 0.0014$). The mean difference between supine and prone positions was 3.254 cmH2O (95% CI 1.564 to 4.944). We observed a significant increase in ERV from supine to prone position with a mean difference of 0.211 L (95% CI 0.05332 to 0.3685, $p < 0.013$). Chest wall compliance decreased from the supine to prone, evidenced by an increase in elastance from 6.67 +/- 3.08 cmH2O/L to 13.93 +/- 4.99 cmH2O /L, ($p < 0.0003$) respectively. Lung compliance did not appear to differ with position. Supine lung elastance was 19.09 +/- 6.14 cmH2O/L and prone 19.98 +/- 8.84 cmH2O/L ($p < 0.67$).

Conclusion: Pes decreases and ERV increases when patients are moved from supine to prone. This indicates that, when prone, shifting abdominal contents and mediastinal weight allow for a greater transpulmonary pressure, resulting in greater lung volumes for a given PEEP. This may

be one of the mechanisms for the observed clinical benefit with prone positioning and an area for potential application of Pes measurements to guide application of PEEP in the prone position.

References: 1.Guérin C, Reignier J, Richard J-C, et al. Prone Positioning in Severe Acute Respiratory Distress Syndrome. The New England Journal of Medicine. 2013;368(23):2159–2168. 2.Washko GR. Volume-related and volume-independent effects of posture on esophageal and transpulmonary pressures in healthy subjects. Journal of Applied Physiology. 2005;100(3):753–758. 3.Owens RL, Campana LM, Hess L, Eckert DJ, Loring SH, Malhotra A. Sitting and Supine Esophageal Pressures in Overweight and Obese Subjects. Obesity. 2012;20(12):2354–2360.

Poster # 35 **Poster Session: 13:30 - 15:00**

Title: High prolactin levels are associated with more delirium but less nososcomial infections in septic patients

Presenter: Duc Nam Nguyen, UZ Brussel, ICU, Brussels, Belgium.

Introduction: Neuropsychological disorders (mood depression, bipolar disorder, schizophrenia) are frequently associated with hyperprolactinemia. In clinical severe sepsis, hypoprolactinemia frequently occurred and was associated with an increased risk of nosocomial infection and lymphopenia in pediatric patients

Objectives: We investigated whether delirium and nosocomial infection could be associated with high prolactin (PRL) levels in septic patients.

Methods: Serum PRL levels were measured in 101 patients within 12 hours after ICU admission and daily over the next four days. Delirium was assessed twice daily by the Richmond Agitation Sedation Scale (RASS) and the Confusion Method Assessment (CAM-ICU) after sedation withdrawal.

Results: Delirium was observed in 79 patients (78%) after sedation withdrawal, especially in the patients older than 65 years. PRL levels were higher in delirium than non-delirium patients over the four days ($p= 0.032$). In contrast, in delirium patients higher PRL levels were associated with a lower incidence of nosocomial infection ($p= 0.006$). Multivariate logistic regression showed that the Sequential Organ Failure Assessment (SOFA) score at ICU admission (Odds ratio (OR): 1.25, 95% CI (1.03, 1.47), $p= 0.010$) and the associated effect of PRL with age (OR: 1.02, 95% CI (1.01, 1.03), $p= 0.009$) were independently associated with the development of delirium after sedation withdrawal.

Conclusion: High prolactin levels could be an associated-risk factor of delirium in septic patients but protect against the development of nosocomial infections

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Poster # 36 **Poster Session: 13:30 - 15:00**

Title: A metabolomics approach to the Bacterial CAP for prognosis of mortality

Presenter: Brent W. Winston, University of Calgary, Departments of Critical Care Medicine, Biochemistry and Molecular Biology, University of Calgary, Calgary, Alberta, Canada, Calgary, Canada.

Introduction: Metabolomic profiling allows one to quantify metabolites as markers of disease that could be used for diagnosis, prognosis and prediction of response to therapy. In this study, we applied nuclear magnetic resonance spectroscopy (NMR), gas chromatography-mass spectrometry (GC-MS) and liquid chromatography mass spectrometry (LC-MS) to identify plasma metabolites from patients with community acquired pneumonia (CAP) for prognosis of those who are at highest risk of dying. These profiles were generated on plasma isolated from patients within the first 24 hours of admission to the hospital.

Objectives: We hypothesized that the plasma metabolomic profiles will be different in bacterial CAP patients who die of CAP infection ≤ 90 days after hospital admission vs. age- and sex-matched patients with CAP who survived > 90 days. This is a retrospective-prospective nested cohort study comparing metabolomic profiles of bacterial CAP survivors vs bacterial CAP non-survivors.

Methods: Plasma samples (n=150) were obtained from two bacterial CAP patient cohorts comprised of 75 non-survivors vs. 75 age- and sex-matched survivors that were identified from The Clinical Research, Investigation, and Systems Modeling of Acute Illness (CRISMA) Laboratory study patients tissue bank. We used either a procalcitonin concentration > 0.25 µg/ml or bacterial culture (sputum or blood) positivity as our screen for bacterial etiology of CAP. Untargeted GC-MS analysis revealed185 features. Untargeted NMR analyses revealed with 54 quantified metabolites. Targeted LC-MS analysis revealed 151 quantified metabolites. We used unsupervised and supervised multivariate data analyses (MVDA), including principal component analysis (PCA) and orthogonal partial least squares-discriminant analysis (OPLS-DA), to identify significant metabolic differences between the two cohorts.

Results: By analyzing untargeted NMR and GC-MS and targeted LC-MS metabolomics datasets, we found that there were metabolomic profiles in plasma that can separate the two bacterial CAP cohorts. The results indicate that a statistically significant separation in metabolic profiles exists between CAP pneumonia survivors > 90 days vs. non-survivors ≤ 90 days. Our results indicated that NMR and GC-MS methodologies were effective ($p = 0.002$) to quantitatively detect abundant plasma metabolites in both groups, whereas the LC-MS methodology was even better ($p= 1.15e-008$) for selectively detecting more discriminating features compared to NMR and GC-MS. The OPLS analysis for all NMR, GC-MS, and LC-MS datasets demonstrated a metabolic pattern that separated bacterial CAP patients dying ≤ 90 days from admission from those that survived >90 days. LC-MS showed higher predictive power ($Q2= 0.284$) than GC-MS ($Q2=0.149$) and NMR ($Q2=0.137$) (fig.1). Interestingly, if we just look at to hospital deaths vs. hospital survival, the OPLS-DA analysis and modeling showed more predictive separation between hospital survivors (those surviving to hospital discharge) and hospital deaths (those dying in hospital) for GC-MS ($Q2=0.336$) (fig.2). If we just focus on the

non-survivors (n=75), OPLS-DA analysis and modeling of NMR data showed very good separation of those who died in hospital (hospital deaths) vs. those who died after discharge from hospital within 90 days (outside hospital deaths) (Q2= 0.296) (fig.3).

Conclusion: These results highlight how combining of NMR, GC-MS, and LC-MS-based metabolomics can give comprehensive insights into bacterial CAP prognosis. Although the three techniques are most often applied separately, their combination is highly valuable for measuring a wider range of metabolites in both targeted and non-targeted manners. Due to the capacity nature of each of these techniques to identify and quantify compounds, we have a comprehensive metabolomic profile allowing for prognostication of death. These findings suggest that using a metabolomics approach may help detect and likely would have great impact on bacterial CAP outcome prediction.

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Poster # 37 **Poster Session: 13:30 - 15:00**

Title: Role of miR-27a mediated regulation of VAV3 in sepsis-induced ARDS

Presenter: Louis Zhou, Li Ka Shing Knowledge Institute, St. Michael's Hospital, Critical Care Medicine, Toronto, Canada.

Introduction: Despite recent advances in medicine, sepsis remains a disease with high mortality (30-50%). Of the many complications of sepsis, acute respiratory distress syndrome (ARDS) remains one of the most common and life-threatening illnesses. To date, there is no specific treatment for ARDS, and therapy is mainly supportive. Recent research show that mesenchymal stem cells (MSCs) have immunomodulatory and reparative potential in sepsis and ARDS (Mei et al. 2010), although the mechanism through which MSCs confer their beneficial effects is yet undetermined. To study the protective mechanisms of MSCs, we took interest in the growing field of study of microRNAs (miRs). MiRs are emerging as important post-transcriptional gene regulators in various diseases, and have potential of being novel therapeutic targets. We have identified miRs that are differentially expressed in septic lungs from MSC-treated vs non-treated mice, and generated a list of predicted targets for each miR. Particularly, miR-27a and its putative target gene VAV3 have been of interest. VAV3 is a guanine nucleotide exchange factor (GEF) for Rho family GTPases. It functions in a signaling pathway that alters actin structures, and thus has roles in cell migration.

Objectives: Our objectives are to 1) verify the regulation of VAV3 by miR-27a in our models of sepsis, 2) determine an observable phenotype through regulation of VAV3, and 3) establish the role of miR-27a mediated gene regulation in disease states of ARDS.

Methods: For our in vitro model of sepsis, we use Human Pulmonary Microvascular Endothelial Cells (HPMECs) treated with 10ng/mL of TNF-α. Through qRT-PCR and western blot, we examine changes in levels of miR-27a and differential expression of the target gene, VAV3, at RNA and protein levels. To verify regulation of VAV3 by miR-27a, we treat HPMECs with miR-27a specific inhibitor and mimic from QIAGEN, and examine subsequent changes in VAV3 expression. To observe VAV3 in a migration phenotype, we use a scratch migration assay on HPMECs treated with miR-27a specific inhibitor and mimic, and stimulated with TNF-α. Preliminary in vivo studies involve using C57BL/6 mice to perform intratracheal lipopolysaccharide (LPS) instillation for 8 hours. Lungs are collected, homogenized, and measured for RNA and protein levels of miR-27a and VAV3.

Results: We observe that VAV3 is down-regulated in both in vitro and in vivo models of sepsis, concomitant to increased levels of miR-27a. Administering the miR-27a mimic to HPMECs also demonstrates increased levels of miR-27a and down-regulation of VAV3, and vice-versa upon administering the miR-27a inhibitor. In scratch migration assays with HPMECs, both TNF-α and the miR-27a mimic are observed to decrease cellular migration, while the miR-27a inhibitor attenuates the decrease resulting from TNF-α stimulation.

Conclusion: MiR-27a functions as a post-transcriptional regulator of VAV3 in our models of sepsis. A decrease in VAV3 results in decreased cell migration, which may play important roles in wound healing and inflammation during sepsis-induced ARDS.

References: Mei, S. H. et al. Mesenchymal Stem Cells Reduce Inflammation while Enhancing Bacterial Clearance and Improving Survival in Sepsis. Am. J. Respir. Crit Care Med. (2010).

Poster # 38 **Poster Session: 13:30 - 15:00**

Title: Peritonitis Due to Kocuria Rosea in a Pediatric Peritoneal Dialysis Patient
Presenter: Tania Ahluwalia, University of Illinois College of Medicine at Peoria, Pediatrics, Peoria, United States of America.

Introduction: We report a 7-year old male with end-stage kidney disease secondary to focal segmental glomerulonephritis undergoing continuous cycling peritoneal dialysis (CCPD) with peritonitis attributable to Kocuria rosea. He presented to the emergency department with history of disconnecting himself from the cycler while he was on dialysis treatment. He was asymptomatic but per protocol, cell count and culture of peritoneal fluid were sent and intraperitoneal cefazolin and ceftazidime were empirically started. White blood cell count was greater than 100/mm3. Peritoneal fluid culture was positive for Kocuria rosea. Ceftazidime was discontinued and subject was successfully treated with cefazolin for 14 days. Kocuria rosea is rarely reported as human pathogen. To our knowledge, this is the second case reported of peritonitis due to this organism in a pediatric patient on peritoneal dialysis (1).

Objectives: To explore the management options for peritonitis due to Kocuria rosea.

Methods: N/A

Results: Kocuria species is a gram-positive, coagulase-negative Actinobacteria, difficult to isolate. It has been reported to be susceptible to penicillin, oxacillin, erythromycin, clindamycin, ciprofloxacin, levofloxacin, trimethoprim/sulfamethoxazole, vancomycin, teicoplanin and linezolid.In a previously reported case, a pediatric patient on peritoneal dialysis presented with common signs and symptoms of peritonitis (fever, cloudy peritoneal fluid). The subject in our case was asymptomatic. The culture and cell count of peritoneal fluid were checked because he disconnected himself from the cycler during the treatment. Peritoneal fluid was clear but white blood cell count was greater than 100/mm3.Initially, empiric treatment with intraperitoneal cefazolin and ceftazidime was started. Kocuria rosea grew in peritoneal fluid culture. Ceftazidime was discontinued and he was successfully treated with cefazolin for 14 days. He continued with peritoneal dialysis without problems.

Conclusion: In pediatric patients on peritoneal dialysis, rare pathogens such as Kocuria rosea can cause peritonitis.

References: 1. Dotis, J., Printza, N. & Papachristou (2012). Peritonitis attributable to Kocuria rosea in a pediatric peritoneal dialysis patient. Peritoneal Dialysis International, 32(5), 577-8.

Poster # 39 **Poster Session: 13:30 - 15:00**

Title: Incidental lung nodules: a case of epithelioid hemangioendothelioma
Presenter: Tania Ahluwalia, University of Illinois College of Medicine at Peoria, Pediatrics, Peoria, IL, United States of America.

Introduction: We report a 12-year-old previously healthy female who presented with abdominal pain and low-grade fevers. Radiographic images of the chest and abdomen showed numerous small nodules scattered throughout both lungs. A chest CT revealed soft tissue nodules throughout both lungs without hilar or mediastinal adenopathy as well as hypodense liver lesions. Hypoechoic and hyperechoic liver lesions were also identified on an abdominal US. Laboratory investigations including liver enzymes, uric acid and LDH were within normal limits. Further laboratory investigations to rule out infectious or rheumatologic etiology were negative, except for a positive mycoplasma IgM antibody screen. The patient completed a 5-day course of azithromycin. The patient underwent an ultrasound-guided liver biopsy, which confirmed a diagnosis of hepatic epithelioid hemangioendothelioma (HEH).

Objectives: To explore the epidemiology, clinical presentation, diagnostic workup and management for epithelioid hemangioendothelioma.

Methods: N/A

Results: HEH was first described by Weiss & Enzinger in 1982 to characterize a group of soft tissue vascular tumors originating from the endothelium. HEH has an incidence of <0.1 per 100 000 with most cases reported in young female adults (Ines, Petitcolin, Joubert-Zakeyh, Democq & Garcier, 2010). No specific etiology has been identified. HEH may present with right upper abdominal pain or with non-specific findings; approximately 25% of patients are asymptomatic (Ines et al., 2010). Diagnostic workup requires histology in addition to routine metastatic staging with computed tomographic scans of the chest, abdomen, pelvis and draining lymph nodes (Eckardt et al, 2011). Given the rarity of this disease, there is no standardized algorithm for treatment and management depends on liver involvement and extrahepatic spread. Surgical resection may be challenging due to extensive liver involvement and numerous nodules; for unresectable HEH, liver transplant remains an option with chemotherapy considered as preoperative treatment (Ines et al., 2010).

Conclusion: HEH is a rare, malignant vascular tumor in children.

References: Ines, D.D., Petitcolin, V., Joubert-Zakeyh, J., Demeocq, F. & Garcier, J. (2010). Epitheliod hemangioendothelioma of the liver with metastatic coeliac lymph nodes in an 11-year old boy. Pediatric Radiology, 40: 1293-1296. Eckardt, M.A., Chang, V.Y., Nelson, S.D. & Federman, N. (2011). Not all hemangiomas are benign - epithelioid hemangioendothelioma: an aggressive vascular lesion in children. 28:622-624.

Poster # 40 **Poster Session: 13:30 - 15:00**

Title: Bartonella Henselae-Mediated Disease in a Renal Transplant Patient

Presenter: Tania Ahluwalia, University of Illinois College of Medicine at Peoria, Pediatrics, Peoria, IL, United States of America.

Introduction: We report a 4-year-old female with a past medical history of end-stage kidney disease secondary to autosomal recessive polycystic kidney disease who had Bartonella henselae-mediated disease, 3 years after a kidney transplant. Her immunosuppression consisted of tacrolimus and mycophenolate. She presented with fever and abdominal pain; she was noted to have cervical lymphadenopathy and splenomegaly on physical examination. Abdominal ultrasound showed hypoechoic nodules throughout the spleen, consistent with microabscesses. The patient was exposed to a house cat. Cat-scratch disease has become more common in patients with solid organ transplants.

Objectives: To explore the etiology, clinical presentation and management of Bartonella-Mediated disease in a patient with solid organ transplant.

Methods: N/A

Results: The etiologic agent of cat-scratch disease is Bartonella henselae, an aerobic intracellular gram- negative bacillus. The major reservoir is cats and transmission to humans is due to inoculation from a cat scratch or bite.The clinical presentation in immunocompetent patients is fever and lymphadenopathy; whereas, immunocompromised patients may have severe disseminated disease. Psarros, Riddel, Gandhi, Kauffman & Cinti (2012) reported 29 cases of solid organ transplant recipients with Bartonella henselae infection of which only 28% were children, 90% had history of cat exposure, 93% presented with fever, 41% with lymphadenopathy and 24% with skin lesions.Treatment of Bartonella henselae in immunocompetent patients is supportive or requires antibiotics; however, treatment for immunocompromised patients has not been well-defined. The subject received oral azithromycin 10 mg/kg/day for 14 days and her fever and lymphadenopathy resolved.

Conclusion: It is important to include Bartonella henselae in the differential of patients with a solid organ transplant who present with fever, lymphadenopathy and splenomegaly. Splenic microabscesses might suggest Bartonella henselae infection in these patients.

References: Psarros, G., Riddel, J., Gandhi, T. Kauffman, C.A. & Cinti, S.K. (2012). Bartonella henselae infections in solid organ transplant recipients: report of 5 cases and review of the literature. 91(2):111-21.

Poster # 41 **Poster Session: 13:30 - 15:00**

Title: AN UNUSUAL FOREIGN BODY IN THE TRACHEOBRONCHIAL TREE OF AN ICU PATIENT

Presenter: ali al bshabshe, king khalid university, critical care, abha, Saudi Arabia.

Introduction: Inhalation of foreign body by no means is an uncommon occurrence. The type of foreign bodies is almost endless and their enumeration is unnecessary. Gustav Killian in 1987 was the first person to remove a foreign body from the lower air passages with a rigid bronchoscope. During the first part of the twentieth century Chevalier Jackson perfected endoscopic techniques and made perioral endoscopy an important part of medical science. Foreign body can only enter the air passage if there is some Interference with the normal reflex action, such as sudden inspiration while eating, playing, fright or laughter . In children probably the protective reflex is not as effective as in adults2 therefore these Accidents being more common in children as compared to adults. When the foreign body is first inhaled there is a bout of cough or dyspnea. The absence of a cough strongly rules out the possibility of foreign body having entered the air passage1. One study3 has classified the thoracic foreign bodies in three types according to the etiology: Type-I being the ingested/aspirated, Type-II due to trauma/ accident and Type-III iatrogenic. Foreign body ingestions or insertions are seen in four broad categories of patients: (a) children, (b) mentally handicapped or mentally retarded persons, (c) adults with unusual sexual behavior, and (d) 'normal' adults or children with predisposing factors or injurious situational problems.4

Objectives: to highlight the importance of fibre optic bronchoscope in foreign body removal in ICU setting

Methods: Here we are reporting a case of a young adult who accidentally aspirated a glass pieces of broken frontal glass of his accidentally crushed car , the aspirated glass pieces were lodged in his tracheobronchial tree and because the patient was deeply comatosed and under ventilatory support , the glass pieces were discovered accidently through our routine brain ,cervical and chest CT scan as part of trauma imaging (Figure-1).

Results: An emergency fibro-optic bronchoscopy was planned and an informed and written consent was obtained for the procedure. fibro-optic bronchoscopy was carried out under sedation { fentanyl and midazolam . 1.1cm Fragment of glass was removed from the right main stem bronchus (Figure -2) as well as multiple fragments were scattered in his right lower lobe segments. removal of these foreign bodies carried out utilizing the stone retrieval basket(dormia stone extractor ,2.5 fr ,0.8mm) through fibro-optic bronchoscope .

Conclusion: Of the tracheo-bronchial foreign bodies, only 12% will impact in the larynx with most passing through the cords into the tracheobronc-hial tree.Flexible fibro-optic bronchoscope is more easier and non traumatic for foreign body removal especially in already ventilated patients.

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http://www.ispub.com/ostia/index.php?xmlFilePath=journals/ijp n/vol6n1/tracheal.xml 2. Gupta IP, Sood VP. Foreign body in the air passages. Ind J Otolaryngol 1967;19:173–4. 3. Kim JT, Goo JM, Moon MH, Im JG, Kim MY. Foreign Bodies in the Chest: How come they are seen in adults? Korean J Radiol 2001;2(2):87–96. 4. Hunter TB, Taljanovic MS. Foreign bodies. Radiographics 2003;23(3):731 5. Sambamurty V, Ramanjaneyalu P, Ramachary V. Foreign body in food and air passage. Ind J Otolaryngol 1971; 23:84–7. 6. Baharloo F, Veyckemans F, Francis C, Biettlot MP, Rodenstein DO. Tracheobronchial Foreign Bodies: Presentation and management in children and adults. Chest 1999;115:1357–62. 7. Limper AH, Prakash UB. Tracheobronchial foreign bodies in adults. Ann Intern Med 1990;112:604–9. 8. Carney SM, Patel N, Clarke R. (eds) Foreign bodies in the ear and the aero digestive tract in children. In: Gleeson M: Scott- Brown's Otorhinolaryngology, Head and Neck Surgery. 7th ed., vol 1. Great Britain, Edward Arnold Publishers; 2008. p.1188. 9. Ayed AK, Jafar AM, Owayed A. Foreign bodies aspiration in children: diagnosis and treatment. Pediatr Surg Int 2003;19:485–8.

Poster # 42 **Poster Session: 13:30 - 15:00**

Title: Plasma exchange treatment for cardiogenic shock in refractory Kawasaki disease: Case series.

Presenter: Masafumi Gima, National Center for Child Health and Development, Critical Care Medicine, Tokyo, Japan.

Introduction: Kawasaki disease (KD), known to complicate coronary artery lesions (CALs) in children, is widely treated by immunoglobulin (IVIG). However, some develop severe hypotensive shock despite this therapy. Plasma exchange (PEX) has been applied for IVIG-resistant KD.

Objectives: NA

Methods: A report of case series.

Results: Case 1. A 2-year-old boy, who underwent IVIG treatment of total 3 g/kg, developed cardiogenic shock on day 7. Echocardiogram (UCG) revealed an enlarged right ventricle compressing the left ventricle, and severe tricuspid regurgitation (TR). Elevated troponin-T levels, reciprocal ST change in II, III, aVF on EKG were suggestive of right ventricular infarction. He was transferred to the pediatric intensive care unit (PICU) under inotropic support, where he was intubated and mechanical ventilatory support was commenced. CXR showed cardiomegaly. EKG demonstrated ventricular premature contractions and atrioventricular block. The UCG showed no CALs, similar right-sided heart findings and fair left ventricular function. Cardiac angiography demonstrated no coronary abnormalities, nor signs of infarction. Cardiogenic shock persisted despite additional administration of IVIG of 2 g/kg. Infusions of milrinone and carperitide, and inhaled nitric oxide all failed to improve cardiac function, with a left ventricular ejection fraction (LVEF) of 40%. PEX (1.5 fold plasma volume) was implemented. LVEF improved to 50% with decreased arrhythmias after the initial PEX. LVEF further improved to 60% with normal cardiac rhythms after completing 4 sessions of PEX. He was extubated on day 12, and was discharged on day 25 without CALs during the course. Case 2. A 4-year-old boy, who underwent IVIG treatment of a total of 4 g/kg, developed cardiogenic shock on day 8. He was admitted to the PICU under inotropic support. CXR revealed cardiomegaly, pulmonary congestion, and pleural effusion. UCG showed no CALs, LVEF of 40%, mild pericardial effusion, mild TR, mild MR, and mild pulmonary regurgitation. He was intubated on day 9, and PEX (1.5 fold plasma volume) was implemented. Hypotension and tachycardia improved immediately, and a total of 3 sessions of PEX was completed. Inotropes were discontinued, and LVEF improved to 63%. He was extubated on day 11, and was discharged on day 19 without CALs during the course.

Conclusion: The series of our patients indicate PEX may be effective to recover from cardiogenic shock with IVIG-resistant KD. Precise mechanism of PEX on improving cardiac function remains unknown. We are conducting cytokine and receptor assays in KD patients, which may provide further understanding of its disease process and effects of therapeutic modalities. Further study in a larger group is warranted.

References: NA

Poster # 43 **Poster Session: 13:30 - 15:00**

Title: Neuroleptic malignant syndrome with metroclopramide in a boy: case report and review of the literature

Presenter: Miguel Glatstein, Dana-Dwek Children's Hospital, Pediatric Emergency Medicine, Tel Aviv, Israel.

Introduction: Neuroleptic malignant syndrome (NMS), an idiosyncratic reaction comprised of muscular rigidity, altered consciousness, and autonomic dysfunction, is a rare but serious medical condition. It is most commonly precipitated by major tranquilizers such as butyrophenones, phenothiazines and thioxanthines. Metoclopramide, a chlorbenzamide derivative with antidopaminergic properties, is widely used to treat nausea and emesis.

Objectives: We describe the case of a child who developed NMS in association with the use of this drug.

Methods: Case: A 13 year-old male child presented to the emergency department with a history of hyperthermia (42.6ºC) and altered level of consciousness. He had recently suffered from acute gastroenteritis that was treated with metoclopramide 10 mg tid for two days. Vital signs were notable for hypotension, and physical examination revealed muscle rigidity. Laboratory testing revealed metabolic acidosis and increased prothrombin and partial thromboplastin times.

Results: He was actively cooled and received rapid boluses (60cc/kg/20 min) of isotonic crystalloids. Sepsis workup revealed no evidence of bacterial infection. He subsequently recovered fully and was discharged home with pediatric follow up.

Conclusion: This case represents the first description of NMS is association with metoclopramide in a child. It demonstrates the importance of considering this diagnosis early in the course of disease in patients with muscular rigidity, altered level of consciousness and autonomic dysfunction, and the need to rapidly respond to the physiological aberrations.

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Sorscher M, Caroff SN. Neuroleptic malignant syndrome induced by metoclopramide in an infant with Freeman-Sheldon syndrome. Anesth Analg. 2006; 103(3):786-7. 10. Heinemann F, Assion HJ, Laux G. Neuroleptic malignant syndrome from treatment with antidepressives. Fortschr Neurol Psychiatr. 1997;65(5):208-13 11. Gurrera RJ. Diaphoresis and dehydration during neuroleptic malignant syndrome: preliminary findings. Psychiatry Res. 1996;64(2):137-45. 12. Gurrera RJ, Romero JA? Sympathoadrenomedullary activity in the neuroleptic malignant syndrome. Biol Psychiatry. 1992; 32:334-343. 13. Addonizio G, Susman VL, Roth SD. Neuroleptic malignant syndrome: review and analysis of 115 cases.Biol Psychiatry. 1987; 22(8):1004-20. 14. Velamoor VR, Norman RM, Caroff SN, Mann SC, Sullivan KA, Antelo RE. Progression of symptoms in neuroleptic malignant syndrome. J Nerv Ment Dis. 1994; 182(3):168-73. 15. Nisijima K, Shioda K. A rare case of neuroleptic malignant syndrome without elevated serum creatine kinase. Neuropsychiatr Dis Treat. 2014 Feb 24; 10:403-7. 16. Bienvenu OJ, Neufeld KJ, Needham DM. Treatment of four psychiatric emergencies in the intensive care unit. Crit Care Med. 2012; 40(9):2662-70. .

Poster # 44 **Poster Session: 13:30 - 15:00**

Title: Extracorporeal membrane oxygenation, pulmonary embolectomy, and right ventricular assist device for massive pulmonary embolus: a case report and literature review.

Presenter: Joseph Bednarczyk, University of Manitoba, Winnipeg, Canada.

Introduction: Massive pulmonary embolus (PE) is a serious medical condition associated with an in-hospital mortality of 40-50% (1). Consensus regarding the management of patients with persistent shock following thrombolysis is lacking (2).

Objectives: Our primary objective was to describe the application of extracorporeal membrane oxygenation (ECMO) and right ventricular assist device (RVAD) as potential rescue therapy for acute massive PE. Second, we aimed to review previous reports of mechanical circulatory support (MCS) in the setting of PE.

Methods: After obtaining written informed consent, pre-specified hemodynamic and laboratory data and in hospital clinical course were obtained from the medical record. A structured literature review was performed.

Results: A previously healthy 30 year old male sustained multiple penetrating injuries during an assault. Initial management included tranexamic acid (1g bolus and 2mg/minute infusion) and laparotomy for primary repair of a bladder laceration. Three days later he developed acute respiratory distress and hypotension (heart rate 140, blood pressure 70/45, respiratory rate 28, and oxygen saturation 88% on 15 litres non-rebreathe mask) (Table 1). SOFA and APACHE II scores were 17 and 38 respectively. Bedside trans-thoracic echocardiography demonstrated severe right ventricular enlargement with inter-ventricular septal shift (Fig 1A). Based on rapid clinical deterioration (Table 1) and high clinical suspicion for pulmonary embolism, systemic thrombolysis (alteplase 60 mg) was administered, however after 60 minutes there was minimal clinical improvement and increased bleeding from wounds was noted.The presence of saddle pulmonary embolus was confirmed with computed tomography (Fig 1B) and veno-arterial ECMO was instituted via femoral cannulation. The goal was to maintain hemodynamic support as a bridge to pulmonary embolectomy, and allow the effects of the thrombolytic to subside prior to surgery. ECMO immediately improved oxygenation, ventilation and markedly reduced norepinephrine requirements (Table 1). The next morning, the patient was transitioned to central cardiopulmonary bypass (CPB) and an open embolectomy was performed (Figure 1C). Separation from CPB was not possible due to worsening hypoxemia and persistent right ventricular dysfunction. An RVAD system (Maquet, Ontario, Canada) with oxygenator was initiated to unload the right ventricle, maintain pulmonary blood flow and improve oxygenation (Fig 1D). After 48 hours of RVAD support, the device was removed. Intraoperative TEE showed complete recovery of right ventricular function. The patient was extubated 72 hours after decannulation. Additional post operative complications included acute kidney injury requiring temporary hemodialysis and intra-abdominal hematoma with abscess. The patient's cognitive status returned to normal. Following a structured MEDLINE search, 43 reports of MCS use in acute PE were retrieved. Of the 104 patients treated with MCS, 56 received ECMO and medical therapy alone. and 48 received ECMO and embolectomy of which five also received temporary

RVAD (3-7). Overall, 72 patients (69%) receiving MCS for PE had neurologically intact survival.

Conclusion: In the setting of massive PE and clinical deterioration despite systemic thrombolytic therapy, resuscitative ECMO and temporary RVAD to support surgical embolectomy are potentially lifesaving therapeutic considerations. Further inquiry into these forms of MCS in the setting of PE is warranted.

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Poster # 45 **Poster Session: 13:30 - 15:00**

Title: A case of severe human parechovirus infection requiring intensive care in an infant
Presenter: Yuko Nakayama, Tokyo Metropolitan Children's Medical Center, Pediatric Emergency & Critical Care Medicine, Fuchu, Tokyo, Japan.

Introduction: Human parechovirus (HPeV), previously known as echovirus, is a Picornaviridae family member. HPeV infection is most commonly associated with mild gastrointestinal or respiratory symptoms. There are 16 HPeV genotypes, of which HPeV3 causes septic shock and meningitis in infants. Here, we present a case of severe HPeV infection in an infant who required intensive care management.

Objectives: Case presentation: A 2-month-old boy presented with fever, an irregular breathing pattern, and a severely deteriorated general condition. Brain magnetic resonance imaging was performed to investigate the cause of apnea. The patient then developed severe respiratory failure and produced a large amount of bloody, foamy sputum. He was intubated immediately. A computed tomographic lung scan revealed poor permeability of the entire lung, indicating pulmonary edema. As echocardiography revealed severely impaired left ventricle contraction, congestive heart failure was suspected as the cause of acute respiratory failure. The patient was admitted to the pediatric intensive care unit and received high-frequency oscillatory ventilation with milrinone and epinephrine. On the second day after admission, the patient's cardiac function improved considerably. As his respiratory condition improved, the ventilator setting was gradually reduced toward weaning, beginning on the third day after admission. Subsequently, the patient was extubated on the ninth day after admission. Because of concern regarding sepsis development, he was also given empirical antibiotics and acyclovir along with systemic steroids. Polymerase chain reaction, which was performed later, indicated the presence of HPeV in his serum and cerebrospinal fluid at admission. Accordingly, he was diagnosed with sepsis and meningitis due to HPeV infection. The patient was discharged on the tenth day after admission without any neurological deficits.

Methods: None

Results: HPeV infections present with various symptoms such as fever, irritability, sucking weakness, exanthema, and respiratory and gastrointestinal symptoms. HPeV infection is also a well-known cause of septic shock and encephalopathy in infants. Polymerase chain reaction assays are useful for rapid HPeV detection in such patients.

Conclusion: HPeV infection can lead to death or serious neurological impairment, and therefore early recognition of sepsis and appropriate management of patients with such severe disease are necessary to improve prognosis.

References: 1. Eis-Hübinger AM, Eckerle I, Helmer A, et al. Two Cases of Sepsis-Like Illness in Infants Caused by Human Parechovirus Traced Back to Elder Siblings with Mild Gastroenteritis and Respiratory Symptoms. J Clin Microbiol. 2013 Feb;51(2):715-8. 2. Abed Y, Boivin G. Human parechovirus types 1, 2 and 3 infections in Canada. Emerg Infect Dis. 2006 Jun;12(6):969-75. 3. Wolthers KC, Benschop KS, Schinkel J, et al. Human parechoviruses as an

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Poster # 47 **Poster Session: 13:30 - 15:00**

Title: Hypercalcemic Crisis Secondary to Parathyroid Adenoma in a Pregnant Woman
Presenter: Kate Gerster, McMaster University, Hamilton, Canada.

Introduction: Hypercalcemic crisis is a rare, but potentially life-threatening complication of hyperparathyroidism. The physiologic changes in calcium homeostasis associated with pregnancy present unique challenges to both diagnosis and management of hyperparathyroidism and hypercalcemia.

Objectives: NA

Methods: A 28-year-old gravid woman at 24 weeks and four days' gestation presented with confusion and epigastric pain. She was diagnosed with pancreatitis, acute renal failure, and severe hypercalcemia, with serum calcium 3.63 mmol/L. Given her viable pregnancy, treatment with calcitonin, rather than bisphosphonates, was initiated. Transfer to a centre with a level III neonatal intensive care unit was arranged, as both pancreatitis and hypercalcemia put her at high risk of preterm labour. Neck ultrasound revealed a parathyroid adenoma, which was treated with urgent parathyroidectomy after initial stabilization. Post-operatively, she developed hungry bone syndrome. Thereafter her medical issues resolved gradually, and her pregnancy progressed without any sign of preterm labour or development of any of the hypertensive disorders of pregnancy. At the time of abstract submission she remained pregnant at 37 weeks and one day's gestation.

Results: Hypercalcemia in pregnancy is often masked by physiologic hemodilution, increased glomerular filtration, and shunting of calcium across the placenta. Nevertheless, morbidity and mortality from severe hypercalcemia are high. Pregnant women are especially prone to nephrolithiasis and pancreatitis, although they can manifest any of the classic signs and symptoms of hypercalcemia. In addition, pregnancy-specific complications include preeclampsia, as well as hypercalcemic crisis at the time of delivery, when calcium shunting across the placenta is abruptly cut off. The fetus may be growth restricted, or may become tetanic in the neonatal period due to hypocalcemic secondary to in utero suppression of the fetal parathyroid glands. Neonatal mortality in these cases can approach 25%.

Conclusion: This interesting case and literature review highlight the unique diagnostic and therapeutic challenges posed by hypercalcemia in pregnancy, due to both the physiologic changes of pregnancy, as well as the lack of robust data on safety and utility of many common investigations and therapies in the pregnant woman.

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Poster # 48 **Poster Session: 13:30 - 15:00**

Title: A Clinical Case Report of a Type A Dialyzer Reaction: Anaphylactic Shock to a Hemodialysis Membrane

Presenter: Allison Brown, McMaster University - Michael G. DeGroote School of Medicine, Hamilton, ON, Canada.

Introduction: Approximately 4 of every 100,000 patients experience dialyzer reactions following the interaction between blood constituents and the hemodialysis membrane. Dialyzer reactions, occurring in 0.004% of patients, are the abnormal sequelae resulting from the interaction between blood constituents and the hemodialysis membrane. Leachable substances may cause these reactions from the dialyzer (e.g. ethylene oxide) or by contamination with bacterial peptides (1). Type A dialyzer reactions occur within the first minutes of dialysis and include symptoms of: itching, burning sensation at the access site, urticaria, flushing, cough, sneezing, wheezing, abdominal cramps, diarrhea, headache, back and chest pain, nausea, vomiting, fever, and chills. More severe reactions result in severe reactions lead to dyspnea, a sense of impending doom, and hypotension, potentially resulting in cardiac arrest and death.

Objectives: (1) Present a rare case of type A dialyzer reactions to a hemodialysis membrane that resulted in anaphylactic shock, cardiac arrest and death. (2) Discuss type A dialyzer reactions and fatal anaphylaxis

Methods: Consent was obtained from the patient's next of kin. Information was gathered retrospectively through medical records.

Results: In our ICU, we received a 70-year old post-cardiogenic shock male patient who was transferred to us following urgent percutaneous coronary intervention for his left main occlusion and receiving two drug eluding stents in LAD and circumflex. This patient also received an intra-aortic balloon. Right coronary artery was completely occluded. The patient was transferred into our ICU, where his stay was complicated by airway edema resulting in failed extubation requiring steroids, CHF requiring diuresis, rapid atrial fibrillation requiring amiodarone infusion, MRSA pneumina requiring vancomycin, sepsis of unknown origin requiring piperacillin/tazobactam and altered level of consciousness/delirium requiring neurology consult and CT imaging of head which suggested against severe anoxic brain injury. For his difficult ventilator wean, a percutaneous tracheostomy was performed. His other complication included renal failure, which necessitated his transfer to our ICU for potential need of renal replacement therapy. After insertion of temporary hemodialysis catheter, the patient was placed on dialysis machine with Revaclear Max 400 membrane. Unfortunately, the patient suffered from recurrent blood clotting on the dialysis membrane precluding effective dialysis. Therefore, the nephrology team decided to switch the membrane to Rexeed polysulfone dialyzer (Asahi). Within minutes of dialysis using the Rexeed polysulfone dialyzer membrane, patient developed bronchospasm followed by hypotension requiring the discontinuation of dialysis. A diagnosis of anaphylactic reaction against the dialysis membrane was made and the use of intravenous epinephrine bolus for blood pressure support was initiated. In addition, corticosteroid, bronchodilators, H1 and H2 receptor blockers were used. Patient initially responded to epinephrine bolus but after a few minutes, patient became hypotensive again. After using 3 boluses of epinephrine, an epinephrine

infusion drip was initiated for ongoing blood pressure support as a treatment for prolonged anaphylactic reaction. Unfortunately, the patient went into ventricular tachycardia cardiac arrest, which necessitated the initiation of advanced cardiopulmonary life support (ACLS) including defibrillation, the administration of epinephrine, magnesium sulphate and sodium bicarbonate. The VT arrest alternated with short run of atrial flutter with slow ventricle response. After 40 minutes of ACLS, the patient was unfortunately pronounced dead.

Conclusion: We believe this unfortunate gentleman suffered a rare case of severe anaphylaxis to the access suture and hemodialysis filter, which resulted in hypotension requiring epinephrine infusion. We suspect this patient suffered a myocardial infarction as a result of the epinephrine. Following prompt discontinuation of dialysis and aggressive resuscitation efforts, this patient died. We hope this case report sheds light on dialyzer reactions, anaphylaxis, and management of anaphylaxis in patients with cardiovascular disease.

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Poster # 49 **Poster Session: 13:30 - 15:00**

Title: Neutrophil gelatinase-associated lipocalin (NGAL) and stress-induced hyperglycemia in critically ill children

Presenter: Tania Ahluwalia, University of Illinois College of Medicine at Peoria, Pediatrics, Peoria, United States of America.

Introduction: Hyperglycemia is common in critically ill patients and it has been associated with increased mortality and morbidity in adults and children [1-3]. However, it is still not clear if stress-induced hyperglycemia correlates with acute kidney injury (AKI)[2]. The incidence of AKI in critically ill patients is difficult to estimate due to the lack of a standard definition. Over 30 definitions of AKI have been published [4]. AKI is associated with significant mortality, as high as 60% [5]. Therefore, prevention of AKI is crucial and includes hemodynamic support, maintenance of euvolemia and avoidance of nephrotoxic agents. Current research has identified a set of kidney injury biomarkers including neutrophil gelatinase-associated lipocalin (NGAL), which may be used for early clinical recognition of patients at risk for AKI [6].

Objectives: To find the association between acute kidney injury based on the pediatric RIFLE criteria, serum and urine neutrophil gelatinase-associated lipocalin and hyperglycemia in critically ill patients.

Methods: We conducted a prospective cohort study of 27 critically ill subjects admitted to the pediatric intensive care unit (PICU). Inclusion criteria were critically ill children 12 months to 18 years of age admitted to the PICU. Exclusion criteria: 1. Diabetes mellitus type 1 and 2 2. Death within 48 hours of admission 3. S/P kidney transplant 4. Requiring renal replacement therapy 5. Chronic kidney disease 6. Requiring treatment of hypoglycemia 7. Systemic steroids within 48 hours 8. Immediate post-cardiac surgery 9. Pregnancy 10. Requiring >7 days in the PICU for tracheostomy care or social issues We determined the intensity of acute kidney injury using the pediatric RIFLE criteria [4]. Two groups were compared, subjects with and without AKI on admission.

Results: 27 critically pediatric subjects were included. 8 of those patients had AKI according to the pediatric RIFLE criteria. A positive correlation between peak glycemia during admission and serum NGAL was found, $p = 0.03$. Urine NGAL was not associated with higher glycemia, $p=0.9$.

Conclusion: We found a positive correlation between serum NGAL on admission and peak glycemia during PICU admission. Although we found higher levels of NGAL in urine in subjects with AKI, it was not statistically significant. Serum glucose and NGAL are useful tools in treating critically ill pediatric subjects.

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Poster # 50 **Poster Session: 13:30 - 15:00**

Title: Manual Muscle Strength Testing In Critically Ill Children: Feasibility and Reliability.

Presenter: Samah Al-Harbi, McMaster University/McMaster Children's Hospital, Pediatric, Hamilton, Canada.

Introduction: Diagnosing Pediatric Intensive Care Unit acquired weakness (PICU-AW) is difficult because of challenges in assessing muscle strength. The Medical Research Council (MRC) grading is a widely used screening method for muscle weakness in critically ill adults(1) however its utility for screening PICU-AW has not been established.

Objectives: To determine the feasibility and inter-observer reliability of muscle strength testing using MRC in critically ill children.

Methods: A prospective observational sub-study of the "Wee-Cover" pilot study conducted at McMaster Children's Hospital. Participants aged >1 year to <18 years of age, admitted to the ICU and limited to bed rest during the first 48 hours of admission were evaluated with weekly MRC exams independently performed by two clinical raters.

Results: There were a total of 95 attempted MRC exams on 33 participants. Fifty-five (57%) of these could not be conducted or completed, and therefore a MRC sumscore could not be assigned. Nine (27%) participants had at least one exam completed while in the PICU, and twenty-one (64%) participants had at least one exam completed before discharge from hospital. Commonest reasons for inability to perform MRCs were patient sedation, and inability to comply due to cognitive ability, pain, or non-cooperation. Inter-rater reliability demonstrated poor reproducibility.

Conclusion: We found that MRC is neither feasible nor reliable as an early screening tool for PICU-AW. Poor reliability was attributable primarily to patient related factors. Future research evaluating the efficacy of exercise based rehabilitation should focus on more meaningful patient endpoints such as functional outcomes and recovery.

References: (1) De Jonghe B, Bastuji-Garin S, Sharshar T, Outin H, Brochard L. Does ICU-acquired paresis lengthen weaning from mechanical ventilation? Intensive Care Med 2004;30(6):1117–1121.

Poster # 51 **Poster Session: 13:30 - 15:00**

Title: Brain tissue oxygenation as a surrogate marker for acute neurological dysfunction in patients with septic shock: a pilot study

Presenter: Andy Song, Queen's University, Kingston, Canada.

Introduction: Delirium is acute brain dysfunction characterized by disordered thinking, inattention, and fluctuating impairments in consciousness. It is a common problem in the intensive care unit (ICU). The duration of delirium is the strongest predictor of long-term neurological dysfunction among ICU survivors. The etiology of delirium is unknown.

Objectives: We hypothesize that poor cerebral oxygen delivery, as measured by near infrared spectroscopy (NIRS), contributes to delirium in patients with severe sepsis/septic shock. The objective of this pilot study was to demonstrate the feasibility of using NIRS to measure cerebral oxygenation (CeO2) in patients with severe sepsis/septic shock, and to correlate these values with the development of acute neurological dysfunction (coma or delirium).

Methods: Eligible adult patients were recruited if they met the SCCM's definition of septic shock. CeO2 was recorded continuously for the first 72 hours of ICU with the CASMED FORESIGHT NIRS monitor and 5 cm sensors. Physiological and biochemical data were also collected. Daily delirium screening was performed using the Confusion Assessment Method-ICU (CAM-ICU) until the patient was discharged from the ICU.

Results: This pilot study has recruited 10 patients. The NIRS monitor recorded an average of 81% of the possible data (range 45-98%). The missing data was excluded by the NIRS monitor due to low signal strength. Mean CeO2 values ranged from 46-77% (normal range 70-80%). No consistent relationship was observed between CeO2 and physiological/biochemical parameters (e.g. mean arterial pressure, heart rate, pO2, and pCO2), with considerable inter-individual variability. Three patients were comatose (no response to external stimuli) for the duration of their ICU stay. As shown in the accompanying figure, a lower range of cerebral oxygenation values was recorded for patients that screened positive for delirium during the majority of their ICU stay (32-79%, n=3), compared to those who screened negative for delirium for the majority of their ICU stay (53-92%, n=4).

Conclusion: We have established the infrastructure necessary, and have demonstrated the feasibility of continuously recording CeO2 with NIRS in patients with septic shock. The relationship between CeO2 and delirium is being investigated in a larger study currently in progress.

References: n/a

Poster # 52 **Poster Session: 13:30 - 15:00**

Title: Using robotic technology to quantify neurological recovery in apparent high functioning survivors of cardiac arrest: a pilot study

Presenter: J. Gordon Boyd, Queen's University, Medicine (Neurology) and Critical Care, Kingston, Canada.

Introduction: Neurologic outcome after cardiac arrest remains poorly defined, with most studies using 5-point rating scales, such as the Cerebral Performance Category (CPC). These rating scales do not provide the granular data necessary to examine the efficacy of modern neuroprotective strategies to improve neurological recovery after cardiac arrest. The KINARM Robot (BKIN Technologies, Canada) provides quantitative metrics of sensorimotor and neurocognitive function. This tool has been used to demonstrate subtle neurological deficits in stroke patients not identified by routine neurological testing. Importantly, these subtle deficits correlated well with quality of life metrics (Coderre et al., 2010).

Objectives: The primary objective of this study was to demonstrate the feasibility of using robotic technology to provide a quantitative definition of neurological function among survivors of cardiac arrest.

Methods: We recruited survivors of cardiac arrest who were all treated with targeted temperature management in our 33-bed medical-surgical ICU. The KINARM end-point device was used to quantify performance on several tasks unique to the robot, including: arm reaching, position matching (proprioception), object hit/hit and avoid (visuomotor and executive), and spatial span (working memory). Subjects also performed an automated version of the Trails A and Trails B test to assess set shifting. Subject performance was compared to a large normative database, thus Z-scores were available for most tasks performed. Additionally, subject performance was compared to the performance of patients awaiting coronary artery bypass surgery who served as an active control group.

Results: This pilot study has recruited 14 (6 post cardiac arrest, 8 active controls) patients. All cardiac arrest subjects would be traditionally defined as having a good neurological recovery according to their CPC at the time of testing (5 were CPC 1-normal; 1 was CPC-2-moderate neurological disability). The mean age of subjects was 49 (range 19-71). They were assessed 1-24 months after cardiac arrest. The active control group was significantly older (mean 68, $p = 0.03$), limiting direct comparisons between groups. For some of the tasks that z-scores were available, we noted that these apparent high-functioning survivors of cardiac arrest scored outside the normal range (defined as z-score +/- 1.5). For example, 2 of 6 cardiac arrest subjects had performance outside the normal range for maximum speed of arm reaching and errors on a limb-matching (proprioception) task. None of the active controls performed abnormally on these tasks.

Conclusion: CoWe have established the infrastructure necessary, and have demonstrated the feasibility of using robotic technology to quantify neurological function in high functioning survivors of cardiac arrest. We are currently enrolling patients into a larger study in order to

build a precise and quantitative definition of the spectrum of neurological recovery after cardiac arrest.

References: Coderre AM., Zeid AA, Dukelow SP, et al., (2010). Assessment of Upper-Limb Seonsorimotor Function of Subacute Stroke Patients Using Visually Guided Reaching. Neurorehab and Neur Rep. 24, 528-41.

Poster # 53 **Poster Session: 13:30 - 15:00**

Title: A survey of physician practice changes, knowledge of and attitudes towards the Rasouli decision.

Presenter: David Cape, University of Toronto, Medicine, Toronto, Canada.

Introduction: In the recent Rasouli decision, the Supreme Court of Canada ruled that the withdrawal of life support in certain cases requires patient or substitute decision-maker (SDM) consent. It is well-established that physician understanding of medical case law impacts practice patterns across a variety of specialties-even if the understanding is incomplete or inaccurate. We surveyed Canadian academic intensivists to learn their understanding and opinions of the Rasouli decision, and how it has changed their practice.

Objectives: We sought to determine the self-reported changes in practice that have occurred as a result of the Rasouli decision, as well as attitudes towards the decision.

Methods: We surveyed intensivists in academic hospitals across Canada. We used explicit questions and realistic vignettes to assess end-of-life care decision making in cases of physician-SDM conflict, asking in each scenario how the Rasouli decision has changed practice, and what management would be "most appropriate" independent of legal considerations. The vignettes presented intractable disputes involving the withholding or withdrawal of life-sustaining measures for a patient with a very poor prognosis. We used a knowledge test to measure physician understanding of the legal decision. We used paired t-tests to assess changes in aggressiveness of management, and measured differences in pre-defined subgroups. We used a Chi-square test to measure changes in behaviour on explicit questions.

Results: We received 80 responses from across Canada. According to vignette-based questions, there were important differences in the care that respondents would provide before and after the Rasouli decision (Kappa=0.67). Respondents are significantly more likely to provide aggressive care following the Rasouli decision ($p=0.01$), and significantly less likely to provide care that they felt was "medically appropriate" ($p=0.03$), even in cases that are not analogous to Mr. Rasouli. The shift away from "medically appropriate" care was significantly larger in respondents from Ontario than from the rest of Canada, but was significant in both groups. Respondents reported familiarity with the decision, although knowledge scores were moderate (60%). Knowledge scores were not associated with differences in responses on the vignettes. Respondents held generally unfavourable views of the decision and its implication for patients and the healthcare system. Both pre- and post-Rasouli, there was a high rate of compliance with SDM directives in cases of SDM – physician dispute—even when this led to care the respondents acknowledged to be medically inappropriate. Most respondents felt withdrawal of life support (57%) and other therapies (71%) should in principle be a medical decision that would not require patient / SDM consent.

Conclusion: Our results suggest that the Rasouli decision has influenced Canadian intensivists to provide or continue more aggressive care for their patients, even outside Ontario, and even in cases that are not analogous to Mr. Rasouli. Notably, our respondents were already likely to seek SDM consent when deciding whether to withhold or withdraw care for the critically ill—even

when that care was acknowledged to be medically inappropriate. The Rasouli decision has influenced more physicians to provide or continue care that they feel is medically inappropriate.

References: None.

Poster # 54 **Poster Session: 13:30 - 15:00**

Title: Patient-Ventilator Asynchrony during Weaning on Proportional Assist Ventilation versus Pressure Support

Presenter: Robert Coke, University of Western Ontario, Internal Medicine, London, Ontario, Canada.

Introduction: IntroductionFor patients undergoing mechanical ventilation (MV), patient-ventilator asynchrony can occur when the patient's spontaneous respiratory efforts are no longer congruent with the ventilator's. The degree of ventilator asynchrony can be denoted by the Asynchrony Index (AI), where an AI>10 is considered to be significantly high and is associated with prolonged duration of MV. Proportional Assist Ventilation, with load adjustable gain factors, (PAV+™, Covidien, Boulder, USA), is a spontaneous breathing mode that offers assistance to the patient in proportion to the patient's effort and thus should promote patient-ventilator synchrony.

Objectives: This study was carried out in order to examine whether or not patients tolerating partial ventilatory support experience less asynchrony using a PAV+ weaning algorithm comparedto a conventional Pressure Support Ventilation (PSV) weaning algorithm.

Methods: Patients first tolerating partial ventilatory support, were screened, and if eligible, were assigned to either a PAV+ or PSV weaning algorithm as part of a pilot observational study (13 patients) or pilot randomized controlled trial (52 patients). Ventilator tracings of flow, and airway opening pressures were recorded for 30 minute intervals using ICU-lab (KleisTek, Bari, Italy) pre-(baseline) and post-algorithm initiation. Asynchrony was detected by visual inspection of the flow and pressure signals. Respiratory recordings were subcategorized according to mode, level of assistance, and pre- or post-algorithm initiation. Continuous non-normal variables were analyzed using the Wilcoxon signed rank tests and categorical variables using the $\chi 2$ or Fisher exact test.

Results: Patients were well matched at baseline in terms of age, gender, BMI, and APACHE II score. There was a higher incidence of COPD/asthma in the PSV group (p=0.04). Overall incidence of AI>10 at baseline was 14/65 (22%), with 7/35 in the PAV+ group, and 7/30 in the PSV group having an AI>10 (p=0.77). After initiating weaning algorithms, 0/32 patients in PAV+ group experienced AI>10 vs. 3/29 on PSV (p=0.10). Median (IQR) AI decreased post algorithm initiation in both the PAV+ and PSV groups: from 3.4(1.2-6.4) to 1.4 (0.6-2.2) on PAV+ (p10 with levels of ventilator assistance <10cmH2O , (p=0.04).

Conclusion: Both weaning protocols showed comparable reductions in AI compared to baseline. A small sample size, as well as the fact that the majority of patients (80% of PAV+, and 77% of PSV) were not experiencing AI>10 at baseline made it difficult to determine differences in treatment effect of PAV+ compared to PSV in reducing asynchony. Furthermore, many patients required less than 10cmH2O of support at baseline, which in previous studies, has been associated with lower AIs. In summary, a larger sample size, with more patients experiencing significant asynchrony at baseline may be necessary to see a significant difference between the two weaning algorithms.

References: 1.Thrille AW et al. Patient-Ventilator asynchrony during assisted mechanical ventilation. Intensive Care Med (2006) 32:1515–1522. 2. JM Boles et al. Weaning from mechanical ventilation. Eur Respir J 2007; 29: 1033–1056. 3.Vitacca, M. et al. Assessment of Physiologic Variables and Subjective Comfort Under Different Levels of Pressure Support Ventilation. Chest (2004) 126: 851-859. 4.Bosma, K. et al. Sleep disturbances in the critically ill patients: role of delirium and sedative agents. Crit Care Med. (2007) 35:1048-54. 5.Pierson, D. et al. Patient-Ventilator Interaction. Respir Care 2011;56(2):214-228. 6.Williams K, Hinojosa-Kurtzberg M. et al. Control of breathing during mechanical ventilation: who is the boss? Respir Care 2011;56(2):127–139.

Poster # 56 **Poster Session: 13:30 - 15:00**

Title: Availability of ARDS therapies and protocols in Canadian ICUs

Presenter: Erick Duan, McMaster University, Department of Critical Care, Hamilton, Canada.

Introduction: ARDS treatment strategies are determined, in part, by emerging clinical research, knowledge translation and resource availability (1).

Objectives: The objective of this report is to describe the availability of various ARDS treatment strategies and protocols in ICUs across Canada.

Methods: Nested within an ongoing observational study of ARDS management, we surveyed 25 of the Canadian ICUs that participated in Oscillation for ARDS Treated Early (OSCILLATE), a trial of early high frequency oscillation for moderate to severe ARDS. In March 2014, we asked clinical research coordinators and physician leaders to report on the current availability of various conventional and advanced ventilation technologies and respiratory adjuncts, as well as the availability of local protocols to guide implementation. We utilized an electronic, self-administered questionnaire to research coordinators and sought consultation with physician leaders by email if clarification was needed.

Results: 25 ICUs from 5 Canadian provinces are represented in this report. The response rate was 100%. No sites declined. The mean bed count was 25 (SD +/- 9). 23 ICUs have rotating residents and 20 have research coordinators. The most commonly available adjuncts to ARDS management were airway pressure release ventilation (100%), pulmonary vasodilators (96%), high frequency oscillation (90%) and esophageal pressure monitoring (60%). Extracorporeal life support (ECLS) was only available in 40% of centres, but 96% of these centres indicated they could access ECLS at another nearby centre. In the 10 centres with ECLS, Novalung iLA was available in 8 centres, extracorporeal membrane oxygenation (ECMO) in 7 centres, and Hemolung RAS in 2 centres. The most commonly available protocols for ARDS management were for low tidal volume ventilation (84%), high frequency oscillation (80%), pulmonary vasodilators (76%), PEEP/FiO2 table (72%), and prone positioning (72%).

Conclusion: Amongst the 25 Canadian ICUs surveyed, the most available ventilation adjunct for ARDS is APRV, which has a physiologic basis but without proven mortality benefit (2,3). The most common protocol at these centres is for low tidal volume ventilation, an evidenced-based ventilation strategy shown to reduce mortality in ARDS (4).

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Poster # 58 **Poster Session: 13:30 - 15:00**

Title: The Role of Critical Care Response Teams in End-of-Life Care

Presenter: Adrienne Kwong, The Ottawa Hospital, Department of Critical Care, Ottawa, Canada.

Introduction: Recent studies have documented the involvement of Critical Care Response Teams (CCRT) in end-of-life care and discussions about limitations of medical therapy.(1,2,3,4,5) However, there is little information about the features of these interactions or the perspectives of the individuals and teams participating in these situations.(6,7)

Objectives: We designed a qualitative study to explore and describe the roles, interactions, and perspectives of CCRT members in the provision of end-of-life care.

Methods: A conceptual model, centered on the CCRT and its interrelationships with patients/families and healthcare professionals, provided the framework for a qualitative strategy to describe the interface between CCRT and end-of-life care. Members of the CCRT sampled in this study included registered nurses (RNs), respiratory therapists (RTs), and physicians. Data was collected through semi-structured focus groups and one-on-one interviews, which represented the scope of CCRT practice at our centers. Thematic coding using a modified Grounded Theory approach(8) was applied to this data set and themes were agreed upon by a core coding team of four members comprised of two qualitative researchers and a physician and RN with CCRT experience.

Results: Focus groups (n=5; 6.5 hours of data) and interviews (n=6; 4 hours of data) were conducted with RNs (n=13), RTs (n=4), and physicians (n=6) who were all established members of CCRTs at two tertiary care hospitals in Ontario, Canada. This process was iterative and continued until saturation of themes was reached. Analysis is currently ongoing; however, preliminary transcript analyses for emerging themes indicate that CCRT members encounter a number of challenges when involved in end-of-life care. Issues relating to physician experience and aptitude with end-of-life care have emerged, particularly in reference to residents who are on-call overnight. CCRT members also reflected that patients' and families' lack of understanding about end-of-life care is an additional barrier in end-of-life care management. In response to these observations, CCRT members suggested solutions to these barriers such as emphasizing their patient advocacy role and understanding the role of cultural and social contexts in end-of-life decision making.

Conclusion: The results of this study will contribute to our understanding of roles that CCRTs play in end-of-life decision making. Additionally, CCRT perspectives inform stakeholders about institutional factors and education needs related to provision of quality end-of-life care in acute care facilities. And finally, these findings provide insight into society's awareness of end-of-life issues, advanced planning, and decision making.

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Poster # 59 **Poster Session: 13:30 - 15:00**

Title: Quality Control In the Conduct of a Probiotic Randomized Trial

Presenter: Daphnée Lamarche, McMaster University, Biochemistry and Biomedical Sciences, Hamilton, Canada.

Introduction: Probiotics are defined as microorganisms, which when ingested, confer health benefits to the host. Probiotics are considered a natural health product in Canada. The imprecise definition of probiotics, and different standardization procedures for dietary supplements raise questions about dose consistency. Furthermore, once probiotics leave the manufacturer, typically no further analysis is performed to examine the integrity of the product. Randomized trials suggest that probiotics reduce the incidence of ventilator associated pneumonia and other acquired infections in the ICU, including clostridium difficile. To investigate these findings more rigorously, a randomized, blinded pilot trial is underway: PROSPECT (Probiotics to prevent Severe Pneumonia and Endotracheal Colonization Trial), which is evaluating enteral Lactobacillus rhamnosus GG versus placebo twice daily, to examine feasibility outcomes.

Objectives: The objective is to evaluate the integrity of the probiotics administered in the PROSPECT Pilot Trial. We established a microbiological quality control procedure to evaluate whether the study product corresponds to 10 to the power of 10 Colony Forming Units (CFUs) of Lactobacillus rhamnosus GG per capsule.

Methods: From each site participating in the PROSPECT Pilot Trial, 1 of every 100 capsules scheduled for administration to patients are sent to the central Microbiome Laboratory of Dr. Surette at McMaster University, Hamilton, Ontario. Protocolized handling and shipping ensures the study product integrity during transportation. When the study product is received at the laboratory, we inoculate de Man, Rogosa and Sharpe (MRS) and Brain Heart Infusion (BHI) agar media with the appropriate dilution. MRS medium is selective for lactic acid bacteria such as Lactobacillus, while BHI media is a non-selective nutrient-rich medium. We determine the total CFU per capsule, and compare that to what is prescribed in the PROSPECT Pilot Trial, and to evaluate whether organisms other than Lactobacillus are recovered.

Results: To date, 18 probiotic capsules have been tested. Results show that every probiotic capsule contained at least 10 to the power of 10 CFU of Lactobacillus rhamnosus GG. No other microorganisms were recovered. We observed that the bacterial content of the capsules decreased over time but still remained above the established threshold for many months. Prior to the beginning of the trial in September 2013, 5 probiotic capsules were tested and showed a mean CFU count of 1.92 x 10 to the power of 14 CFU (standard deviation 1.76 x 10 to the power of 14 CFU). Then in June 2014, 5 more capsules were tested, and the counts were still elevated, surpassing the CFU threshold of the prescribe probiotic (10 to the power of 13 CFU per capsule). In September 2014, 10 more capsules were tested, yielding a mean count of 1.95 x 10 to the power of 10 CFU (standard deviation 3.76 x 10 to the power of 9).

Conclusion: The importance of quality control is illustrated by this study, to ensure stable probiotic products over time. Viable organisms remained in amounts above the CFU threshold for over one year, such that dose attenuation was not observed. We identified no contamination.

The PROSPECT Pilot Trial capsules tested during this quality control study reflect the doses prescribed by the protocol.

References: NA

Poster # 60 **Poster Session: 13:30 - 15:00**

Title: African Critical Care Resource Assessment Survey: Pilot survey results

Presenter: Aleksandra Leligdowicz, University of Toronto, Interdepartmental Division of Critical Care, Toronto, Canada.

Introduction: The burden of global critical illness is substantial, but information aboutavailability of critical care resources is scarce. We designed a survey targeting health care professionals providing care to critically ill patients with the objective of assessing access to resources for the management of critically ill patients in resource-limited settings. We focused on information about facilities, equipment, management options, diagnostic tools, and availability of skilled personnel. We hypothesized that vast disparity will be present between countries.

Objectives: To design a survey for critical care health care providers to assess access toresources for the management of critically ill patients in resource-limited settings.

Methods: Sample: A self-administered pilot survey was distributed by email betweenFebruary-March 2014 to 9 healthcare providers who manage hospital locations caring for critically ill patients in 9 low-income countries. Questionnaire development: Using surveys from peer-reviewed journals, websites (WHO, ESICM), and personal communication (Dr. C. Gomersall), areas of interest (domains) and specific questions (items) within domains were identified. A simplified questionnaire consisting of 8 domains and associated items was developed.Testing and administration: Face validity was assessed with a sensibility questionnaire. Test-retest reliability was assessed by administering the survey to the same sample two weeks after initial completion. Respondents received up to 3 reminder emails for the pilot questionnaire and the test-retest component. Kappa values and interclass correlations (ICC) were computed using R statistical software (v3.0.0). The study was approved by the REB at the Sunnybrook Health Sciences Centre.

Results: Response rate: We contacted 15 critical care providers and 9 completed thepilot survey and test-retest reliability. Sensibility testing: There was agreement among respondents the questionnaire identified important issues (mean 3.9/5), was easily understood (mean 4.6/5), contained appropriate questions (mean 4.9/5), and was quite likely to identify capacity to provide care for critically ill children and adults in low-income settings (mean 3.9/5). Demographics: Majority of responders were physicians (7/9) and all worked at academic hospitals, most of which were government-funded (8/9). Hospital bed numbers varied between >1000 (2/9), 500-1000 (6/9), and <50 (1/9), with 4-13 dedicated ICU beds which were occupied 76-100% of the time in 75% of the sites surveyed. The number of mechanical ventilators varied between 3-11 per ICU. Resources: Items that were always/often available included: oxygen, mechanical ventilation, pulse oximetry, crystalloids, antibiotics, sedation, whole blood, a microbiology lab and a non-portable XR machine, CT scan. Items that were rarely/never available were: central venous catheters, single or negative pressure rooms, MRI scan. The physician specialties available at each center to provide ICU care included anesthesia (9), internal medicine (8), surgery (7), pediatrics (5), intensive care (4). None of the sites had access to a respiratory therapist. The test-retest reliability for questions related to resource availability was excellent

(ICC=0.94 (95% CI: 0.75-0.99)). The equipment supply domain had 29 items and the mean weighted kappa statistic was 0.67 (SD 0.19).

Conclusion: The pilot study demonstrated that this survey could be feasibly distributedby email and had reasonable test-retest reliability. Future research on critical care capacity in low-resource settings should focus on more extensive data collection within a defined sampling frame. This important work will help clinicians understand how critical care is currently practiced in low-income countries, what we can learn from it, and how we can contribute to improving it.

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Poster # 62 **Poster Session: 15:30 - 17:00**

Title: Alternative models for consent and the management of study data in Emergency Research: A survey of current Canadian Research Ethics Board (REB) practices

Presenter: Barto Nascimento, Sunnybrook Health Sciences, Trauma, Toronto, Canada.

Introduction: Emergency research entails the enrollment of participants into a study where participants may lack capacity to consent and where interventions are typically time-sensitive, such that substitute consent may not be possible at the time of enrollment. Canadian guidelines for alternate models of consent are incorporated into the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans (TCPS-2)[1]. However, TCPS-2 does not provide guidance on pragmatic issues such as data management and operational details on alternate consent models.

Objectives: To ascertain self-reported practices of REBs that review emergency research regarding permissibility of alternate consent models (deferred, independent physician authorization, telephone consent from substitute decision-maker) and data management practices various consent scenarios, and to measure support for a future related national guideline.[2]

Methods: We developed a web-based survey using sequential steps of item generation and item reduction involving pre-testing, pilot testing and clinical sensibility analysis. Questions were formatted with nominal responses. The final questionnaire was translated into French. We created a list of all Canadian based REBs from the National Council on Ethics in Human Research (NCEHR) membership list and all listed biomedical REBs were contacted by phone to determine if they reviewed emergency research protocols. The survey was distributed as a weblink by email to all respondents, with an option to receive a word document of the survey. No incentives were offered to participate in this study and non- responding centres were sent up to a maximum of 3 reminder emails.

Results: After screening, a total of 92 REBs were identified as having experience with the review of emergency research. Each site was provided a link to the survey online or the option to fill in a paper copy of the survey. 60/92 (65.2%) REBs responded to our survey, however only 34 REBs further identified as reviewing Canadian investigator initiated emergency studies (Non-FDA) and our study analysis is based on this subset of REBs. Our survey analysis identified considerable practice variation in several key methodological components of deferred consent: For minimal risk studies, 14 (50%) of REBs would approve a deferred consent process for the study without restrictions. In greater than minimal risk studies this dropped to only 5 (17.24%) of REBs. The use of an independent physician authorization model for enrollment into an emergency research protocol was a requirement of 6(21.43%) and 7(24.14%) of REBs for minimal risk and less than minimal risk studies respectfully. This level of variation was noted throughout the survey and when asked 73.5% of respondents indicated a national consensus conference could provide helpful guidelines and recommendations for the ethical conduct of emergency research. 85.3% of REBs indicated a willingness to participate in a national consensus conference.

Conclusion: Our engagement of Canadian REBs on the issue of consent models in the context of

emergency research confirmed that considerable variation in practice with respect to the methodological norms applied to the review of emergency research does exist across the country [2][3] and that support exists for the development of a national guideline to further support researchers and REBs in this work.

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Poster # 63 **Poster Session: 15:30 - 17:00**

Title: Burnout among Critical Care Workers

Presenter: Aussama Nassar, Hamilton Health Sciences, Surgery, Hamilton, Canada.

Introduction: The healthcare environment has many pressures. The Intensive Care Unit (ICU) is a physically, cognitively and emotionally demanding workplace such that ICU workers are at risk for the Burnout Syndrome (BOS). BOS can negatively impact personal health and morale, can predispose to absenteeism and may affect patient care, creating compassion fatigue. BOS was reportedly experienced by 50% of all critical care physicians and 35% of critical care nurses in a recent study.

Objectives: To identify the prevalence of BOS amongst different critical care workers, highlight potential contributing variables relating to BOS, and explore whether a correlation between BOS and job satisfaction exists.

Methods: We conducted a multi-center survey of BOS among intensivists, critical care fellows, nurses, and respiratory therapists working in four ICUs in Hamilton, ON. BOS was evaluated using the Job Satisfaction questionnaire and the Maslach Burnout Inventory (MBI) comprised of three subscales: emotional exhaustion (EE), depersonalization (DP), and reduced personal accomplishment (PA). Research Ethics Board approval was obtained.

Results: We used principle component factor analysis and internal consistency to assess validity and reliability, respectively. Using Maslach's three subscales of burnout, 46.3%, 41.5%, and 46.7% of the total respondents experienced high levels of burnout through EE, DP, and PA subscales, respectively. Critical care fellows experienced the highest levels of EE (71.4%) and DP (57.1%) in comparison with other ICU staff (Table 1). All four ICUs showed a substantial rate of burnout in each of the three categories (EE, DP and PA) (Table 2). The cardiovascular and oncology ICUs had the highest levels of burnout. Young age and junior staff are positive correlations to burnout (Table 3). Lastly, job satisfaction is inversely correlated with burnout (Table 4).

Conclusion: Burnout Syndrome is prevalent among Hamilton ICU clinicians. We found a negative correlation between BOS and job satisfaction. Awareness of the impact of BOS on job performance is the first step to addressing this problem.

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Poster # 64 **Poster Session: 15:30 - 17:00**

Title: Reduction of the work of breathing estimated from the electrical activity of the diaphragm during HFNC usage.

Presenter: Yu Onodera, Yamagata University Faculty of Medicine, Department of Anesthesiology, Yamagata city, Japan.

Introduction: Clinical studies of the high flow nasal cannula (HFNC) have shown its effect on oxygenation by measuring P/F ratio and airway pressure and by using electrical impedance tomography. Its effect on ventilation has been observed as a reduction of the respiratory rate (RR) and minute volume (MV), but a reduction of the work of breathing (WOB) has not been quantitatively evaluated. Electrical activity of the diaphragm (Eadi) is a part of neurally adjusted ventilatory assist, recently introduced to the commercial market. A recent study showed that Eadi is in proportion to the WOB.1 Therefore, we evaluated Eadi on a healthy volunteer using various HFNC flows to estimate the reduction of the WOB.

Objectives: To estimate the reduction of the WOB by HFNC using Eadi.

Methods: A Servo-i® ventilator system with an Eadi catheter (MAQUET, Solna, Sweden) was used to measure Eadi. OptiflowTM (Fisher and Paykel Healthcare, Auckland, NZ) was used as the HFNC system. The Eadi catheter was inserted into a healthy volunteer, and the Eadi was recorded while the volunteer was asleep. After recording Eadi without the HFNC system for 10 min, the HFNC system was applied with 10 L/min. Eadi was recorded for 10 min, and the HFNC flow was raised to 20 L/min. This sequence was repeated up to an HFNC flow of 50 L/min. The Eadi amplitude (EadiAMPL) and the AUC of the EadiAMPL for 3 minutes in each sequence were analyzed.

Results: The EadiAMPL for HFNC flow with 0, 10, 20, 30, 40, and 50 L/min were 33.5, 19.8, 27.3, 21.0, 19.1, and 21.3μV, respectively, and the AUC was 10.75, 6.80, 9.41, 6.12, 5.51, 6.59μV.sec, respectively. There were significant differences in EadiAMPL between an HFNC flow of 0 vs 10 L/min and 10 vs 20 L/min, but no significant differences were found between 10 vs 30, 10 vs 40 and 10 vs 50 L/min. RR was 16 breaths/min and did not change with the change of HFNC flow. Eadi was lowered by HFNC flow as low as 10 L/min. Although Eadi was raised by an HFNC flow of 20 L/min, there were no differences in Eadi between an HFNC flow of 10 L/min vs 30–50 L/min. This result suggests that an HFNC flow of 10 L/min is enough to reduce the WOB. One study found that HFNC reduced the MV without raising the PaCO2, which suggests that the reduction of the WOB may be due to the washout effect of the anatomical dead space.2 HFNC flow of 10 L/min supplies 166 mL/sec of fresh gas into the pharynx and oral cavity, and this may be enough to wash out the dead space to reduce the WOB.

Conclusion: Estimated from Eadi, a reduction of the WOB by HFNC may be achieved and reaches its maximum effect with flow as low as 10 L/min.

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Wirtz H. Effects of nasal high flow on ventilation in volunteers, COPD and idiopathic pulmonary fibrosis patients. Respiration 2013;85(4):319-325.

Poster # 65 **Poster Session: 15:30 - 17:00**

Title: Implementation process of a large multicenter study in trauma

Presenter: Catherine Ouellet, Research Center of the Centre Hospitalier Universitaire (CHU) de Québec, Université Laval, Anesthesiology and Critical Care Medicine, Quebec City, Canada.

Introduction: Ensuring the successful conduction of a multicenter clinical study starts with efficient study implementation within participating centers. Research ethics board (REB) review, data sharing and financial agreement, and training of the research personnel are all essential steps in the implementation process.

Objectives: To evaluate the time from shipping of the study start-up package to study screening, as well as conditions that may impact this process, in the context of a large-scale multifaceted and multicenter clinical study in trauma.

Methods: We designed a survey questionnaire based on 4 main domains identified: REB characteristics and process, centers' characteristics, experience of the study and clinical teams, and center specific implementation approaches. The questionnaire was self-administered to all lead research coordinators of the participating centers in the TBI-Prognosis Study (www.tbi-prognosis.ca) currently ongoing in 17 level 1 trauma centers across Canada. Descriptive statistics were used.

Results: Overall, 33.4 (95%CI 24.8-42.1) weeks were required on average from the start-up package mailing to centers and the start of the screening process. Data sharing and financial agreement were mainly responsible for this delay with an average of 28.6 weeks (95%CI 20.4-36.7) needed to complete the agreement with the coordinating center. REB approval was obtained on average 17.5 weeks (95%CI 13.8-21.2) from the shipping of the study package to the participating centers. Eighty percent of the REBs had members with prior experience in multicenter clinical research, and more than half with specific clinical expertise in critical care medicine or neurology/neurosurgery. A standardized electronic REB submission process was used in most REBs (60%) and all centers, except 2, had dedicated personnel for contract negotiation. All centers had experience in implementing multicenter clinical studies. PIs had experience conducting from 0 to 40 prior clinical studies, and from 3 to 24 years of research experience with protected research time ranging from 5 to 75%. Most RCs were registered nurses by training (73%) and had managed from 0 to more than 50 clinical studies. Most research teams were composed of 2 RCs or more. Most centers (87%) organized specific presentation of the study to the critical care medical staff (93%), while some (60%) presented the study to other medical teams. Agreements from other departments such as radiology (87% of centers), electrophysiology (80%) and clinical imaging (73%) were requested in most centers.

Conclusion: The implementation of a large Canadian multicenter and multifaceted clinical study in the trauma population involved a significant amount of time and energy from both the coordinating and the participating sites. The variable experience of participating sites and teams, as well as the involvement of different medical disciplines may have had an impact on time for study implementation. Delays for REB approval, but also for data sharing and financial

agreement must be taken into consideration in the timeline for implementing large multicenter clinical studies in trauma.

References: NA

Poster # 66 **Poster Session: 15:30 - 17:00**

Title: Impact of Intensive Care Unit acquired weakness on weaning failure and mortality in mechanically ventilated patients.

Presenter: Oscar Peñuelas, Hospital Universitario Infanta Cristina, Intensive Care Unit, Parla, Madrid, Spain.

Introduction: Intensive Care Unit Acquired Weakness (ICUAW) is a severe complication in mechanically ventilated patients who survive the acute phase of a critical illness. Reported rates of ICUAW vary substantially, depending on the patient case mix, diagnostic criteria applied, and the timing of examination (1, 2).

Objectives: To assess whether the development of intensive care unit acquired weakness (ICUAW) influences weaning failure and intensive care unit (ICU) mortality.

Methods: A pragmatic analysis of a prospective, international, multicenter observational study of adults receiving invasive mechanical ventilation for at least 12 hours during a 1-month period including 494 intensive care units from 39 countries. 3,617 patients who were mechanically ventilated for more than 3 days, had a Glasgow Coma Scale above 9, and did not have neuromuscular disease. Patients were screened daily for ICUAW defined as the presence of symmetric and flaccid weakness associated with decreased or absent deep tendon reflexes. A multinomial logistic regression model was used to estimate the predictive variables for ICUAW. A propensity score analysis was performed to evaluate the influence of ICUAW on weaning failure (a composite outcome of interrupted weaning, prolonged weaning as duration longer than 6 days, tracheotomy during weaning, or reintubation within seven days after the extubation) and ICU mortality.

Results: Globally, ICUAW was diagnosed in 114 patients (3.15%; 95%CI: 2.60% to 3.77%). Predictive associated variables were: duration of mechanical ventilation (Relative Risk Ratio [RRR] per day, 1.10; 95%CI, 1.08-1.12, $p < 0.001$), steroid therapy (RRR 1.8; 95%CI, 1.2-2.8, $p= 0.005$), insulin therapy (RRR 1.8; 95%CI, 1.2-2.7, $p= 0.005$), sepsis (RRR 1.9; 95%CI, 1.2-2.9, $p=0.002$), acute renal failure (RRR 2.2; 95%CI, 1.5-3.3, $p < 0.001$) and hematological failure (RRR 1.9; 95%CI, 1.2-2.9, $p=0.005$). Risk-adjusted weaning failure (paired rate difference 22.1%; 95%CI: 9.8-31.6% $p=0.003$) and ICU mortality rates (paired rate difference 10.5%; 95%CI: 0.1-24.0%, $p=0.025$) were higher for patients with ICUAW.

Conclusion: In a propensity score analysis, ICUAW was associated with higher rates of weaning failure and ICU mortality.

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Poster # 67 **Poster Session: 15:30 - 17:00**

Title: Ophthalmologic Changes in Hypertensive Disease of Pregnancy

Presenter: Arturo Ariph Ibarra-Sánchez, Hospital General de Tampico "Dr. Carlos Canseco", Terapia Intensiva, Tampico, Mexico.

Introduction: Hypertensive Disease of Pregnancy (HDP) complicates up to 10% of pregnancies worldwide and is a high maternal and fetal morbidity and mortality, causing ocular symptoms or condition across the visual axis.

Objectives: To Identify the ophthalmologic changes associated with HDP and establish its relationship with the severity of symptoms.

Methods: A total of 126 women of HDP were examined, 63 with HDP (cases) including all its variants, and 63 without HDP (controls) in a period December 2013 to June 2014. They were examined by fundoscopy in puerperal stage by a single ophthalmologist calibrated for this purpose, on two occasions; puerperal and two weeks attending a clinic as an outpatient. Also measurements of blood pressure (BP) when the initial fundoscopy and two weeks later.

Results: The predominant HDP was severe preeclampsia (35%), 78% had ophthalmologic changes, predominantly angioespastic angiopathy, and the predominant symptom was phosphenes, however, 43 patients in this group had no symptoms (68%). In the control group, no eye changes or symptoms were reported. It was observed that the degree of retinopathy was associated with variations in BP, showing that the higher the BP increased severity of retinopathy was reported. ($p < 0.05$)

Conclusion: The fundoscopy to identify the time course and severity of symptoms allowing to take the proper precautions. At 15 days nearly half of patients continue to ophthalmologic changes, and only 15% were reported with symptoms. Fundoscopy helps in assessing the severity of HDP.

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Poster # 68 **Poster Session: 15:30 - 17:00**

Title: Venoarterial extracorporeal membrane oxygenation (VA-ECMO) for patients in shock or cardiac arrest secondary to cardiotoxicant poisoning: a cost-effectiveness analysis

Presenter: Maude St-Onge, University of Toronto, Clinical pharmacology and toxicology, Institute of Medical Science, Toronto, Canada.

Introduction: A recent systematic review of treatments for patients with a type of cardiotoxicant poisoning revealed that venoarterial extracorporeal membrane oxygenation (VA-ECMO) was one of the most strongly supported interventions in the literature.

Objectives: The objective of this cost-effectiveness analysis was to assess the incremental cost-effectiveness ratio (ICER) of using VA-ECMO for adults in cardiotoxicant-induced shock or cardiac arrest compared to standard care.

Methods: Adults in shock or in cardiac arrest secondary to cardiotoxicant poisoning treated in Canadian tertiary centres providing VA-ECMO were studied with a lifetime horizon and a societal perspective. VA-ECMO cost-effectiveness was calculated using a decision analysis tree. The effect of the intervention and the probabilities used in the decision model were taken from an observational study identified by a systematic review as being the highest level of evidence available. The costs in 2013 Canadian dollars ($1.00CDN = $0.9562US) were documented with interviews, questionnaires, consultation of official provincial documents or published articles. A series of one-way sensitivity analysis and a probabilistic sensitivity analysis using a Monte Carlo simulation were used to evaluate uncertainty in the decision model.

Results: The cost per life-year gained (LY) in the VA-ECMO group was $145,931/18LY compared to $88,450/10LY in the non-ECMO group. The ICER ($7,185/LY but $34,311/LY using a more pessimistic approach) was mainly influenced by the probability of survival. The probabilistic sensitivity analysis identified an increase in cost with a variable increase in effectiveness.

Conclusion: This analysis suggests that VA-ECMO may be cost-effective in treating cardiotoxicant poisonings.

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Poster # 69 **Poster Session: 15:30 - 17:00**

Title: Survey of Canadian Intensive Care Unit Pharmacists' Attitudes, Knowledge, and Use of Probiotics for Patients (Pro-Surve)

Presenter: Kathleen Wheeler, Mount Sinai Hospital, Department of Pharmacy, Toronto, Canada.

Introduction: Ventilator-associated pneumonia (VAP) is a lung infection that affects 10-25% of patients in the Intensive Care Unit (ICU) [1]. PROSPECT (Probiotics: Prevention of Severe Pneumonia and Endotracheal Culture Trial: A Pilot Trial) is currently underway to assess the feasibility of a larger trial of probiotics to prevent VAP and other infections. In conjunction with the PROSPECT Pilot Trial, we conducted a survey of ICU pharmacists.

Objectives: To assess Canadian ICU pharmacists' attitudes toward the use of probiotics in critically ill patients; secondary objectives were to evaluate their knowledge and self-reported use of probiotics for critically ill patients.

Methods: We surveyed pharmacists providing care to ICU patients in Canada. The survey instrument was rigorously designed according to previous guidelines [2,3,4]. Following a literature review, a preliminary version of the survey was generated. This version was pre-tested by experts in the areas of survey development, natural health products, and/or critical care. Pilot and reliability tests of English and French versions of the survey were conducted by 5 ICU pharmacists (3 English and 2 French). Possible respondents were identified by telephoning inpatient pharmacies of all Canadian hospitals known to have ICUs. Of 356 total pharmacists identified, 9 were excluded due to participation in survey development, 12 could not be reached to obtain their email address, and 10 declined to provide one. Following an electronic announcement by the Canadian Society of Hospital Pharmacists, the final survey was distributed via email to 325 Canadian ICU pharmacists. The French version was sent to pharmacists in Quebec, and the English version to all others. Three waves of follow-up will occur via email at one, two, and three weeks after the first distribution. The survey will close after 5 weeks.

Results: At the time of abstract writing (after the first follow-up email), 137 pharmacists had responded to the survey (42% response rate). Of these, 70% said probiotics were available in their institution, and another 6% indicated availability only under certain circumstances. 80% of respondents stated that they would "never" recommend probiotics for VAP prevention in critically ill patients, while 61% said they would "never" recommend them for prevention of C. difficile infection. 6% believed that probiotics are "definitely safe" for VAP prevention, while 34% were "unsure". 56% of respondents accurately estimated the cost of a daily dose of probiotics as less than $5, and 65% indicated that they had used probiotics for at least one patient in the last year (in any formulation, for any purpose). However, 73% identified the "absence of written guidelines or protocol" as a barrier to usage of probiotics in their ICU practice.

Conclusion: Preliminary survey results indicate that probiotics are available in most institutions, and that the majority of Canadian ICU pharmacists have used probiotics for patients in the last year. However, most pharmacists do not recommend them routinely for prevention of VAP in critically ill patients.

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Poster # 71 **Poster Session: 15:30 - 17:00**

Title: Use of dexmedetomidine for prophylactic analgesia and sedation in patients with delayed extubation after craniotomy: a prospective, randomised, double-blind, placebo-controlled trial

Presenter: Guang-Qiang Chen, Beijing Tiantan Hospital, Capital Medical University, Beijing, China.

Introduction: Clinical studies have shown that patients after craniotomy are at high-risk of pain and agitation, and inadequate treatment is associated with adverse outcomes [1]. However, clinicians remain reluctant to administer analgesics and sedative in patients following craniotomy [2]. The major concerns are the side effects of these drugs, which mainly include the influence of consciousness and respiratory depression. Dexmedetomidine, a potent and highly selective alpha-2-adrenoceptor agonist, provides dose-dependent sedation, anxiolysis, and analgesia (involving spinal and supraspinal sites) without respiratory depression [3]. These characteristics make dexmedetomidine a potential agent for sedation and analgesia in neurosurgical patients.

Objectives: The aim of the present study was to evaluate the safety and efficacy of dexmedetomidine for prophylactic analgesia and sedation in patients with delayed extubation after craniotomy. The primary hypothesis was that prophylactic use of dexmedetomidine would increase the percentage of time in optimal sedation.

Methods: The present study was a prospective, single-center, randomized, double-blind, placebo-controlled trial in patients with delayed extubation after craniotomy. Trial was registered at ClinicalTrials (NCT: ChiCTR-PRC-12002903) and protocol was publish in 2013 [4]. All patients after intracranial surgery with delayed extubation admitted to the neurosurgical intensive care unit (ICU) were screened for study eligibility. Eligible patients were older than 18 years and presented with a motor responses to external stimuli in Glasgow Coma Scale (GCS-M) equal or higher than 5 within 2 h of arriving in the ICU. Within 2 h of ICU admission, enrolled patients were randomly assigned in a 1:1 ratio to receive intravenous infusion of dexmedetomidine (the intervention group: DEX group) or normal saline (the control group: NS group). Dexmedetomidine (10 μg/ml) and normal saline with the same character were prepared by the clinical pharmacist. Patients and all study personnel except the investigative pharmacist were blind to treatment assignment. The intervention group (DEX group) received a continuous intravenous infusion of dexmedetomidine at a dose of 0.6μg/kg/h. The control group (NS group) received a maintenance infusion of normal saline at a volume and rate equal to that of DEX group. Depth of sedation was assessed using Riker's Sedation-Agitation Scale (SAS). Assessment of SAS score was performed every 1 h or as needed after the infusion of experimental agents, and the sedation goal was set at a SAS score of 3-4. If patients exhibited agitation (SAS score of 5-7), rescue bolus of propofol was given at a dose of 0.5mg/kg. If agitation was not eliminated, continuous infusion of propofol (20 mg/mL) was started and titrated to reach a SAS of 3-4. Pain was treated with fentanyl in 0.05 mg increments. The allocated intervention was terminated until any of the following criteria was met: a maximum of 24 h on the study infusion protocol; 30 min after extubation; or ICU discharge. The primary endpoint was the mean percentages of time in optimal sedation (SAS of 3-4). The percentage of

patients requiring propofol and/or fentanyl for rescue to achieve/maintain targeted sedation (SAS 3-4) and total dose of propofol and/or fentanyl required throughout the study drug infusion were collected.

Results: During the study period, 146 patients were enrolled, 71 in DEX group and 75 in NS group. There were no significant differences in baseline data between the two groups (Table 1). Study agent was emergent terminated in 9 patients in DEX group, 4 because of bradycardia, 3 because of hypotension, 1 because of cerebral infarction, and 1 because of intracranial hemorrhage. Data of efficacy of dexmedetomidine for sedation are shown in Table 2. The mean percentage of time in optimal sedation in DEX group was significantly higher than NS group ($p=0.002$). Three (4.2%) and 10 (13.3%) patients received rescue propofol in DEX group and NS group, respectively ($p=0.048$). Total dose of propofol in DEX group (2.08±11.03mg/pts) was significantly lower than NS group (28.29±109.73 mg/pts).

Conclusion: Intravenous infusion of dexmedetomidine increased incidence of bradycardia and hypotension. However, prophylactic use of dexmedetomidine in patients with delayed extubation after craniotomy provided satisfactory analgesia and sedation.

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Poster # 72 **Poster Session: 15:30 - 17:00**

Title: Respiratory Mechanics Registry for ARDS: Pilot Analysis of a Quality Improvement project

Presenter: Lu Chen, 1St' Michael's Hospital and 2University of Toronto, 1 Department of Critical Care and 2Interdepartmental Division of Critical Care, Toronto, Canada.

Introduction: Respiratory system, lung and chest wall mechanics are not routinely measured in patients with the acute respiratory distress syndrome (ARDS). Many clinicians are unfamiliar with the procedure. Implementing respiratory mechanics into routine clinical practice could help to choose safe limits or useful pressures and be incorporated into a medical decision process. Airway pressure (Paw) based mechanics alone may be limited to generate individualized insights [1]. Esophageal pressure (Pes) allows estimating transpulmonary pressure (PL) to better individualize ventilator strategy [2]. We proposed a quality improvement (QI) project to facilitate integration of respiratory mechanics monitoring for management of ARDS. We report the preliminary results.

Objectives: To test whether a multidisciplinary educational program for systematic assessment of respiratory mechanics would change ventilatory management.

Methods: A voluntary QI team was composed of respiratory therapists (RTs) and clinical fellows. The QI program included 3 interventions: a) implementation of educational sessions to increase awareness and understanding of respiratory mechanics monitoring. These consisted of lectures, bench and bedside hands-on sessions, and feedback rounds; b) implementation of protocols to guide esophageal catheter placement and systematic measurements; c) creation of a PDF form automatically calculating physiological parameters and generating a report.
The QI program started in 3 ICUs. During this period, patients admitted to the ICUs who met the Berlin definition of ARDS [3] were eligible for measurements. Placement of an esophageal catheter was considered when $PaO_2/FiO_2 \leq 200$. Measurements included Paw-based respiratory mechanics, Pes-based lung and chest wall mechanics, oxygenation response to PEEP and alveolar derecruitment using a simplified bedside maneuver [4].
A comparison of ventilator settings and the frequency of documented plateau pressure (Pplat) before and after measurements was conducted.
Continuous variables are presented as means ± SD and compared with the use of Student's t-test, or medians [interquartile ranges] and compared with the use of the Mann–Whitney test, as appropriate. Dichotomous or nominal categorical variables are compared with the use of the chi-square test with normal approximation or Fisher's exact test, as appropriate.

Results: In the first 3 months of the project, 17 RTs and 1 clinical fellow constituted the QI team. All clinical fellows attended 1 of the 8 education sessions provided in the first month. So far, 18 ARDS patients (Male/Female: 14/4, age 55±12) have been enrolled and measured. Pes and PL were measured in 17 patients. In thirteen patients (72%), ventilation settings were changed according to the measurements, while in five (28%) settings were unchanged. Tidal volume was 6.6±1.3 and 6.3±1.0 ml/kg (P=0.021), PEEP was 13±3 and 12±3 cmH_2O (P=0.009), PaO_2/FiO_2 ratio was 148±65 and 163±71 (P=0.355), before and after measurements,

respectively. PEEP was decreased in 10 patients, from 13±3 to 10±3 cmH2O (P<0.001). Pplat was documented in 7 patients before the measurements and in 11 patients after the measurements.

Conclusion: A multidisciplinary QI program changed the routine ventilatory management often by limiting VT and PEEP.

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Poster # 73 **Poster Session: 13:30 - 15:00**

Title: Entrustable Professional Activities to Improve Faculty Engagement with Critical Care Medicine Evaluations

Presenter: Michael Coppolino, Kaiser Permanente San Francisco Medical Center, CCM, San Francisco, United States of America.

Introduction: Suboptimal Evaluation Process: Faculty members in academic community intensive care units may lack engagement in the evaluation process for internal medicine residents. The ACGME's new accreditation system provides an opportunity for improving evaluation systems. Social Cognitive Learning Theory: Social cognitive learning theory suggests that clear objective goals and guided practice should enhance faculty satisfaction, thereby increasing engagement with the evaluative process.

Objectives: We defined a core set of Entrustable Professional Activities (EPA's) for medical trainees rotating though Critical Care Medicine (CCM) rotations and implemented an evaluation system enabling assessment of trainees based on these EPA's. We assessed faculty satisfaction and resident evaluations of the CCM rotation pre and post intervention.

Methods: Using the ABIM milestone framework and consensus meetings, 6 core ICU EPA's were defined. Three (respiratory failure, shock management and ability to present complex patients) were implemented as the new evaluation system. Faculty satisfaction and resident rotation reviews were assessed using electronic surveys pre and post-implementation and compared to a control institution. Survey items were scored on 5-point Likert scales with 5=Very satisfied/Strongly agree and 1=Very dissatisfied/Strongly disagree. Differences were tested with Wilcoxon rank-sum and signed-rank tests

Results: Faculty Satisfaction with the Evaluation Process: At baseline, faculty at the intervention and control center demonstrated similar satisfaction with the evaluation system. While the intervention group showed greater post-intervention improvement than the control group for all the domains of satisfaction, these differences were generally small and none were statistically significant. Faculty Satisfaction with Ability to Provide Feedback: Confidence in providing constructive and reinforcing feedback was similar between centers at baseline. A non-significant trend towards improvement in confidence providing reinforcing feedback was demonstrated at the innovation center ($p=0.09$). Trainee Review of CCM Experience: Trainees were generally satisfied with the CCM rotation. There were no statistically significant changes for the quality of feedback ($p=0.37$). The balance of autonomy versus supervision was noted to improve post-intervention ($p = 0.008$) as was learning about competency based evaluations and milestones ($p = 0.003$).

Conclusion: Trends toward improved faculty satisfaction and improved resident evaluation experiences following introduction of an intensive care unit, EPA-based evaluation system support further development and larger studies of such innovations in CCM training programs.

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Poster # 74 **Poster Session: 15:30 - 17:00**

Title: In Situ Simulation Training Improves Interprofessional Teamwork and Collaboration in the ICU

Presenter: Stuart McAdam, Dalhousie, Medicine (Medical Student), Halifax, Canada.

Introduction: Several studies have found teamwork and communication to be the root cause of the majority of medical errors.[1,2,3] Effective teamwork and communication are especially important to ensure optimal patient care in the ICU, as multidisciplinary teams work together to care for extremely vulnerable patients.

Objectives: To determine whether running in situ simulations could objectively improve teamwork and communication in the ICU.

Methods: Multidisciplinary teams consisting of residents, nurses, and respiratory therapists performed in situ simulations in the ICU. Simulations involved a 10-minute case followed by a debrief. During the debrief teamwork and communication issues were resolved, and the importance of the use of SBAR and transparent thinking was stressed. Teams were evaluated during the simulation by two observers using 8 components of the Clinical Teamwork Scale [4] (CTS) during a pre-intervention phase (0 returning participants) and a post-intervention phase (1,2, or 3 returning participants).

Results: All 8 components of the CTS that were evaluated showed significant improvement ($p<0.001$) in scores with increasing returning participants. Greatest correlation between number of returning participants and CTS score was observed for the components of the score that were targeted directly (overall teamwork, overall communication, use of SBAR, and transparent thinking). Comments made by the participants during the debriefs also supported the need for these simulation sessions.

Conclusion: Performing in situ simulations is effective at improving teamwork and communication among multidisciplinary teams in the ICU. Implementing regular in situ simulation training in the ICU could therefore potentially help address previously cited safety concerns over shortfalls in effective teamwork and communication.

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Poster # 75 **Poster Session: 15:30 - 17:00**

Title: The Utility of an Instructional Video to Teach Chest Tube Insertion to Medical Trainees

Presenter: Tomas Saun, Sunnybrook Health Sciences Centre, Critical Care Medicine, Toronto, Canada.

Introduction: Online medical education resources are becoming an increasingly used modality and many studies have demonstrated their efficacy in procedural instruction.

Objectives: This study assessed if a procedural video is as effective as Advanced Trauma and Life Support (ATLS)-like teaching for chest tube insertion.

Methods: This was a randomized control trial of 28 volunteers from two subsequent graduating classes of the Schulich School of Medicine & Dentistry in London, Ontario. Participants were enrolled into: i) a ATLS-like teaching video on chest tube insertion, or ii) a NEJM video on chest tube insertion. Participants filled out a questionnaire before and after performing the procedure on a cadaver, which was filmed and assessed by two evaluators using a standardized tool.

Results: 28 volunteers were screened for eligibility, none being excluded. There were 13 in the NEJM group, and 15 in the ATLS group. Participant demographics were similar. The NEJM group's average score was 45.2% (± 9.56) on the pre-questionnaire, 67.7% (± 12.9) for the procedure, and 60.1% (± 7.65) on the post-questionnaire. The ATLS group's average score was 42.8% (± 10.9) on the pre-questionnaire, 73.7% (± 9.90) for the procedure, and 46.5% (± 7.46) on the post-questionnaire. There was no difference between the groups on the pre-questionnaire (Δ +2.4%; 95% CI: -5.16, 9.99), or the procedure (Δ -6.0%; 95% CI: -14.6, 2.65). The NEJM group had better scores on the post-questionnaire (Δ +11.15%; 95% CI: 3.74, 18.6).

Conclusion: The NEJM video was at least as effective as ATLS-like training for teaching the knowledge and technical skills essential for chest tube insertion. Participants expressed high satisfaction with this modality. It may prove to be a helpful adjunct to standard instruction on the topic.

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Poster # 76 **Poster Session: 15:30 - 17:00**

Title: Handover practices in the ICU: resident perceptions and exposure-based learning
Presenter: Zahra Tejani, Queen's University, Department of Medicine, Kingston, Canada.

Introduction: Continuity of care is an ongoing target for improvement in healthcare. One important component of continuity in hospital medicine is the handover that occurs between providers at shift change. Handover is an opportunity for a physician to transfer authority and responsibility, ensure adequate understanding, and relay relevant information to the oncoming physician(1). However, inadequate handover communication can lead to adverse patient outcomes (2,3). Little is known about effective strategies to teaching handover practices, and evidence supporting formal curricula in handover communication is scarce.

Objectives: We sought to evaluate the perceptions of residents rotating in the intensive care unit (ICU) regarding their handover experience in a setting where handover is largely standardized. We also queried whether exposure to routine handover practices, including techniques employed by senior learners and attending physicians, would be associated with perceived improvement in performance during the ICU rotation.

Methods: In this prospective study, all junior residents completing the full 8-week ICU rotation at Kingston General Hospital over the course of one year (July 1, 2013 – June 30, 2014) were contacted to complete a survey regarding their perceptions of the daily handover to the on-call resident(s), occurring at the end of each workday. A peer-reviewed, 25 question Likert scale questionnaire was administered electronically. Questionnaire items were generated based on literature review, reduced and categorized into 4 domains, including physical and human environment, information shared, anticipated tasks, and general evaluation. The questionnaire was evaluated for sensibility and face validity. Respondents were asked to anonymously complete the survey after 2 weeks of their ICU rotation, and again after the full 8 weeks. Differences between the early and the late responses were evaluated using the sign test.

Results: Of 35 residents, 30 completed the survey at least once, with response rates of 85.7% and 66.6% for the early and late surveys, respectively. Overall, residents reported generally favourable responses, with 80%, 95%, and 67.5% positive responses about general evaluation, environment, and information shared. However, compared with the early surveys, in the late ones 10 residents reported increased perceived pressure to complete handover in a shorter amount of time ($p=0.04$). Furthermore, 10 and 11 residents were less satisfied in the late surveys with the accuracy and with the completeness of the information received from their peers ($p=0.04$ and $p=0.006$, respectively). There was a trend toward improvement in the late surveys regarding perceived overall performance in providing and receiving handover, but no change in other domains (i.e. use of materials/tools, time spent on sicker patients, tasks assigned during handover, amount of information provided, and ability to handle issues overnight based on handover received).

Conclusion: In an ICU setting where junior residents regularly attend structured handover conferences along with senior trainees and attending physicians, residents reported on positive experience overall. Yet, they identified deficiencies in the handover they receive, and they

perceived little improvement during the ICU rotation. Although the junior residents were able to recognize what constitutes effective handover, it is possible that they have not yet cultivated the necessary skills to their fullest extent after a relatively short ICU rotation. Furthermore, given junior residents' limited clinical experience, it is likely that handover discussion at a higher level is insufficient to meet their needs. Additional research is required to identify ways to evaluating individuals' skill in handover communication, and to adjusting the discussion appropriately.

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Poster # 78 **Poster Session: 15:30 - 17:00**

Title: A Quality Improvement Project to Decrease Non-Value Blood Work in Critical Care
Presenter: Andre Amaral, Sunnybrook Health Sciences Centre, Critical Care Medecine, Toronto, Canada.

Introduction: In 2012, the Choosing Wisely campaign, initiated by the American Board of Internal Medicine, was implemented in an effort to encourage physicians, interprofessional teams, hospitals and patients to be aware of medical treatment, procedures and testing that may not provide value or may cause harm. When compared to routine testing, clinical guidelines led to reduced testing, without compromising patient safety. Routine testing may cause harm due to painful phlebotomy and iatrogenic anemia, which may result in potentially hazardous transfusion. (1- 4)

Objectives: To decrease the frequency of non-value added blood work.

Methods: A quality improvement intervention, with PDSA cycles. We used quality walk-about rounds, the relevant literature and logistical process mapping to identify opportunities for improvement. To demonstrate success we measured the number of tests, number of abnormal tests, and number of tubes drawn on a monthly basis before and after the intervention. We used segmented linear regression to measure the change in total number of tests before and after the intervention.

Results: (1) opportunities for improvement: education on the value of blood work; new order entry process; collaboration with the laboratory to perform multiple testing on the same samples; new pre-printed orders with no routine orders for blood work after 5 days and blood work routine stratified by severity of illness, clinical guidelines for several commonly ordered tests; (2) baseline data: average of 250 ml of blood drawn in the first 48 hours after admission; 89% of patients had coagulation tested and 95% of patients had lactate tested daily in the first 7 days of admission; less than 5% tests were critically abnormal. Our blood conservation project resulted in a reduction of 591 tests/month (95% CI –1143 to – 41, $p = 0.038$).

Conclusion: Several factors are important in the maintenance of excessive blood testing, thus a multifaceted interprofessional approach is required to safely decrease blood work.

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Poster # 80 **Poster Session: 15:30 - 17:00**

Title: Personalizing Death in the ICU: The Three Wishes Demonstration Project
Presenter: Marilyn Swinton, McMaster University, Hamilton, Canada.

Introduction: Death in the technological setting of the intensive care unit (ICU) is common. The overall goal of the 3 Wishes Demonstration Project is to improve the quality of the dying experience.

Objectives: The specific aims are: 1) For patients, to dignify their death and celebrate their lives; 2) For family members, to humanize the dying process and create positive memories; and 3) For clinicians, to foster patient-centered and family-centered end of life care, and inspire a deeper sense of vocation.

Methods: Using a mixed-methods study design, we enrolled dying patients, their families and 3 of their clinicians from a 21 bed medical-surgical ICU. We elicited and honoured a set of 3 wishes with the goal of bringing peace to the final hours or days of a critically ill patient's life, and to ease the grieving process for families. Quantitative data included demographics, processes of care, and Quality End-of-Life Care-10 (QEOL-10) scores. Qualitative data collection involved semi-structured interviews which were digitally recorded, transcribed verbatim, then analyzed using a qualitative descriptive approach.

Results: Participants included 39 dying patients, one of their family members, and 117 clinicians caring for the dying patient in the last 72 hours. Wishes were interpreted and classified in 5 domains: humanizing the environment (e.g., flowers, pet therapy, music therapy, bringing personal momentos into the room), tributes (e.g., tea party, final toast, word cloud, planting a tree in the patient's favourite park), connections (e.g., sponsoring a memorial meal, finding a lost relative, skype and email reunion with family and friends), rituals and observances (e.g., firework display, blessing, renewal of wedding vows, wedding) and 'paying it forward' (e.g., unsolicited family donations to other families in the 3 Wishes Project, contributions to charities important to the patient, organ donation). Most wishes were simple and inexpensive, or priceless. Many wishes (62%) were antemortem, but some (38%) were post mortem. QEOL-10 scores were high. The interview participation rate was 100%. The central theme that emerged from the interviews was personalizing dying in the ICU. Eliciting and customizing the 3 Wishes honoured patients by individualizing and humanizing the dying process, and empowered families to participate in their loved one's end of life care. For clinicians, the 3 wishes project offered a model of interprofessional care, engendering respect for all, and promoting death with dignity.

Conclusion: The 3 Wishes Demonstration Project facilitated personalization of the dying process in the ICU through a deliberate integration of spiritual care and palliative care into critical care practice. Quantitative and qualitative data from this mixed methods study demonstrated the key concept of dignity, and helped to create the comfort, preparedness, and interpersonal connection remembered by survivors after death.

References: N/A

Poster # 81 **Poster Session: 15:30 - 17:00**

Title: Electroencephalographic changes with intraventricular catheter placement in patients admitted to a neurointensive care unit

Presenter: Sacha Schweikert , University Health Network Toronto, Toronto, Canada.

Introduction: Intraventricular catheters (IVC) are routinely placed in neurosurgical patients. Complications of insertion include misplacement, haemorrhage, infection and malfunction. Parenchymal changes including focal cortical oedema with local compression, as well as blood along the IVC path are reported and may have epileptogenic properties. The incidence of epileptogenic potentials or clinical seizures associated with IVC placement has not been studied, to our knowledge, but the incidence is presumed to be high. Further, local practice may be heterogeneous in its prescribing practices of antiepileptic drugs (AEDs) for patients with hydrocephalus requiring IVC placement.

Objectives: N/A

Methods: In order to better understand our practices and to inform future protocol development/quality improvement project, we reviewed the charts of 84 patients, admitted to our tertiary level ICU between January 2011 and 2013, who had an IVC placed and subsequently required monitoring with electroencephalography (EEG). The EEG data was read independently by an epileptologist unaware of the presence or absence of an IVC or the location of the IVC. Data collected included incidence of epileptogenic potentials and seizures localized to the cortex affected by the IVC, clinical indication for EEG (e.g. clinical seizure), prescribed AEDs, as well as other potential risk factors for the development of electroencephalographic changes.

Results: Median age of 55 years (Interquartile range, 44 – 66); 54 men (64%); 9 patients (11%) had a past medical history significant for having had a seizure; 18 (21%) had an IVC at the time of the EEG; 16 (19%) were not on antiepileptic drugs at the time of the EEG recording, 38 (45%) were on a single agent, and 23 (36%) were on more than one agent; aetiology of the hydrocephalus was ICH/IVH (33%), SAH (24%), TBI/stroke (15%), malignancy (14%), and CNS abscess/ meningitis/ ventriculitis (13%). In 46 (55%) of cases the IVC was successfully inserted on the first attempt, 7 (9%) required greater than one pass, and in 31 (37%) of cases the number of passes was not recorded. In 18 (23%) of cases, a spike and wave pattern was described, concordant with the location of the IVC. A previous history of seizure disorder was not associated with an increased risk of epileptiform activity (OR 0.94, 95% CI 0.16 – 5.49).

Conclusion: Epileptiform discharges hypothetically related to the IVC placement are not an uncommon occurrence. Further study will be undertaken to see if these epileptiform discharges are clinically significant and predispose to convulsive or nonconconvulsive status epilepticus. Findings will inform the development of a protocol to improve our prescribing practices in this patient population.

References: N/A

Poster # 82 **Poster Session: 15:30 - 17:00**

Title: Adherence to low tidal-volume ventilation guidelines in ARDS management: An observational study

Presenter: Matthew Ernst, Queen's University School of Medicine, Medicine, Kingston, Canada.

Introduction: Acute respiratory distress syndrome (ARDS) is a type of severe respiratory failure characterized by acute inflammatory lung injury and diffuse alveolar damage. Mechanical ventilation is a mainstay of ARDS management; however, ventilator induced lung injury may contribute to disease progression and mortality. Currently, the only recommendation that has been shown to reduce mortality in ARDS management is low tidal volume (LTV) ventilation. The purpose of this study was to evaluate adherence to current ARDS ventilation guidelines in a tertiary care ICU.

Objectives: The primary objective was to determine the incidence of LTV ventilation in patients with ARDS.

Methods: A prospective, observational study over was conducted over consecutive 8 weeks in a Level-3 intensive care unit (ICU) at Kingston General Hospital, a tertiary care, teaching hospital in South-Eastern Ontario. All intubated and ventilated adult patients were screened daily, and those with PaO2/FiO2 ratios < 300 within the previous 24 hours were further assessed. The target population was classified according to 3 separate ARDS definitions: (1) the clinical impression of the attending physician based on a semi-structured interview, (2) the Berlin definition for ARDS with radiographic and echocardiographic criteria assessed by an independent ICU physician, blinded to other information, and (3) documentation of ARDS in the patient chart. Ideal-bodyweight-adjusted (IBW) tidal volumes from the last day of study inclusion for each patient, were compared within the 3 different groups using the Kruskal-Wallis test. A multivariate analysis was performed to explore potential associations between relevant demographic and clinical characteristics and LTV ventilation. Concordance between ARDS classification groups was assessed using a chi square test.

Results: Of 66 ventilated patients, 12 (18%) had a physician diagnosis of ARDS, 6 (9%) met the Berlin criteria, and 8 (12%) did not have adequate investigations to evaluate Berlin criteria. Of patients with a physician diagnosis, 5 (40%) had ARDS documented in the chart. The mean IBW-adjusted tidal volume (mL) was lower for patients who met the Berlin criteria compared with those who did not (7.6; 95%CI, 6.6-8.6 vs. 10.23; 95%CI, 9.5-11.0; p=0.01), and for those that had documented ARDS compared with those who did not (7.5; 95%CI, 6.2-8.8 vs. 10.8; 95%CI 9.3-12.3; p=0.007). There was no difference in administered tidal volumes between patients with or without a physician diagnosis of ARDS (9.2; 95%CI, 6.8-11.7 vs. 10.1; 95%CI 9.3-11.0; p=0.2). Multivariate analysis revealed that female gender was the only patient characteristic associated with LTV ventilation (p=0.01). There was concordance between physician diagnosis of ARDS and Berlin Criteria (p=0.002).

Conclusion: Patients diagnosed with ARDS by ICU attending physicians received LTV ventilation inconsistently. Patients with ARDS documented in their chart and those who fulfilled the Berlin Criteria were more likely to receive LTV ventilation than patients diagnosed by a

physician, possibly through involvement of other team members such as respiratory therapists. It is likely that many patients with ARDS were never diagnosed. Possible reasons include unawareness of hypoxemia and lack of necessary diagnostic procedures. Quality improvement efforts are required to ensure appropriate diagnosis and management of ARDS.

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Poster # 83 **Poster Session: 15:30 - 17:00**

Title: Does Practice Variation in Spontaneous Breathing Trial Performance and Reporting Compromise Extubation Outcome Prediction?

Presenter: Stephanie Godard, University of Ottawa, Medical Program, Ottawa, Canada.

Introduction: Spontaneous Breathing Trials (SBTs) are the standard-of-care means to assess extubation readiness, however, there exist no universally accepted guidelines regarding their precise performance and documentation. A review of the literature reveals significant variation in the implementation of SBTs with respect to the level of ventilatory support, oxygenation and sedation at which they are performed and variability surrounding the clinical criteria documented for assessing extubation readiness.

Objectives: We aimed to evaluate SBT implementation and documentation techniques across multiple centers to investigate the degree of practice variation and help inform the process of standardization. A secondary aim was to evaluate change in physiologic variables during an SBT to better understand when reporting should be performed.

Methods: Data on 680 patients (931 SBTs) across 8 centers was taken from the Weaning and Variability Evaluation (WAVE) observational study. SBT performance was analyzed with respect to distribution of ventilatory support, oxygenation and sedation levels using the Richmond Agitation Scale Score (RASS). SBT reporting was assessed in terms of the incidence of use of clinical extubation criteria. The change in physiologic variables throughout an SBT was plotted to elicit the importance of timing in SBT reporting.

Results: While the majority (80% and 78%) of SBTs used 5 cmH2O ventilation for both pressure support (PS) and positive-end-expiratory-pressure (PEEP), several individual sites uniformly employed 0 cmH2O level support for PS, and other sites demonstrated significant variation in ventilatory support within that site. A significant range in oxygenation was observed with the majority of SBTs (68%) performed at FiO2 21-30%. Sedation level was variable within and between sites, with 22% having a RASS $\leq$-2. Clinical extubation criteria were employed heterogeneously amongst centers, ranging in frequency of use up to 60% for a given criterion. On average, there was no change in physiologic variables, including heart rate, respiratory rate, tidal volume or oxygen saturation or RSBI (respiratory rate / tidal volume) over the duration of an SBT.

Conclusion: Our study highlights both inter- and intra-institutional variation in SBT performance and reporting. Variability in ventilatory support highlights the debate over "minimal" or "zero" level support and variation in RASS scores is inconsistent with evidence favouring minimization of sedation. These factors impact both patient safety and methods for predicting extubation outcome. Further research is needed to determine the impact of variation in oxygenation. Inconsistency in the application of clinical criteria within and across sites diminishes the reproducibility of extubation prediction and hinders research evaluating the effectiveness of predictive criteria. The lack of change in physiologic variables over an SBT suggests there is no ideal time of measurement. The above results support efforts to further clarify and standardize optimal SBT implementation and documentation with further research

warranted to determine ideal targets. We believe that universal SBT protocols can improve clinical outcomes by increasing adherence to evidence-based practice and alleviating human error in implementation. Standardization may power future research on outcome prediction, fostering the development of novel predictive indices to enhance the safety and efficiency of extubation.

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Poster # 84 **Poster Session: 15:30 - 17:00**

Title: USE OF A SEVERE SEPSIS MANAGEMENT BUNDLE CAN IMPROVE ED CARE: FINDINGS FROM A COLLABORATIVE EMERGENCY-CRITICAL CARE QUALITY INITIATIVE

Presenter: Sara Gray, St. Michael's Hospital, Emergency Medicine, Toronto, Canada.

Introduction: The 2012 Surviving Sepsis Guidelines introduced evidence based bundles to optimize early resuscitation of septic patients.

Objectives: To assess whether a collaborative ED-Critical Care sepsis bundle affected timeliness of antibiotics, fluids and lactate measurements.

Methods: An interprofessional team developed a severe sepsis management bundle: i) triage flagging; ii) sepsis lab panel; and iii) pre-printed order sets to standardize ordering of antibiotics,fluids and serial lactates. A 9-month (September 2013– June 2014) review of ED patients admitted to ICU and Step-Up with pneumonia, sepsis or urosepsis was conducted after the bundle introduction.

Results: 89 patients were identified: 19 (21%) received 2 bundle elements (lab panel, order set) with remainder managed with standard care. Patients with at least 2 elements of the bundle showed a trend to improved initial (100% vs 78%) and serial lactate measurement (86% vs 61%), reduced (mean, SD) time-to-first-antibiotics (2:05+1:53 vs 3:14+2:47 hr), reduced time-to-3L fluids (4:40+3:09 vs 5:09+3:26 hr), improved time-to-serial lactate (4:35+1:39 vs 5:20+3:23 hr), reduced time-to-admit (4:41+2:05 vs 6:01+4:36 hr) and shorter ED LOS (9:36+7:43 vs 11:34+8:16 hr). There was a trend toward increased mortality in the bundle group (42% vs 21%).

Conclusion: A collaborative model in our ED has resulted in low rate of bundle use but trend towards improved quality indices of sepsis management and patient flow. The increased mortality may be explained by selection bias in providers using the bundle on more critically ill patients. Further study will focus on understanding the impact of and barriers to sepsis bundle use.

References: not applicable

Poster # 85 **Poster Session: 15:30 - 17:00**

Title: A Questionnaire on Satisfaction of Family Members During Family Issues Meetings in the Intensive Care Unit

Presenter: Marnie Jakab, Mount Sinai Hospital, Intensive Care Unit Research, Toronto, Canada.

Introduction: ICU family meetings (FM) are an important method of communication between the ICU team and family; FM play a key role in developing patient and family centered care.

Objectives: To identify key elements of an effective FM from a family perspective.

Methods: A prospective exploratory study evaluating family members' perceptions of trust, comfort, decision making and level of satisfaction of ICU FM. ICU FM include an attending physician, fellow, bedside nurse, chaplain, and social worker in addition to the family of the ICU patient. Any person attending the FM on behalf of the patient was defined as a family member in this study. Between September 2013 and June 2014, all family members were offered a questionnaire for completion immediately following the FM. The questionnaire asked family members about their satisfaction with the FM relating to: physician ability to communicate, address questions, deliver information and general satisfaction on a scale of 0-4 (with 0 being not at all and 4 being often), for a total average satisfaction (TAS) score out of 16. We related the TAS score to participants' self-perceived level of comfort, trust and whether an end of life (EoL) discussion was held. Data were analyzed using descriptive statistics.

Results: 100 FM took place during the study period; 61 of these had at least one completed questionnaire returned, with a mean of 2.5 respondents per FM. There were a total of 154 completed questionnaires. No questionnaires were completed in 39 FM. Of the 154 respondents 59% were female; 21% self-identified as a child, 18% self-identified as a parent, 18% self-identified as a spouse/partner, and over 20% were extended family. We noted a high mean rating for physician ability to communicate (3.7/4), address questions (3.7/4), delivering information (3.7/4) and general satisfaction with the meeting (3.6/4) leading to a high TAS score of 14/16. Comfort and trust was experienced "often" by 95% of respondents vs. sometimes" in 4% of respondents. There were no respondents that did not trust the physician and only 1.5% felt that the ICU team did not care. Family members that had increased comfort/trust in the ICU team tended to have higher TAS scores. The TAS scores were increased in the "often" group (15/16) compared to the "sometimes" group (11/16) and the "no" groups (8/16). A total of 134 respondents (87%) always trusted the physician, 18% were uncomfortable with the information provided and had lower TAS scores then those who were comfortable even with the same self-perceived level of trust, 13/16 vs. 15/16. This finding suggests that comfort may have a greater impact on family satisfaction than trust alone. End of Life (EoL) discussions took place in 59% of the FM; we found no difference between response rates or TAS scores between non-EoL and EoL discussions. Finally, 86% of respondents preferred to share decision making with the ICU team and 94% of family members felt involved with the decision making process.

Conclusion: Family members taking part in FM are not limited to the traditional family unit. Family members that experience more comfort/trust towards the ICU team are more satisfied with their FM. Comfort may contribute more to family satisfaction than trust alone. EoL

discussions remain an important part of the ICU FM; despite the sensitive nature of the conversation, families prefer a shared decision making model.

References: NA

Poster # 86 **Poster Session: 15:30 - 17:00**

Title: Measuring congruence between international sepsis guidelines and current practice at a Canadian academic health centre: An observational prospective study

Presenter: Stephanie Lammers, Queen's University, School of Medicine, Faculty of Health Sciences, Kingston, Canada.

Introduction: Severe sepsis occurs in 2% of hospitalized patients in the United States, and accounts for 10% of total ICU admissions.1 Severe sepsis and septic shock carry high mortality rates.1 Early administration of antibacterial therapy can decrease mortality from sepsis, and, therefore, widely promoted guidelines recommend that the first dose of antibiotics be administered within one hour.2,3 Adhering to this practice, as well as to other guideline items, is challenging.

Objectives: To inform further quality improvement efforts, we sought to describe adherence to the sepsis guidelines, in particular early administration of effective antibiotics, in our ICU.

Methods: A prospective observational study in the ICU of Kingston General Hospital, Kingston, Ontario, Canada, was carried out over eight weeks in June and July 2014. All patients older than 18 years admitted to the ICU were assessed daily for suspected septic shock by review of their medication administration records (MARs) for antibiotic administration. Those who had received antibiotics had their paper and electronic charts reviewed for the indication for these antibiotics. Patients were included who received antibiotic therapy for suspected severe sepsis and demonstrated hypotension (MAP 2.2mmol/L). Patients were excluded from this study if their initial management was performed at another hospital or they had expressed goals of care that limited their septic shock resuscitation.

Results: Twenty-five patients, age 67.5 (±17.4), 44% male, were included: 17 (68%) presented first with sepsis in the ED, 5 (20%) in the ICU, 2 (8%) on hospital wards, and 1 (4%) in a step-down ICU. Nine (36%) and 18 (72%) of patients received their first antibiotic doses, within 1 and 3 hours, respectively. Of 23 patients who had blood cultures sent with a time recorded, 16 (70%) were drawn before antibacterial therapy was administered. Fifteen patients were found to have positive blood cultures. It took 220 (IQR, 155-311) minutes to administer the first 2 liters of intravenous fluids, and a median of 2044mL (IQR, 1754-2658) were administered in the first 6 hours of resuscitation. Just 14 (56%) patients received at least 2L of fluids. Twenty-one (84%) patients received central lines and 15 (60%) required, or were already receiving, vasopressor support. Lactate levels were initially measured for 23 (92%) patients: of 17 patients with elevated levels, 15 (88%) had a second lactate drawn a median of 180 minutes (IQR, 151.5-212.5) after the first level. The 30-day ICU mortality rate was 40% and the average length of stay in the ICU was 12 days (IQR, 5-16).

Conclusion: Surviving Sepsis guidelines were inconsistently followed in our institution, across all locations studied. Quality improvement is warranted.

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Poster # 87 **Poster Session: 15:30 - 17:00**

Title: Man Vs Machine : Let me Breathe Free

Presenter: FAISAL MASUD, HOUSTON METHODIST HOSPITAL, CRITICLA CARE ANESTHESIOLOGY, HOUSTON, United States of America.

Introduction: Pulmonary complications are the leading cause of morbidity and mortality in post-CABG. Factors such as anesthesia, surgical incision, cardiopulmonary bypass (CPB), ischemia time, surgical technique and drains may predispose the patient to the change in pulmonary function postoperatively. Furthermore, mechanical ventilation (MV) is a contributing factor to these complications [1].Patients undergoing cardiac surgery are at increased risk of infections especially pneumonia (2) after prolong ventilation of more than 24 hours and if they are on the vent more than 48 hours it more negative impact.Studies in cardiac surgery patietns have shown that there is quite a bit variation in post operative ventilation times (3)P Plan-Do-Study-Act (PDSA)Quality improvement projects aimed at making positive changes in health care processes to effecting favorable outcomes have been used effectively by Institute for Healthcare Improvement, (4) One of the unique features of this model is the cyclical nature of impacting and assessing change, most effectively accomplished through small and frequent PDSAs rather than big and slow ones(5)Agency for Healthcare research and quality has shown that variations in care have a negative impact on quality of care.(6) With this background we wanted to address prolong ventilation at our Institution as we had almost twice the expected rate of patients with prolong ventilation (defined as more than 24 hours on the ventilator after the surgery)undergoing isolated CABG surgery

Objectives: Quality improvement literature has shown that limiting variations in care can have beneficial effects .We Initiated this PDSA process by identifying team members(respiratory therapists, Anesthesiologists, Nurses , nurse practioners and physician assistants and critical care physicians) the nature and scope of problem. The goal was reducing the Observed vs Expected ratio to less then 1 of patients having prolong ventilation.

Methods: First step was education and engagement of team. We did PDSA cycles in many areas including pre op area with Spirometry testing and identifying high risk patients ,and optimizing them,intra-op extubation evaluation, post operative every patients is fast track unless a exception. head of bed charts showing hourly goals . repeated evaluation of patient's readiness for extubation at multiple intervals and repeated communication among the team. weekly and Monthly chart reviews and huddle on patients who could not be extubated within 24 hours. This was a retrospective review of 9 months data of all patients undergoing Isolated CABF surgery at MDHVC

Results: In a 9 month time period we went down from a rate of 13.9% of patents have prolong ventilation after isolated CABG surgery to 4.1% . That is more than 66% reduction in number of patients with prolong ventilation. Our O/E ratio also decrease to less than 1 . We were able to discharge these patients from CVICU earlier.

Conclusion: Quality Improvement tools like PDSA can be successfully applied to a very complex and diverse clinical environment, resulting in enhanced care for patients , reducing

process variation , team building. We have been able to cut the number of patients requiring prolong ventilation by more than half and potentially preventing some healthcare associated infections and costs. This can have an impact on our Society Of Thoracic Surgeon star ranking of our Institution by reducing morbidity .

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6. Improving quality AHRQ

Poster # 88 **Poster Session: 15:30 - 17:00**

Title: Improving ECMO outcomes in Respiratory failure Patients

Presenter: FAISAL MASUD, Houston Methodist Hospital, Anesthesiology & Critical Care, Houston, United States of America.

Introduction: The mortality for Severe ARDS remains high, even in the modern era. Initial management includes treating treatable causes, low tidal volume ventilator strategy as described in ARDSnet, and consideration of more conventional advanced therapies such as prone positioning, inhaled Nitric Oxide and epoprostenol. ECMO is also considered in severe ARDS,however it needs to be considered early, and for those patients who are potentially recoverable.(1) IN the CESAR trial, Peek and colleagues reported a substantial benefit to ECMO for the management of severe adult respiratory distress syndrome . As compared to the control group, the experimental group saw an improvement in survival without severe disability. The control group had a survival at 6 months of 47%, whereas the experimental group had a 6 month survival of 63%.(2)The number of VV ECMO patients has grown substantially. Over the past ten years, the number of ECMO centers has grown from 115 to 223, with the number of cases increasing from 1967 to 4357, according to the The Extracorporeal Life Support Organization (ELSO).(3)With the use of ECMO as part of the therapy in selected patients with influenza A (H1N1) in Australia and New Zealand, the growth of both ECMO programs and numbers of patients on ECMO has accelerated. (4) Our outcomes were not in line with National and International centers . We wanted to improve our processes , care pathways and ultimately to improve patient outcomes.

Objectives: Objective was to utilize Processes Mapping and PDSA as quality tools, to identify the strength and weakness of our ECMO program, to map a pathway for improvementBased on these tools we developed a Multidisciplinary team, mutually agreed on protocol, addressed variations in care , reviewed outcomes and held each other accountable

Methods: First step was identifying that we didn't have a process for ECMO placement in these patients and it was based on individual physician's discretion and decision making. It showed that variations in care was one of the primary weakness in our program. We developed a process map for these patients , developed an inclusion/exclusion criteria, treatment protocol, case reviews, etc. This was based on multiple PDSA cycles which we had to do with team member including, surgeons, Intensivists,Perfusionists, Nurses, Respiratory therapist, pulmonologists. In order to accommodate the increase case load we had to reinvent the care model from full time perfusionist at bedside to a Nurse ECMO specialist model with oversight from Perfusionist.

Results: From the 2011 and 2012 we were able to reduce mortality among respiratory cases of ECMO from 80% to almost 23% by September 2014. This translates to almost 75% reduction in mortality among this high risk category . Also we were able to increase the volume of cases from 14 cases to 21 (and counting) cases leading to a 50% increases in number of cases. This number which will increase more as the flu season hasn't started.

Conclusion: From the 2011 and 2012 we were able to reduce mortality among respiratory cases of ECMO from 80% to almost 23% by September 2014. This translates to almost 75% reduction

in mortality among this high risk category. Also we were able to increase the volume of cases from 14 cases to 21 (and counting) cases leading to a 50% increases in number of cases. This number which will increase more as the flu season hasn't started. Quality improvement tools have to go hand in hand with clinical tools in order to provide excellent care for patients

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Poster # 89 **Poster Session: 15:30 - 17:00**

Title: A PICU Patient Safety Checklist: Rate of Utilization and Impact on Patient Care
Presenter: Brianna McKelvie, Children's Hospital of Eastern Ontario, PICU, Ottawa, Canada.

Introduction: In healthcare, checklists help to ensure patients receive evidence-based, safe care. Since 2007, we have used a bedside checklist in our PICU to facilitate daily discussion of care-related questions at each bedside.

Objectives: The primary aim of this study was to assess compliance with checklist use and to assess how often individual checklist elements affected patient management. A secondary aim was to determine whether patient and unit factors (severity of illness, unit census, weekday vs. weekend, admitting diagnosis group) influenced checklist use.

Methods: The study was conducted in the CHEO PICU, a 12-bed cardiac and medical-surgical unit. A research assistant attended daily bedside rounds to assess compliance with the use of the checklist in eligible patients, and to determine whether discussion of an individual checklist element was associated with a change in the patient's management plan. Data was also collected on patient census, severity of illness using PELOD score, day of the week (weekday vs. weekend), and admitting diagnosis group (cardiac vs. non-cardiac).

Results: 148 encounters were collected on 28 days between September 2013 and February 2014. Compliance with the checklist was 89.2% (132/148; 95% CI 83.2 – 93.2%) and was not influenced by admitting diagnosis group, patient census, severity of patient's conditions or weekday/weekend status. The checklist affected the patient management plan 52.6% of the time (69/132; 95% CI 44.2 – 61%). The items that most commonly affected the patient management plan included whether a chest radiograph should be ordered for the next morning (11.4%, 15/132; 95% CI 7 – 17.9%), whether the frequency of bloodwork had been evaluated (11.4%, 15/132; 95% CI 7 – 17.9%), whether any new consults were needed (10.6%, 14/132; 95%CI 6.4 – 17%) and whether NG or NJ position had been verified on radiograph (9.1%, 12/132; 95% CI 5.3 – 15.2%).

Conclusion: Our study found that compliance with checklist use at daily bedside PICU rounds was high. Checklist use frequently resulted in a change in the patient management plan.

References: N/A

Poster # 90 **Poster Session: 15:30 - 17:00**

Title: Non-Essential Blood Testing in the ICU: An Observational study
Presenter: Michael Mikhaeil, Queen's University, Medicine, Kingston, Canada.

Introduction: Healthcare expenditures are rising at a staggering rate. This is partly due to technological advancements, but likely also due to wasteful practices. Non-essential blood testing in acute care settings has been identified as a prominent source of wasteful spending. In addition to increased workload to providers and cost to hospitals, unnecessary phlebotomy can lead to patient discomfort, as well as morbidity and mortality through hospital-acquired anemia and the risks inherent to subsequent blood transfusion. Although interventions to address this issue have been reported, the extent of non-essential blood testing in different acute care settings has not been well described.

Objectives: We aimed to describe the extent of unnecessary blood testing at the 33-bed, Level-3 intensive care unit (ICU) of Kingston General Hospital, a tertiary care teaching hospital in Ontario, Canada.

Methods: Over a period of 4 weeks, all ICU attending physicians were interviewed once, each during a single weekday. They were asked to select from a comprehensive list, which blood tests they deemed essential to maintain appropriate care for each of their patients on the following day. Tests that were actually processed on the following day were recorded. Relevant demographic and clinical variables, as well as the cost of processing the various tests were also recorded. Descriptive statistics were used to describe the proportion of essential blood tests out of all tests processed. Chi-squared and T-tests were used to examine for associations between selected demographic and clinical variables and proportions of essential blood tests.

Results: Nine attending physicians provided input for a total of 81 patient days. Of all processed blood tests, only 55% were deemed essential by the attending physicians. Arterial blood gases, complete blood count, and serum electrolytes were deemed essential most commonly (81%, 81%, and 75%, respectively); PTT, PT, and albumin were deemed essential the least (22%, 21%, and 16%, respectively). Patients that received mechanical ventilation or infusions of vasoactive drugs were less likely to have non-essential blood tests performed (OR=0.39; 95%CI, 0.28-0.54 and OR=0.30; 95%CI, 0.20-0.46, respectively). On average, non-essential blood tests incurred an excess cost of $27.5 per patient day. Extrapolating this over a one-month period in the ICU, which on average has 30 beds occupied, comes to $25,584 in unnecessary cost.

Conclusion: In summary, a large proportion of blood tests processed in the studied ICU were not deemed necessary by attending physicians. Certain test types, as well as tests for patients receiving a higher level of life-sustaining measures were deemed essential more commonly than others. Non-essential blood testing incurred a substantial cost. Further work is required to better understand the underlying factors contributing to these wasteful practices. We suspect that the lack of a routine daily process for identifying essential blood tests is a major contributor. The results of this project will be used to guide future quality improvement measures.

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Poster # 91 **Poster Session: 15:30 - 17:00**

Title: Implementation of a SIRS-based Early Warning System using wireless real-time alerts: The AEGIS pilot project at William Osler Health System

Presenter: Michael Miletin, William Osler Health System, Medicine, Toronto, Canada.

Introduction: Approximately 50% of ward patients admitted to the intensive care units at William Osler Health System (Toronto, Ontario) have not had a prior consultation by the critical care response team (CCRT). Delays in ICU or CCRT notification average 10 hours from onset of calling criteria. Overall, 30% of all patients admitted to the ICUs originate from the inpatient wards, and 80% of these patients have vital sign parameters that include ≥3 SIRS criteria within the 48 hours of ICU admission. In response to these data, we launched a quality improvement initiative to address the timely detection of ward patients at risk of deterioration.

Objectives: To reduce inpatient code blue rates and unscheduled admissions to the intensive care unit.

Methods: We conducted a 6-month quality improvement project on 6 inpatient medical wards at two community hospitals. A multi-parameter early warning system was designed to prioritize sensitivity. The hospital's existing electronic medical record system was programmed to continuously search nurse-entered vital sign data and bloodwork values, generating alerts whenever a patient's vital sign set included any of the following: 3 or more modified SIRS criteria (HR>89, Temperature >37.9 or < 35, RR>19, WBC< 4 or > 12), a shock index (HR/SBP) of >1.3, a RR > 27, or met CCRT calling criteria (SBP>200, HR>130 or < 40). Alerts were sent wirelessly to a PDA carried by a ward-based charge nurse. We provided education to bedside nurses focusing on timely entry of vital sign data into the EMR. The charge nurses were instructed to follow a scalable response algorithm once an alert was received. Outcome measures for this quality improvement project included code blue rate, unplanned ICU admissions, CCRT consultation rate, and time lapse from CCRT activation criteria met to call during the six months following the implementation of the early warning system.

Results: Despite an expected low positive predictive value of 15% for the outcomes of unplanned ICU admission and code blue, alert frequency was a manageable 3-6 per day per ward. Relative to a baseline period during the same six calendar months of the previous year, the code blue rate on the three wards at Brampton Civic Hospital decreased by 43% (0.76 per 1000 admissions to 0.43 per 1000 admissions) during the six months of the early warning project. At Etobicoke General Hospital, the code blue rate decreased by 55% (baseline 0.84 per 1000 admissions vs 0.38 per 1000 admissions during the six months of the early warning project). Unplanned ICU admissions decreased by 25% in the six months of the early warning project compared to the baseline period at Etobicoke General Hospital, while at Brampton Civic Hospital, no change was observed. No changes in the rate of CCRT activation or time to CCRT activation were observed. However, charge nurses on the pilot wards felt that the early warning system facilitated their communication with bedside and CCRT nurses as well as with attending physicians.

Conclusion: A simple "track and trigger" early warning system based on SIRS criteria and

CCRT calling criteria that sends real-time wireless alerts to a ward charge RN is feasible and inexpensive to implement in a large community hospital. The observed decrease in code blue events and positive nursing feedback has prompted us to expand the program to all inpatient wards and deploy a parallel system using more specific criteria to identity the highest risk patients and trigger direct activation of the CCRT to the bedside.

References: None

Poster # 92 **Poster Session: 15:30 - 17:00**

Title: Trending performance of changes in cardiac output of four non-invasive cardiac output devices after cardiac surgery.

Presenter: Rohit Mohindra, McGill University, FRCPC Emergency Medicine Training Program, Montreal, Canada.

Introduction: Cardiac index (CI) is frequently measured during the early management of patients after cardiac surgery (1,2). Currently, this is obtained with a pulmonary artery (PA) catheter and thermodilution (TD) measurements. Newer non-invasive cardiac output devices may provide an alternative (3–6). Most studies have examined the accuracy and precision of these devices (agreement analysis), but another important function is the ability to track changes in response to fluid challenges or vasoactive drugs (7–10). We examined the agreement ability of each device and tested trending performance using a polar plot format.

Objectives: To evaluate the agreement and trending performance of four non-invasive cardiac output monitoring devices compared to thermodilution.

Methods: This was a prospective quality assurance study in a non-randomized convenience sample of patients post cardiac surgery at a tertiary academic ICU. Accordingly, individual consent was not required. All patients had PA catheters as part of routine care. Four currently approved devices were tested (Cheetah NICOM™, Edwards Vigileo/FloTrac™, LiDCO Rapid™ or PhysioFlow Enduro™). CI measurements were taken simultaneously from the PA catheter and the non-invasive device over the first 24 hours in the ICU whenever a TD measurement was obtained. We compared agreement performance of the devices to TD measurement by Bland-Altman analysis, concordance correlation coefficient, and ability to identify "panic values" (CI < 2.2 L/min/m2) by inter-rater kappa (11–18). Trending performance was evaluated with polar plots (8,9).

Results: We studied 73 patients (NICOM 19, Vigileo 14, LiDCO 19, PhysioFlow 21). Measures of bias and upper and lower limits of agreement ((L/min/m2, 95% CI) by Bland-Altman analysis were: NICOM 0.11 (1.65-1.43), FloTrac -0.11 (0.98-1.20), Physioflow 0.10 (1.70-1.51) and LiDCO -0.56 (1.11-2.24). Concordance correlation coefficient was weak (less than 0.8) for all devices (95% CI): NICOM 0.22 (0.21–0.23), FloTrac 0.67 (0.64-0.71), PhysioFlow 0.35 (0.34–0.37) and LiDCO 0.21 (0.20–0.22). Agreement of detection of "panic" CI by Kappa statistic was poor for all devices: 0.08 (0.03-0.14) for NICOM, 0.25 (0.20–0.29) for FloTrac, 0.21 (0.16–0.25) for PhysioFlow and 0.34 (0.30–0.38) for LiDCO.

All devices showed excellent trending performance by polar plot analysis. No device demonstrated deviation > 45^0 from the line of identity. Greater than 99% of the trend data for all four devices was within the accepted limit of agreement of 10% (0.3 L/min/m2, see Figure 3).

Conclusion: The NICOM, PhysioFlow and FloTrac devices demonstrated minimal bias, with reasonable limits of agreement, compared to TD. However, the LidCO device tended to overestimate the change in CI with increasing CI. The suboptimal concordance correlation of the devices could limit the use of these devices in certain critical situations. Especially concerning is the high miss rate of panic values of cardiac output. Based on polar plot analysis, all four

devices tracked cardiac output well (8). Polar plot analysis is likely a more intuitive and clinically meaningful measures of trending. In clinical situations where CI trend is useful, such as monitoring response to fluid challenges or vasoactive medications, our results suggest all four devices would be well suited to track cardiac function.

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Poster # 93 **Poster Session: 15:30 - 17:00**

Title: Introduction of an electronic early warning score in an academic hospital without a rapid response system: Preliminary findings and challenges.

Presenter: Benjamin Tam, McMaster University, Department of General Internal Medicine, Hamilton, Canada.

Introduction: Inpatient arrests can be considered a failure to rescue and are often preceded by abnormal vital signs. We are in the process of introducing an electronic early warning score (EWS) throughout Hamilton Health Sciences to improve attention to care and reduce inpatient arrests. Current literature primarily describes the outcomes of EWS implementation in the setting of a rapid response team (RRT). (1) We have an academic site without a RRT that had a high inpatient arrest rate. We wondered if implementing an EWS without a RRT would still reduce inpatient arrests.

Objectives: Our primary objective was to determine the inpatient arrest rate before and after implementation of an electronic EWS on two medicine wards without RRT support. Our secondary objectives were a) to determine the impact of an electronic EWS on arrest rates on two medicine wards with RRT support and b) to determine whether the nursing staff on the medicine wards without RRT thought EWS implementation improved patient safety.

Methods: We conducted a retrospective chart review of consecutively admitted medical patients over 6 months (January-June 2014). The EWS was implemented starting April 2, 2014 after collaboration with critical care and internal medicine departments at the hospital without RRT. A ramp-up system to respond to the EWS was created and implemented with both critical care and internal medicine support. Bedside nurses were educated and trained to use the EWS prior to implementation. The comparison site was the medicine ward with a RRT since 2006 and EWS since August 2013. Charts were reviewed and data was abstracted by a team following training with a standardized operating procedure. We aimed for a kappa of 0.8 or greater on 10% of charts reviewed. An inpatient arrest was defined as either a respiratory arrest requiring intubation or cardiac arrest requiring chest compressions and/or defibrillation. A qualitative survey was distributed both electronically and in hard copy to nurses who worked at the site without the RRT in September 2014.

Results: There were 2141 patients admitted over the study period to the medicine wards and 1385 were admitted at the implementation site. We had similar number of patients admitted before (657 patients) and after (728 patients) implementation. Figure 1 shows the inpatient arrest rate over time per 1000 admissions. The event rate is low at both sites. We found a trend towards fewer inpatient arrests in the study time period at the site without RRT that was not seen at the mature EWS and RRT site. We had a 30% response rate to our qualitative study. We found that 17% of nurses felt the EWS improved access to appropriate care, and 14% felt that EWS improved patient safety.

Conclusion: The event rate for inpatient arrests is low at both sites. Although not statistically significant, there is a trend towards reduced inpatient arrests at the site without RRT following EWS implementation. We noted variability in arrests at the site with both a RRT and EWS.

Further analysis is required to determine if an elevated EWS preceded these events. Despite significant education, additional collaboration with bedside nurses is needed to ensure that this trend for reduction in inpatient arrests is maximized and sustained.

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Poster # 94 **Poster Session: 15:30 - 17:00**

Title: The Effect of Critical Care Echocardiography on the Usage rates of Diagnostic Echocardiography in the Intensive Care Unit

Presenter: Aws Alherbish, Schulich School of Medicine and Dentistry, Western University, London, ON, Canada, Critical Care Medicine, London Ontario, Canada.

Introduction: Critical care echocardiography (CCE) is routinely used by intensive care unit (ICU) providers to provide real time interpretation and integration of findings into patient care. By comparison, diagnostic echocardiography (DE) employs a comprehensive examination with a more traditional imaging workflow and sophisticated techniques not included in CCE. Despite these differences, CCE and DE are frequently employed to answer similar diagnostic questions that arise in the ICU. This overlap raises questions of duplicate testing, which may result in redundancy of hospital resources and patient morbidity through over-testing. An examination of the utilization patterns of these modalities in the ICU and, in particular, how the advent of CCE may influence the use of DE is of great interest.

Objectives: To evaluate the effect of the introduction of CCE over the utilization of DE in tertiary care ICUs from 2 hospitals: University hospital (UH) and Victoria hospital (VH). To examine if a change in trend (if any) had resulted in any change in outcomes.

Methods: The monthly mean ratios of CCE and DE studies to patient care days (PCD) were plotted and general linear models were used to test for trends over time. Student's t-test was used to compare the mean ratio of DE studies to PCD before and after the introduction of CCE. Outcome measures were compared using Pearson’s chi-square test of association or the Wilcoxon Rank Sum test, where applicable.

Results: Whereas the ratio of CCE/PCD increased significantly and the ratio of DE/PCD decreased significantly over time at VH ($p=0.0001$ and $p=0.0037$ respectively), they did not change significantly over time at UH ($p=0.11$ and $p=0.81$ respectively) (Figure 1). The mean ratio of DE/PCD decreased significantly between pre CCE and post CCE periods at VH (5.27% to 4.51%, $p=0.011$) while insignificant decrease was seen at UH (5.90% to 5.79%, $p=0.689$) (Table 1). At both hospitals, there was no significant increase in ICU mortality or LOS when comparing the pre to post CCE periods. At VH, ICU mortality was (23.69% and 24.61% pre and post CCE respectively, $p=0.479$) and median LOS was (4.18 and 3.53 pre and post CCE respectively, $p<0.0001$). At UH, ICU mortality was (23.3% and 23.4%, respectively, $p=0.933$) and median LOS was (3.85 and 3.63 pre and post CCE respectively, $p=0.473$) (Table 1).

Conclusion: Significant CCE utilization is associated with a significant decrease in utilization of DE in an academic ICU environment with no influence on outcomes.

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Poster # 95 **Poster Session: 15:30 - 17:00**

Title: Legionella in the Niagara Region: A Retrospective Case Series

Presenter: Stephanie Cargnelli, Michael G. DeGroote School of Medicine, McMaster University, Medicine, Hamilton, Canada.

Introduction: Legionella pneumophila, the main causative agent of legionellosis, was first recognized in 1976 when an outbreak at an American Legion convention in Philadelphia, PA resulted in 29 deaths and 147 hospitalizations. Legionnaires' disease is characterized by fatigue, myalgia, fever that increases in a stepwise fashion, headache, confusion out of proportion to the degree of fever, gastrointestinal complaints including diarrhea and nausea, cough (productive or non-productive), and hyponatremia. Based on studies conducted in Europe and North America, Legionella continues to account for 2 to 15 percent of all community-acquired pneumonias requiring hospitalization. In the summer of 2013, an outbreak in the Niagara region resulted in 17 cases of legionellosis.

Objectives: Using the cases of legionellosis in the Niagara region, we sought to characterize the signs, symptoms and natural history of this disease to educate physicians on the recognition, diagnosis, and treatment of this potentially fatal disease.

Methods: A retrospective chart review was conducted on 14 hospitalized cases of Legionella in the Niagara region from June to December of 2013. 3 patients were not hospitalized and records could not be retrieved. REB approval was obtained and a case report form was developed. Patients who tested positive for Legionella were reviewed on our computerized medical record (Meditech) and data collection was supplemented and confirmed with paper charts.

Results: The mean age of patients at the time of hospitalization was 57.8 years. The majority of patients had comorbidities (78.6%) and were cigarette smokers (71.4%). A minority of patients presented with characteristic symptoms of Legionella including headache (14.3%) and gastrointestinal symptoms such as nausea and vomiting (21.4%), diarrhea (28.6%), and abdominal pain (28.6%). Most of the patients presented with shortness of breath (85.7%), fever >38°C (71.4%), heart rate >90 beats per minute (71.4%), and respiratory rate >22 breaths per minute (92.9%). Patients presented with both a productive cough (50%) and a cough without sputum (35.7%). Most patients had hyponatremia at the time of admission (64.3%) with most cases being mild. Few patients demonstrated a high lactate (35.7%) and exactly half of the patients presented with an elevated creatinine kinase. Most common method of diagnosis was Urinary Antigen test (85.7%) followed by sputum sample (35.7%) and bronchial washing (21.4%). A chest X-ray was done on all patients admitted and demonstrated bilateral airspace disease in 78.6% of cases. The majority of patients were admitted to the ICU (78.6%) and over half required ventilation (64.3%) and pressors (57.1%) with the most common being norepinephrine. Five patients required dialysis throughout their admission. Three patients expired during their admission.

Conclusion: Legionella does not always have the typical presentation noted in the literature. It should be considered in patients demonstrating bilateral airspace disease on chest X-ray, hyponatremia, and abnormal vital signs. Diagnosis should be made with urine antigen testing or

respiratory tract secretions. Legionella has proven to be a potentially life-threatening condition with a rapid decline. Appropriate antibiotic treatment with azithromycin or a fluoroquinolone is a potentially life-saving treatment that should be initiated immediately rather than delaying until laboratory confirmation is received.

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Poster # 96 **Poster Session: 15:30 - 17:00**

Title: Long-term outcomes of prolonged ICU length of stay

Presenter: Yiorgos Alexandros Cavayas, Centre Hospitalier de l'Université de Montréal, Critical Care, Montreal, Canada.

Introduction: After the acute phase of critical illness, some patients stay dependent on life sustaining therapies. These patients are often affected by generalized neuromuscular weakness, endocrine [1], immune system and brain dysfunction [2] as well as sustained respiratory insufficiency requiring prolonged mechanical ventilation. This syndrome, chronic critical illness, usually results in a prolonged intensive care [ICU] length of stay [LOS] [3, 4]. However, ICU LOS is also affected by institutional organizational factors and healthcare system structure. Patients with a prolonged ICU LOS (defined as $\geq$ 21 days) impose a significant economical burden to the society by occupying a sizable proportion of available ICU beds [4, 5]. Although great efforts have been made in the last decade to better characterize these patients, there are few recent studies available on Canadian ICUs [6, 7].

Objectives: The aim of our study was to characterize the patients with a prolonged ICU LOS in a Canadian tertiary ICU setting. We determined the prevalence, short and long-term mortality as well as the orientation at discharge from the hospital.

Methods: We conducted a retrospective descriptive study from March 2009 to March 2011 in the Centre Hospitalier de l'Université de Montréal, a 1200-bed academic hospital with a total of 50 mixed medical-surgical ICU beds. Using the hospital administrative database, we extracted data on the 5313 consecutive patients admitted to our institution's ICUs, excluding those admitted solely for organ donation and those without a health insurance card from our province. We collected data on patient demographics, diagnosis at ICU admission according to ICD-9 criteria, surgical interventions performed including tracheostomy, ICU and hospital length of stay, hospital mortality and disposition at hospital discharge. We also determined if patients were mechanically ventilated on the 21rst day of ICU admission using the electronic medical records. Finally, using the provincial Ministry of Health database, we obtained the date of death of all the patients in the following 3 years (March 2014).

Results: During the two-year period studied, 196 patients had a prolonged ICU length of stay, making up 3.7% of all admissions. They accounted for 7 147 ICU bed-days, which represented 26% of ICU bed-days utilized during that period. Chronically critically ill patients had a mean hospital length of stay of 70 days. There were 60% males among them and their mean age was 62. Surgical patients constituted 84% of this group, as compared with 64% of the overall ICU population of our institution. Of the 196 patients with a prolonged ICU LOS, only 43 (21.9%) were discharged from the hospital back to their home. Their in-hospital mortality was 39.2%, 90-day mortality 37.2%, the 1-year mortality 49.5% and 3-year mortality 59.2%.

Conclusion: Although they represent only 3,7% of admission, patients with a prolonged ICU stay account one quarter on ICU bed utilization in our institution. Only one fifth of these patients are discharged home directly from the hospital and about half of them are deceased by one year.

Our findings underline the need to further our understanding of this group of patients with extremely high resource utilization for very poor outcomes.

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Poster # 99 **Poster Session: 15:30 - 17:00**

Title: CHARACTERISTICS AND OUTCOMES OF PATIENTS WHO HAD BEDSIDE TRACHEOSTOMY PERFORMED IN THE INTENSIVE CARE UNIT

Presenter: Gabriella Jacob, Mount Sinai Hospital, Intensive Care Unit, Toronto, Canada.

Introduction: Tracheostomy is commonly performed in the intensive care unit (ICU) for critically ill patients who are anticipated to require prolonged mechanical ventilation. However, there is minimal literature describing the course of ICU patients who have a tracheostomy inserted in the ICU.

Objectives: To describe the demographics and outcomes of patients who had open bedside tracheostomy procedures performed in the ICU.

Methods: Retrospective chart review of all patients who underwent non-urgent tracheostomy insertion in the ICU between February 2009 and April 2013. Data collected from patient records included: 1) age, gender, past medical history, APACHE II score, reason for admission; 2) tracheostomy procedural details and complications; and 3) outcomes: length of mechanical ventilation, decannulation details, ICU and hospital length of stay and mortality.

Results: 97 patients had open tracheostomy performed by the Otolaryngology service in the ICU; 53% (n=51) were male, 59±17 years, APACHE II score 27±8. The majority (n=66, 68%) of patients were admitted for respiratory issues. Tracheostomy was performed between days 1 and 39 post-intubation; the mean ICU day was 15±8 days. The largest proportion of tracheostomies were performed between day 7-12 (25%, n=24), day 13-18 (24%, n=23) and day 19-24 (21%, n=20), with fewer undergoing the procedure between day 1-6 (15.5%, n=15) and day 25-39 (15.5%, n=15). For procedural sedation, 52 of 95 patients (54.7%) received propofol, fentanyl, and midazolam, 38.9% (n=37) received 2 of these, and 6.3% (n=6) received only one. Of 93 patients, 62 (67%) received a neuromuscular blocker and 54% (n=50) received phenylephrine during the procedure. 40% of patients were receiving sedative infusions on the day of tracheostomy; infusion rates fell to 22%, 15%, and 10% on days 1, 2 and 3 following tracheostomy, respectively., The most commonly inserted airway was the #6DCT (n=65, 68%). 8 of 96 patients experienced complications during the procedure: desaturation (n=4), excessive bleeding (n=3), and hypotension (n=1). The most common early complication (within 48 hrs), was bleeding at tracheostomy site (n=22); and complications after 48 hrs included skin necrosis at the site (n=26), mucous plugs (n=25), and bleeding (n=17). 75% of patients had at least 1 tracheostomy change while in hospital. 80 patients were weaned from ventilation while at MSH; 67 of them survived and their average duration of mechanical ventilation was 27±17 days. Thirty-four patients (35%) died with tracheostomy in place, 30 (31%) were discharged to another hospital with the tracheostomy, and 8 (8%) were discharged to a long term care facility with the tracheostomy. Twenty-five (26%) were decannulated at Mount Sinai, with 23 (24%) of these patients surviving to hospital discharge.

Conclusion: Bedside tracheostomy in the ICU was performed on average 15 days after intubation and initiation of mechanical ventilation, but the timing ranged widely. Procedural complications were rare. For patients receiving sedative infusions, the majority were

discontinued by day 3 post-procedure. There were a few early and late tracheostomy complications, most commonly bleeding and local skin necrosis.

References: NA

Poster # 100 **Poster Session: 15:30 - 17:00**

Title: Appropriate and timely antimicrobial prophylaxis in cirrhotic patients with spontaneous bacterial peritonitis and septic shock: a retrospective cohort study.

Presenter: Constantine Karvellas, University of Alberta, Critical Care Medicine, Edmonton, Canada.

Introduction: Spontaneous bacterial peritonitis in cirrhotic patients carries significant mortality. Time delay to appropriate antimicrobial therapy has been shown to significantly impact outcome in critically ill patients with septic shock.

Objectives: To determine whether practice-related aspects of antimicrobial therapy contribute to the high mortality from septic shock among patients with cirrhosis and spontaneous bacterial peritonitis (SBP). We examined the relationship between aspects of initial antimicrobial therapy and mortality in these patients along with other covariates on in-hospital mortality.

Methods: From the Cooperative Antimicrobial Therapy of Septic Shock (CATTS) Database Research Group between 1996 and 2011, a nested retrospective cohort study of all cirrhotic patients with septic shock, cirrhosis (biopsy-proven cirrhosis or documented portal hypertension) and evidence of SBP (neutrophil count > 250 or positive ascitic culture).

Results: Among 126 patients (mean age 55 years, 60% male), overall hospital mortality was 81.8%. In comparing survivors (n=23) with non-survivors (n=103), survivors had lower mean APACHE II (22(7) vs. 32(8), MELD (24(9) vs.34 (11) and serum lactate on admission (4.9(3.1) vs. 8.9(5.3), $p<0.001$ for all three). Survivors were less likely to have co-existent bloodstream infection (BSI) (22% vs. 50%, $p=0.015$) or culture positive infections (52% vs. 75%, $p=0.07$). Survivors were less likely to receive inappropriate initial antimicrobial therapy (0% vs. 25%, $p=0.013$) and more likely to receive appropriate antimicrobial therapy earlier (median 1.8(1.1-5.2) vs. 9.5 (3.9-14.3) hours, $p<0.001$). Predicted death rates (regression) according to APACHEII score, lactate and time to antibiotics are shown in Figure 1a,b,c.

Conclusion: Cirrhotic patients with septic shock secondary to SBP have high mortality (> 80%). Each hour of delay in appropriate antimicrobial therapy was associated with a 1.86 times increase in hospital mortality. Admission APACHEII and serum lactate also significantly impacted hospital mortality. Earlier identification of septic shock and initiation of antimicrobial therapy could potentially improve outcome in this patient population.

References: Figure 1 legend TILES A, B, C: Predicted death rate (univariable regression) according to APACHE II, lactate and time to antibiotics (hours). Grey bands represent 95% Confidence Intervals. TILE D: Predicted death rate according to time to antibiotics for different APACHEII values. Regression lines for APACHEII scores of 20,30 and 40 have been selected as representative.

Poster # 101 **Poster Session: 15:30 - 17:00**

Title: Emergency Room Utilization by Patients at the End of Life: Results from a Retrospective Chart Review at a Major Ontario Teaching Hospital

Presenter: Christopher Klinger, University of Ottawa, Department of Medicine, Division of Palliative Care, Ottawa, Canada.

Introduction: Despite many Ontarians favoring a home death, and provincial initiatives promoting community-based care, a majority still die in a hospital setting – often following admission via the emergency room (ER).

Objectives: To describe the patterns of ER utilization by end-of-life patients; to establish their advance care planning documentation rates; and to identify barriers and enablers for palliative care provision.

Methods: Retrospective chart review (standardized data abstraction form) of all patients seen by the inpatient Supportive and Palliative Care Program (SPCP) at a major Ontario teaching hospital who died in hospital within the 2012 calendar year. Descriptive data analyses of those patients utilizing the ER via IBM SPSS Statistics software (N = 568).

Results: A majority of patients were male (54%), 42% had a cancer diagnosis, the mean number of comorbidities was 3.6; mean patient age was 75 (range 20 to 101) years. Canadian Emergency Department Triage and Acuity Scale (CTAS) mean score was 2.4, with a median of 2 (Emergent, medical care within 15 minutes). Ninety percent of patients reported on having a family physician, 60% had social support, 32% were on the Community Care Access Centre (CCAC) caseload. The mean Palliative Care Performance Scale (PPS) score at the time of the index SPCP consult was 20% (totally bed-bound, extensive disease). Sixty-three percent of ER visits occurred within 2 weeks of death and 97% of visits overall within the last three months of life. Table 1 provides an overview of patients' reasons for the ER visit, with Table 2 highlighting the recorded reason for hospital admission. Inpatient interventions included: Access to the Critical Response Team (CRT; 21.5%), ventilatory support (13%), Intensive Care Unit admission (12%), surgery (9%), pleuro/paracentesis (8%), radiotherapy (5%), hemodialysis (4%), and (palliative) chemotherapy (2%). The majority of patients (72%) had an unknown/undocumented advance care planning status upon presentation to the ER, while a named Power of Attorney was provided in 53% of cases. An advance care directive category was defined in 92% of cases at the time of the initial palliative care consult. Death at the teaching hospital site occurred mostly as a discharge plan was not documented (33%), the patient was imminently dying (26%), or died while awaiting placement (19%).

Conclusion: The majority of ER visits was appropriate by level of acuity. Increased awareness toward advance care planning and improved documentation is needed to enhance patient care.

References: NA

Poster # 102 **Poster Session: 15:30 - 17:00**

Title: Sterile cultures in patients dying from septic shock: Implications for the pathophysiology of sepsis

Presenter: Aleksandra Leligdowicz, University of Toronto, Interdepartmental Division of Critical Care, Toronto, Canada.

Introduction: Sepsis is a syndrome caused by an inflammatory response to a microbial infection that can result in shock and organ dysfunction. Despite decades of research, no specific therapies exist for sepsis and its pathogenesis in humans is poorly understood. Sepsis-induced immunosuppression leading to nosocomial infections and death has been postulated to be the major cause of fatalities, however, there is a paucity of literature to support or refute it.

Objectives: To determine whether nosocomial infection is the cause of death in patient who are admitted to the ICU because of septic shock

Methods: Patients admitted to the MSICU at St. Michael's Hospital considered for enrolment in the multicenter randomized controlled trial "Heparin AnticoaguLation to improve Outcomes in septic shock: The HALO pilot" were retrospectively screened and those who died during hospital admission were considered for inclusion, even if not enrolled in HALO. Patients deemed not to be septic or with inadequate source control were excluded. Basic demographics, admission diagnosis, all microbiological culture data, appropriate source control, and appropriateness of initial antimicrobial therapy based on antibiotic sensitivities were recorded and the Sequential Organ Failure Assessment (SOFA) score was calculated at the time of the first positive culture. The development of nosocomial infection was defined as detection of a new antemortem microbial isolate. Patients who died with negative cultures <72 hours prior to death were classified as not having a nosocomial infection. All cases were adjudicated by consensus. Ethics approval was obtained from REB at St. Michael's Hospital.

Results: Of 112 patients screened, 56 died during hospital admission. Among the patients who died, 26 were adjudicated to have had septic shock, 5 of whom (19%) lacked adequate microbial surveillance in the days preceding death. Of the 21 patients with adequate microbial surveillance, a minority (14%, 3/21) had evidence of a new nosocomial infection while the majority (86%, 18/21) did not. In most of these cases, cultures were taken 1 day prior to death. The mean SOFA score was 12.4 ± 4.1 (SD) and the median ICU length of stay was 16.5 (IQR 6, 46) days. Multiorgan failure was the most common cause of death.

Conclusion: Nosocomial infection is uncommon in patients dying from septic shock and most patients die with multiorgan failure despite broad-spectrum antibiotics and negative microbial cultures. These data and a review of the literature suggest factors other than immunosuppression may account for mortality from sepsis. As most patients who die from sepsis have sterile cultures, boosting the immune system or adding additional antimicrobials is unlikely to improve clinical course. Instead, mechanisms such as endothelial barrier dysfunction leading to microvascular leak and subsequent tissue edema may contribute to morbidity and mortality in patients with septic shock. It is crucial that sepsis pathogenesis is better understood if novel therapies are to be developed.

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Poster # 104 **Poster Session: 15:30 - 17:00**

Title: Necrotizing Lung Infections: An observation of practice patterns and management changes over time.

Presenter: Michael Peirce, London Health Sciences Centre, Department of Medicine, London, Canada.

Introduction: Necrotizing lung infections (NLI) are a rare, but severe and life-threatening complication of community-acquired pneumonia that can range from a solitary abscess to necrotizing pneumonia and lung gangrene (1). However, data on optimal management for critically ill patients with NLI in the modern era is limited to case reports and case series' dating from 1975 to present, with the largest ICU cohort study consisting of 10 patients (2).

Objectives: The goal of this project was to examine local ICU practice patterns at London Health Science Centre (LHSC) and determine if management or outcomes of NLI have changed over time.

Methods: A retrospective, observational study of patients admitted to the LHSC Intensive Care Units from January 1, 2002 to December 31, 2013 was completed by chart review. Patients were screened for inclusion if they had an admitting diagnosis of pneumonia and/or had undergone bronchoscopy or computed tomography (CT) scan of the thorax (N=1373). Of these 1373 patients, we identified 47 cases for review.

Results: In our ICU cohort of 47 NLI cases, 12 (26%) were classified as primarily lung abscess, 32 (68%) as necrotizing pneumonia, and 3 (6.3%) as lung gangrene. Of the 47 cases, 44 (94%) had a CT thorax, 40 (87%) had a bronchoscopy, 32 (68%) had a thoracic surgery consult, 28, (60%) had ≥1 chest tube, and 14 (30%) went to the Operating Room for debridement of devitalized tissue. The average number of antimicrobials per case was 5.3. The mortality in our cohort was 32% (15/47). There was no statistically significant change in survival over the 12-year study period on a year-to-year basis (p=0.081, Cochrane-Armitage trend test). However, there was a significant improvement in survival comparing the 2010-2013 cohort to the 2002-2009 cohort (p=0.049), following a surge of cases of pneumonia in 2009. There was no significant change in number of CT scans (p=0.25), operating room visits (p=0.35), or thoracic surgery consults (p=0.52) over time. The number of patients with a chest x-ray showing concerning features of NLI was 11 (25%). Survivors were more likely to have had a CT scan than non-survivors (32/32 vs. 12/15, p=0.028 in univariate analysis), but only APACHE II score was significantly associated with survival in a multiple regression analysis (p=0.034). APACHE II scores on ICU admission were significantly lower post 2009 (p=0.01), although the average age of patients was not significantly different post 2009 (p=0.912).

Conclusion: Our data shows improved survival when comparing 2002-2009 and 2010-2013. However, we did not detect a significant change in the number of CT scans, thoracic surgery consults, operating room visits, chest tubes, bronchoscopies, or number of antibiotics used between 2002 to 2013. APACHE II scores on ICU admission were significantly lower post 2009. Possible explanations for the improved survival include better recognition of NLI following a surge of cases in 2009 or the introduction of the 'Surviving sepsis campaign' to LHSC in 2010,

which may have resulted in improved early sepsis management and lower APACHE II scores upon ICU admission. Our data represent the largest cohort of ICU patients with NLI in the medical literature and highlights the poor sensitivity of chest x-rays and importance of CT scans in the diagnosis of NLI.

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Poster # 105 **Poster Session: 15:30 - 17:00**

Title: The effect of BMI on severity of acute pancreatitis in hospitalized patients

Presenter: Nongnooch Poowanawittayakom, Advocate Illinois Masonic Medical Center, Internal Medicine, Chicago, United States of America.

Introduction: Acute pancreatitis is a common gastrointestinal disease often seen in daily practice. Obesity defined as body mass index (BMI) ≥30kg/m2 has been shown to be a risk factor and a prognosticator in many populations. Many studies have found obesity is a risk factor for severe acute pancreatitis. However, there is a recent single large cohort study showed the paradoxical result that being overweight and obesity improved survival both 30 days and 1 year after ICU admission in adult patients. The aim of this study was to examine the effect of obesity on the severity of acute pancreatitis.

Objectives: The aim of this study was to examine the effect of obesity on the severity of acute pancreatitis.

Methods: A total of 135 patients with the diagnosis of acute pancreatitis were included in this retrospective study.Clinical data was collected. Our primary studied variable was overweight and obesity defined by BMI>25kg/m2 and >30 kg/m2 respectively by WHO criteria. Severe pancreatitis was defined as a Ranson score at any time ≥ 3. Appropriate descriptive statistics and statistical tests were performed. Statistical significance was defined as a p value < 0.05.

Results: The cohort consisted of 58% (78 of 135) men with a mean (SD) age of 50 (18) years. Of the 135 patients, 4 (2.96%) had gallstone pancreatitis, 4 (2.96%) had alcoholic pancreatitis, and 127 (94.07%) had pancreatitis of unknown etiology. Median (interquartile range) Ranson score on admission and 48 hours afterwards were 2 (1, 3) and 1 (0, 2), respectively. There were 43 patients (32%) on admission day and 19 patients (14%) at 48 hours after admission in higher severity group. Being obese or overweight had no statistically significant difference in severity of acute pancreatitis on admission. At 48 hours after admission, obesity or overweight was not statistically different either (p = 0.18 and 0.384 respectively) between the two severity groups as shown on Table 2. Multivariable regression analysis showed that female gender was the only independent variable associated with a higher severity of pancreatitis (p = 0.046)

Conclusion: This pilot study demonstrates that obesity or overweight has no effect on severity of acute pancreatitis. Our study showed opposite finding from previous studies which obesity was found to be associated with a higher severity of pancreatitis .Female gender was associated with a higher severity of acute pancreatitis in the first 48 hours after admission.

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Poster # 106 **Poster Session: 15:30 - 17:00**

Title: Does Aspirin use decrease severity of acute pancreatitis ?

Presenter: Nongnooch Poowanawittayakom, Advocate Illinois Masonic Medical Center, Internal Medicine Department, Chicago, United States of America.

Introduction: Acute pancreatitis is a common gastrointestinal disease often seen in daily practice. Although the precise mechanism of pancreatitis is still not fully understood, it is believed that the inflammatory response via phospholipase A2, cyclogenase, and neutrophils plays a role. Aspirin is a commonly used NSAID, most notably prescribed for cardiovascular diseases such as stroke, myocardial infarction, and select groups of patients with atrial fibrillation. The aim of this study was to examine the effect of aspirin use on the severity of acute pancreatitis.

Objectives: The aim of this study was to examine the effect of aspirin use on the severity of acute pancreatitis.

Methods: A total of 135 patients with the diagnosis of acute pancreatitis were included in this retrospective study. Relevant clinical data were collected. Patients were divided into two groups according to aspirin use or non-use and the severity of acute pancreatitis was compared. Severe pancreatitis was defined as a Ranson score at any time ≥ 3. Appropriate descriptive statistics and statistical tests were performed. Statistical significance was defined as a p value < 0.05.

Results: The cohort consisted of 58% (78 of 135) men with a mean (SD) age of 50 (18) years. Of the 135 patients, 4 (2.96%) had gallstone pancreatitis, 4 (2.96%) had alcoholic pancreatitis, and 127 (94.07%) had pancreatitis of unknown etiology. Median (interquartile range) Ranson score on admission and 48 hours afterwards were 2 (1,3) and 1 (0,2), respectively. On admission, there was no statistically significant difference in aspirin user group and non-aspirin user group between the mild-to-moderate acute pancreatitis group and the severe acute pancreatitis group (Table 1). Likewise, at 48 hours after admission, the percentage of patients with aspirin use was not statistically different ($p = 0.678$) between the two severity groups as shown on Table 2. Multivariable regression analysis showed that female gender was the only independent variable associated with a higher severity of pancreatitis ($p = 0.046$)

Conclusion: This pilot study demonstrates that aspirin use has no effect on decreasing the severity of acute pancreatitis. Female gender was associated with a higher severity of acute pancreatitis in the first 48 hours after admission. This association has never been identified in prior studies. Obesity, however, which has previously been found to be associated with a higher severity of pancreatitis was not identified as a predictor for the severity of acute pancreatitis in this study.

References: none

Poster # 107 **Poster Session: 15:30 - 17:00**

Title: Evaluation of nutritional delivery to elderly patients admitted to the ICU: a retrospective study

Presenter: Jessica Ray, Mount Sinai Hospital, Medical Surgical Intensive Care Unit, Toronto, Canada.

Introduction: In 2012, 38.7% of total admissions to the Mount Sinai Medical-Surgical Intensive Care Unit (ICU) were over the age of 65. Few nutritional studies focus on the elderly critically ill population, who are at a high risk for malnutrition. Malnourished patients may have impaired immune function, longer stays, and increased mortality. Muscle wasting can affect long-term outcomes in elderly patients, and may drastically alter quality of life and independence post-discharge.

Objectives: The primary aim of this chart review was to retrospectively analyze data on nutritional delivery methods and to describe actual nutrition delivered to elderly patients who were admitted to the Mount Sinai Hospital Intensive Care Unit.

Methods: We performed a retrospective chart review of patients over 65 admitted to the ICU for ≥ 48 hours, from April 2013 to April 2014. Data collected included type of nutrition, method of delivery, tolerance, weight, BMI, and calories and protein received daily (unavailable for oral nutrition). Daily calories and protein were either prescribed by the ICU dietician during stay, or calculated retrospectively from admission weight when a dietician note was not available. Also collected was data on age, admitting diagnosis, APACHE II, SOFA, NUTRIC score, ventilation status, and adverse events such as delirium. Statistical analysis was conducted using R with t-tests or Fisher's exact tests where appropriate.

Results: Data was collected on 169 patients. Patient demographics are shown in Table 1. Patients were categorized into 3 groups: early nutrition (<48 hours from ICU admission), late nutrition (≥48 hours), and no nutrition during ICU stay. Seventy percent of eligible patients received nutrition within 48 hours, 19% after 48 hours, and 11% never received nutrition in the ICU. Age, SOFA, APACHE II, and NUTRIC scores were similar between all 3 groups. Of the patients who received nutrition, the highest proportion (39%) received only enteral nutrition (EN); with 26% receiving oral only, 2% parenteral (PN) only, 18% mixed oral and EN, 2% mixed EN and PN, and 1% mixed PN and oral. Admitting diagnoses varied between groups. More patients who received no nutrition were admitted post-operatively. More patients in the late group were admitted for gastro-intestinal diagnoses. The length of stay and mortality differed between groups, with the late nutrition patients having higher ICU and hospital mortality rates, and the longest ICU and hospital lengths of stay, although these differences were not statistically significant. Patients who received any type of early nutrition tended to have shorter ICU stay than the late group. On Day 1, only 48 of 169 patients were fed, and they received on average 8% of recommended calories and 9% of protein, via EN, TPN, or oral route. By day 6, patients being fed received >70% of prescribed calories and protein. Intolerance to feeding, defined as gastric residual volumes >200 mL or vomiting, occurred on average with 8.2% of patients daily.

Conclusion: The critical care guidelines recommend initiation of enteral nutrition 24-48 hours following ICU admission. We found that elderly patients who received early nutrition had no significant differences in length of stay or mortality when compared with patients receiving late nutrition. Notably, when nutrition was provided in the initial 48 hours, patients received amounts well below prescribed amounts.

References: NA

Poster # 108 **Poster Session: 15:30 - 17:00**

Title: Neurological and Cardiac Functional Status after Extracorporeal Membrane Oxygenation in Children with Heart Disease

Presenter: Anupam Seghal, Sickkids Hospital, Critical Care Medicine, Toronto, Canada.

Introduction: Although extensive data are published regarding the immediate and hospital survival after paediatric extracorporeal membrane oxygenation (ECMO) for heart disease, there are no published data regarding longer term survival in this cohort or the functional quality of survival.

Objectives: We sought to describe the immediate and long term survival in pediatric patients who underwent venoarterial (VA) ECMO for primary heart disease. In addition, we reviewed follow-up assessments to grade neurological and cardiovascular functional status at multiple time points after hospital discharge.

Methods: We reviewed data of all children with heart disease receiving venoarterial ECMO for a cardiac indication between 2001-2012 with a minimal follow-up period of 1 year post ECMO. Pre-ECMO characteristics, ECMO details, ECMO complications and patient outcomes were abstracted from institutional databases and medical records. Logistic regression analysis adjusted for repeated measures was used to determine factors associated with ECMO survival and post-discharge functional neurological (using the Pediatric Cerebral Performance Category [PCPC] score) and cardiovascular (using the pediatric New York Heart Association classification) status.

Results: 303 ECMO episodes (283 patients) occurred at a median (25th, 75th %ile) age of 16 weeks (2 weeks, 18 months); non-mutually exclusive indications were failure to wean from CPB (44, 15%), low cardiac output state (162, 53%), persistent hypoxia (57, 19%), arrhythmia (20, 7%), pulmonary hypertension/hypertensive crisis (6, 2%) and cardiac arrest (175, 58%). The median duration of CPR was 37 (24-55) minutes. The median ECMO duration was 4 (2-7) days. ECMO complications included intracranial hemorrhage (47, 18%), ischemic brain injury (64, 26%), seizures (48, 16%), pulmonary or gastrointestinal bleeding (43, 16%) and need for renal replacement therapy (100, 36%). Immediate outcome of the ECMO run was recovery in 158 (39%), cardiac transplantation in 19 (6%), conversion to VAD in 8 (3%) and death in 118 (39%); of immediate survivors, 112 (61%) were alive at a median follow-up of 16 months with the majority (90%, 90%, 91%) having a PCPC score ≤ 2 at 6 months (n=89), 1 year (n=77) and 2 years (n=67) respectively. Of the 175 patients who had cardiac arrest, 100 (57%) were successfully decannulated; 58 (58%) of whom were alive at a median follow-up of 13 months with the majority (83%, 87%, 88%) having a PCPC score ≤ 2 at 6 months (n=47), 1 year (n=39) and 2 years (n=32) respectively. At 2 years follow-up, 64/65 (98%) surviving patients were in pediatric NYHA Class ≤ 2 heart failure. Factors associated with mortality prior at decannulation were ischemic HIE (HR 4.9, p=0.002), intracerebral hemorrhage (HR 2.2, p=0.02) and mechanical complications on ECMO (HR 3.3, p =0.003). Those requiring ECMO for cardiac arrest and those with a diagnosis of intracranial hemorrhage while on ECMO were less likely to have a PCPC ≤ 2 (81% vs 98%, p=0.01 and 67% vs 92%, p=0.05 respectively).

Conclusion: Children with heart disease who survive to ECMO decannulation have ongoing early mortality; despite these concerns, the majority of survivors have good quality neurological and cardiac functional status even after hospital discharge. Risk for poor neurological and cardiac functional outcome at 6 months were associated with the use of ECMO for cardiac arrest and development of intracranial hemorrhage while on ECMO.

References: 1) Kane DA, Thiagarajan RR, Wypij D, Scheurer MA, Fynn-Thompson F, Emani S, delNido PJ, Betit P, Laussen PC. Rapid-response extracorporeal membrane oxygenation to support cardiopulmonary resuscitation in children with cardiac disease.Circulation. 2010 Sep 14;122(11 Suppl):S241-8. doi:10.1161/CIRCULATIONAHA.109.928390. PubMed PMID: 20837920. 2)Lequier L. Extracorporeal life support in pediatric and neonatal criticalcare: a review. J Intensive Care Med. 2004 Sep-Oct;19(5):243-58. Review. PubMedPMID: 15358943. 3) Sivarajan VB, Best D, Brizard CP, Shekerdemian LS, d'Udekem Y, Butt W.Duration of resuscitation prior to rescue extracorporeal membrane oxygenationimpacts outcome in children with heart disease. Intensive Care Med. 2011May;37(5):853-60. doi: 10.1007/s00134-011-2168-6. Epub 2011 Mar 3. PubMed PMID:21369812.

Poster # 109 **Poster Session: 15:30 - 17:00**

Title: The sedative effect of propranolol on critically ill patients

Presenter: Junji Shiotsuka, University Health Network and Mount Sinai Hospital, Medical-Surgical Intensive Care Unit, Toronto, Canada.

Introduction: Hyperactive delirium is a common problem in the ICU. Analgesics, sedatives, and antipsychotics are frequently used to control it, but they can be insufficient in some cases. There has been interest in the use of alpha-2-adrenergic agonists. However, propranolol, a non-selective beta adrenergic antagonist with good penetration of the blood brain barrier, has not been investigated for this purpose. The purpose of this study was to determine whether propranolol has a sedative effect on ICU patients. We hypothesize that propranolol administration is associated with a reduction in the use of sedatives, analgesics, and antipsychotics.

Objectives: N/A

Methods: We retrospectively included all patients who were prescribed propranolol in the Medical-Surgical ICU in Toronto General Hospital, Toronto, Canada from January 1, 2010 to December 31, 2013. Patients were excluded if propranolol was started on the day of ICU admission or given for ≤ 48 hours, or if the patient was discharged from the ICU ≤ 48 hours of starting propranolol. We recorded the daily dose of sedatives, analgesics, and antipsychotics administered, and the Sedation Agitation Score (SAS), Intensive Care Delirium Screening Checklist (ICDSC), and Sequential Organ Failure Assessment (SOFA) scores each day for 6 days after starting propranolol. We then compared these daily doses and scores to the day before starting propranolol (D-1) using pairwise comparisons (paired t-test and Wilcoxon rank-sum tests as appropriate).

Results: Sixty-four patients met inclusion criteria. Thirty-eight (55%) episodes were excluded, leaving 27 patients (31 episodes). The administration of propranolol was associated with significant reductions in fentanyl equivalents (65%, P=0.009), midazolam equivalents (57%, p=0.048), propofol (16%, p=0.009), and haloperidol (44%, p=0.024) on Day 2. A stratified analysis showed that these decreases were found regardless of whether or not the SOFA score improved, except in the case of propofol. SAS and ICDSC scores had not changed significantly by day 2. In five cases (17%), patients had pressors started or increased ≥ 20% within 48 hours of propranolol administration, and in 1 case (3%) the patient developed a new AV block.

Conclusion: The use of propranolol was associated with significant reduction in sedative dose. A prospective study with protocolized propranolol and sedative dosing will be needed to confirm this effect.

References: N/A

Poster # 110 **Poster Session: 15:30 - 17:00**

Title: Nosocomial gram-negative bacteremia in intensive care: epidemiology, antimicrobial susceptibilities and outcomes

Presenter: Wendy Sligl, University of Alberta, Divisions of Critical Care Medicine and Infectious Diseases, Edmonton, Canada.

Introduction: Nosocomial gram-negative bacteremia in critically ill patients is associated with significant morbidity and mortality.

Objectives: In this study we describe the epidemiology, antimicrobial susceptibilities and outcomes of nosocomial gram-negative bacteremia in a large tertiary care general systems intensive care unit over nearly a decade.

Methods: All patients admitted to the University of Alberta Hospital Intensive Care Unit who developed a hospital-acquired (as per CDC/NHSN definitions) gram-negative bacteremia from January 1, 2004 to December 31, 2012 were identified through prospective Infection Prevention and Control surveillance. Charts were then retrospectively reviewed for patient characteristics, microbial etiology, antimicrobial susceptibilities, treatment and outcomes. Predictors of 30-day mortality were examined using multivariable Cox regression.

Results: Seventy-eight nosocomial gram-negative bacteremias occurred in 74 patients with an infection rate of 0.97/1000 patient days. Patient characteristics included mean age 55 years, 46/74 (62%) male, and 51/74 (69%) medical admission diagnosis. Specific admission diagnoses included 25/74 (34%) respiratory failure, 33/74 (45%) sepsis or septic shock, 7/74 (9%) post-liver transplantation and 5/74 (7%) major trauma/burn. Mean APACHE II score was 25 (±8 SD) at the time of ICU admission. Seventy-three (94%) bacteremic events required mechanical ventilation. Mortality was 26/74 (35%) at 30-days and 36/74 (49%) in-hospital. Common sources of bacteremia included pneumonia (26/78 [33%]), gastrointestinal (17/78 [22%]) and central line-associated (10/78 [13%]). Of 83 gram-negative isolates, the most common were Escherichia coli (17/83 [20%]), Pseudomonas aeruginosa (15/83 [18%]) and Klebsiella pneumoniae (10/83 [12%]). Multi-drug resistant pathogens were identified in 14/83 (17%) isolates. Seventeen events were polymicrobial (5/78 [6%] with other gram-negative bacilli, 12/78 [15%] with gram-positive micro-organisms). In aerobic isolates tested, susceptibilities to ciprofloxacin (40/66 [61%]) and piperacillin/tazobactam (44/65 [68%]) were low. For pseudomonal isolates, susceptibility to ciprofloxacin (8/15 [53%]), piperacillin/tazobactam (10/15 [67%]), and imipenem (8/15 [53%]) were equally disappointing. Adequate empiric antimicrobial therapy was prescribed in 66/78 (85%) bacteremias. All cases of inadequate empiric treatment were associated with Stenotrophomonas maltophila or multi-drug resistant pseudomonal bacteremia. Variables associated with mortality on univariate analysis included coronary artery disease, immune suppression (predominantly steroid use), pseudomonal bacteremia and adequate empiric therapy. On multivariable analysis, adequate empiric therapy (adjusted hazard ratio [aHR] 0.38, 95%CI 0.16-0.89; p=0.03), immune suppression (aHR 3.4; 95%CI 1.4-8.3; p=0.006) and coronary artery disease (aHR 4.5; 95%CI 1.7-11.9; p=0.003) were independently associated with 30-day mortality.

Conclusion: Nosocomial gram-negative bacteremia is associated with high mortality in critically ill patients. Resistance to ciprofloxacin and piperacillin/tazobactam was common. In addition, carbapenem resistance among pseudomonal isolates was surprisingly high. Despite this, most patients received adequate empiric antimicrobial therapy. Coronary artery disease, immune suppression and adequate empiric antimicrobial therapy were independently associated with 30-day mortality.

References: N/A

Poster # 111 **Poster Session: 15:30 - 17:00**

Title: Timing of tracheostomy and associated complications in cardiothoracic intensive care patients

Presenter: Jessica Cassey, University of Cambridge, Cambridge, United Kingdom.

Introduction: Tracheostomy is an invasive procedure that creates a surgical airway in the cervical trachea and is commonly performed in critically ill patients requiring prolonged mechanical ventilation (MV). Tracheostomy is not without risks and prediction of which patients will require prolonged MV and decision about optimal timing (early vs late) of tracheostomy remain contentious in the medical literature.

Objectives: To report tracheostomy-related complications and determine the association between timing of tracheostomy and duration of MV, in a tertiary care teaching hospital cardiothoracic intensive care unit (ICU).

Methods: After obtaining institutional review board approval, we conducted a retrospective descriptive study of all consecutive patients, admitted to our cardiothoracic ICU for MV, between January 2011 and May 2014. Patients receiving a tracheostomy before 10 days of MV were assigned the 'early tracheostomy group'. Patients receiving a tracheostomy after and including 10 days of MV were assigned the 'late tracheostomy group'. Descriptive statistics were used to summarize data.

Results: A total of 8136 patients were included. Mean age was 62 years. Of these patients, 232 (2.85%) underwent tracheostomy. 223 patients received a bedside percutaneous tracheostomy and 9 patients received a surgical tracheostomy. The mean time of tracheostomy formation within our ICU was 10 days. 55.17% of patients were admitted to ICU post-cardiothoracic surgery, 11.2% post-transplant surgery (either cardiac transplant, single or bilateral lung transplant or cardiac and lung transplant), 20.26% were non-surgical admissions, 10.34% were admitted with acute cardiorespiratory failure requiring extracorporeal life support (ECLS) and 3.02% after percutaneous coronary intervention. The mean total days of MV in the early group was 22.39+/-SE1.57 vs 34.69+/-SE 2.00 in the late group (p=0.00001). The mean length of ICU stay in the early group was 38+/-SE10 vs 42.89+/-SE 7.39 in the late group (Tables 1-4, Figure 1). In total, 105 patients (45.26%) had a tracheostomy-related complication. The three most commonly reported complications were: bleeding (9.05%), occlusion of the tracheostomy tube (10.78%) and air leak (5.60%) (Figure 2). Bleeding was the most common complication in the ECLS patients (33.33%). 6 patients (2.59%) suffered cardiorespiratory arrest secondary to tracheostomy associated causes and they were successfully resuscitated. 1 patient died due a tracheostomy-related cause (secondary hemorrhage and airway obstruction). Fewer tracheostomy related complications were observed in the early group (43%) in comparison to the late group (50%).

Conclusion: Our data suggest that failure of our cardiothoracic ICU patient to separate from MV within 10 days, is predictive of eventual requirement for tracheostomy formation. The overall post-operative complication rate of tracheostomy within our ICU was high, hemorrhage being the most common among ECLS patients. Although we have not used a strict definition of

‘bleeding’, this finding suggests the need for increased awareness and careful risk stratification prior to performing a tracheostomy on anticoagulated and often coagulopathic cardiothoracic ICU patients.

References: 1. Huang H, Li Y, Ariani F, Chen X, Lin J. Timing of tracheostomy in critically ill patients: a meta-analysis. PLoS One. 2014 Mar 25;9(3):e92981. 2. Young et al. 2013 Effect of Early vs Late Tracheostomy Placement on Survival in Patients Receiving Mechanical Ventilation The TracMan Randomized Trial JAMA 309(20):2121-2129. 3. Diehl JL, El Atrous S, Touchard D, et al. Changes in the work of breathing induced by tracheotomy in ventilator-dependent patients. Am J Respir Crit Care Med 1999; 159:383–388.Plummer AL, Gracey DR. 4. Consensus conference on artificial airways in patients receiving mechanical ventilation. Chest. 1989;96:178–80. 5. Wang F, Wu Y, Bo L, et al. The timing of tracheostomy in critically ill patients undergoing mechanical ventilation: a systematic review and meta-analysis of randomized controlled trials.Chest 2011;140(6):1456-65. 6. Ciaglia P, Firsching R, Syniec C. Elective percutaneous dilatational tracheostomy. A new simple bedside procedure; preliminary report. Chest 1985;87(6):715-9.

Poster # 112 **Poster Session: 15:30 - 17:00**

Title: Optimal Vasopressor Targets in Septic Shock: A Systematic Review and Meta Analysis

Presenter: Emilie Prudence Belley-Cote, McMaster University, Anesthesie-Critical Care Medicine, Hamilton, Canada.

Introduction: Patients with septic shock receive vasopressors under the assumption that correcting hypotension improves perfusion, organ function and survival. However, the association between pharmacologically enhanced blood pressure and tissue perfusion remains unclear. Vasopressor use in septic shock is influenced by guidelines that recommend aiming for a mean arterial blood pressure of 65 mmHg or more (grade 1C).

Objectives: We undertook a systematic review of clinical studies evaluating different blood pressure (BP) targets for the titration of vasopressors in septic shock. Our goal was to evaluate whether higher BP targets for vasopressor titration modified clinical outcomes in patients with septic shock when compared to lower BP targets.

Methods: We searched EMBASE, MEDLINE and CENTRAL from inception to November 2013 for observational studies and randomized controlled trials (RCTs) in humans with septic shock comparing titration of vasopressors to different target BP levels or ranges. The included studies had to report mortality, myocardial infarction, arrhythmias, need for renal replacement therapy or surrogate outcomes evaluating macro or microcirculation Two reviewers independently assessed titles, abstracts and papers for eligibility, and abstracted data onto pretested forms. We pooled results across studies of similar design when a given outcome was reported across a minimum of 5 studies. We used the GRADE approach to summarize the quality of evidence for each outcome.

Results: We identified 4416 citations and assessed 67 full text articles for eligibility. Agreement between reviewers for relevance was moderate [k = 0.67] and for eligibility, excellent [k = 1.0]. Two articles were identified through the grey literature. Two RCTs and nine before-after studies were included. Only one RCT comparing mean arterial blood pressure targets of 65-70mmHg versus 80-85mmHg assessed mortality, which was similar between groups (N =776 ; hazard ratio 1.07 ; 95% CI 0.84,1.38 ; p=0.57). However, patients in the high BP target group had a higher risk of atrial fibrillation and a lower risk of renal replacement therapy. The remaining studies evaluated short-term surrogate endpoints. When meta-analyzed, the cardiac index and heart rate in the before-after studies were significantly higher with a high BP target [7 studies, N=104; mean difference (MD) in cardiac index 0.76 L/min/m2; 95% CI 0.28,1.24; heterogeneity X2=22.75, p<0.001, I2 =0% and 6 studies, N=84; MD in heart rate 5.51 beats per minute; 95% CI 2.13,8.88; heterogeneity X2=5.02, p=0.001, I2=0%]. Lactate levels were similar in both BP groups [5 studies, N=70; MD 0.08 mEq/L; 95% CI -0.55,0.38; heterogeneity X2=0.13, p=1.0, I2 0%]. All included studies except for the RCT evaluating clinical outcomes were at high risk of bias.

Conclusion: Despite one low risk of bias study evaluating clinical outcomes in septic shock patients with higher versus lower BP targets, it remains uncertain whether 65 mmHg is the

optimal target. Significant harm or benefit could be associated with vasopressor titration to this target.

References: N/A

Poster # 113 **Poster Session: 15:30 - 17:00**

Title: Effect of Steroids Administration on Organ Donors After Death by Neurological Criteria and Recipients: A Meta Analysis

Presenter: Frederick D'Aragon, McMaster University, Anesthesia-Critical Care Medicine, Hamilton, Canada.

Introduction: Administration of steroids is currently recommended by North American guidelines. However, most of the recommendations are based on observational studies. Over the last few years, RCTs (randomized controlled trial) have been published on steroid administration for potential organ donors after death by neurological criteria. The aim of this systematic review was to evaluate the clinical efficacy of steroids administration and to assess the quality of these RCTs.

Objectives: The objective was to evaluate the effect of steroids administration compared to no steroids administration on vasopressor requirement and number of organs recovered in donors after death by neurological criteria. Graft survival and acute graft rejection were also assessed.

Methods: A search through EMBASE, MEDLINE and CENTRAL was conducted from inception to February 2014. An extensive search of grey literature was also realized. RCT involving administration of steroid to donors after death by neurological criteria was included for full review. Studies were assessed in duplicate. In case of disagreement, a third party took the decision. Sought outcomes were vasopressor requirement, physiologic parameters, organ recovery and graft outcomes. If needed, trial authors were contacted for additional information. The GRADE approach was used to summarize the quality of evidence for each outcome

Results: Our search identified 2949 citations. Ninety one full text articles were assessed for eligibility. Seven met eligibility criteria and 4 articles were identified through the grey literature. There was a good agreement for relevance (minimum k=0.64) and an excellent agreement for eligibility(minimum k =1.0). Most studies administered boluses of Methylprednisolone 5-8 hours before organs recovery. There was no difference between groups on vasopressor requirement, number of organ recovered and graft outcomes in each study. When pooled, there was no difference on vasopressor requirement (3 studies;N=452,RR 0.95 [95%CI 0.83to1.08]), number of multiorgan donors (2 studies;N=309,RR 0.89 [95%CI 0.64to1.24]) or kidney graft survival at 3 months (4 studies;N=251,RR 1.00 [95%CI 0.81to1.22]). There was significant clinical and statistical heterogeneity for each of these outcomes. The quality of evidence for each outcome was very low.

Conclusion: The findings suggest no evidence to support administration of steroids in organ donors after death by neurological criteria. Several methodological challenges in donor management research need to be address for future well designed RCTs

References: N/A

Poster # 114 **Poster Session: 15:30 - 17:00**

Title: Albumin Administration for Fluid Resuscitation in Burn Patients: Systematic Review and Meta-analysis

Presenter: Roberto Eljaiek, Université de Montréal, Critical care, Montreal, Canada.

Introduction: The role of albumin containing solutions in the resuscitation of patients with acute burn injury remains controversial. Two previous meta-analysis (Cochrane group and Wilkes et al. have compared albumin vs. non-albumin solutions in the management of critically ill patients. They provided opposite results in burn patients in subgroup analyses (RR 2.93; 95% CI, 1.28 to 6.72 in Cochrane and RR 1.76; 95% CI, 0.97 to 3.17 in Wilkes).

Objectives: Systematically review the literature summarizing the effect on mortality of albumin compared to non-albumin solutions during the fluid resuscitation phase of burn injured patients.

Methods: Data Sources: MEDLINE, EMBASE and CENTRAL and the content of two leading journals in burn care, Burns and Journal of Burn Care and Research. Study Selection: Two reviewers independently selected randomized controlled trials comparing albumin vs. non-albumin solutions for the acute resuscitation of patients with burn injuries greater than > 20% body surface area. Studies using albumin solution for correction of hypoalbuminemia were excluded. Data Extraction and statistical analysis of included trials: Reviewers abstracted data independently and assessed methodological quality using predefined criteria. The primary outcome was all cause mortality. Secondary outcomes of interest were the total volume of resuscitation fluid infusion, length of stay (LOS) and organ dysfunction. We used a fixed-effect model to pool the results. We reported the relative risk (RR) for binary outcomes and weighted mean difference (WMD) for continuous outcomes with their associated 95% CI. We assessed heterogeneity using the Cochran Q statistic and I2 statistic.

Results: We identified 164 trials of which, 4 trials involving 140 patients met our inclusion criteria. Overall, the methodological quality of the included trials was fair. We did not found a significant benefit of albumin solutions as resuscitation fluid on mortality in burn patients (RR 1.74; 95% CI, 0.93 to 3.25). Total volume of fluid infusion during the phase of resuscitation was lower in patients receiving albumin containing solution -1.00 ml/kg/%TBSA (total body surface area) (95%CI -1.42 to -0.58)

Conclusion: Our meta-analysis did not demonstrate a benefit of albumin solutions on mortality even if burn patients treated with albumin required significantly less fluid during resuscitation. Trial selection and data extraction may explain the differences between our results and those of the two previous meta-analyses. We excluded the study conducted by Greenhalgh et al. which was included in both meta-analysis, because it used albumin solutions to correct hypoalbuminemia and not as resuscitation fluid. Data abstraction are also different between the 3 meta-analyses. According to us, the two previous meta-analysis committed several mistakes in data extraction in studies conducted by Jelenko et al. and Goodwin et al. Our meta-analysis did not support early use of albumin for resuscitation of burn injured patients but it was not associated with higher mortality as shown in previous work. Difference in study selection and data extraction might explain this discrepancy.

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Poster # 115 **Poster Session: 15:30 - 17:00**

Title: The Impact of Palliative Care Interventions on the Length of Stay of Critically Ill Patients in the Intensive Care Unit: A Systematic Review

Presenter: Louis-Philippe Gagnon, University of Ottawa, Ottawa, Canada.

Introduction: Our population is aging and health care costs are increasing due to the complexity of patients and innovation of care that is provided. One of the largest areas of resource consumption is the intensive care unit (ICU). Many strategies have been looked at to reduce critical care costs. It has been shown that 46% of patients receive care they would not want in ICU (SUPPORT Trial Group, 1995). Addressing goals of care and avoiding prolonged ICU stays would contribute to reducing costs. We hypothesized that involving palliative care teams in the care of high-risk ICU patients would decrease these patients' length of stay in the ICU. Therefore, we performed a systematic review looking at the impact of palliative care involvement on ICU length of stay.

Objectives: To evaluate the impact of palliative care involvement on ICU length of stay.

Methods: We performed an electronic literature search of PubMed, Medline (Ovid), Embase and the Cochrane Library for English and French language articles published from 2000 to February 2014. We included randomised controlled trials, prospective cohort studies, retrospective studies and case reports that discussed palliative care services given within adult medical and surgical ICUs. Our primary outcome was ICU length of stay and our secondary outcomes were overall mortality as well as total hospital length of stay. Studies focusing on intermediate care units or pediatric populations, and that did not evaluate ICU length of stay were excluded from our search.

Results: In total, 814 studies were retrieved from the electronic databases. 712 studies were eliminated on the basis of title or abstract screening. 102 full text papers were subsequently evaluated, 22 from which data was extracted. Ultimately, 9 studies were included in the systematic review upon application of our inclusion and exclusion criteria on the extracted data. Overall, 6 studies demonstrated a reduction in ICU length of stay with palliative care involvement. Among the 3 remaining studies, 2 of them illustrated an increase in ICU length of stay. Finally, 5 out of 6 studies showing a reduction in ICU length of stay, showed no change in mortality. Statistical analyses are pending and will be presented at the Critical Care Canada Forum.

Conclusion: Palliative care involvement with high-risk ICU patients will likely reduce ICU length of stay without impacting mortality. It is difficult to draw definitive conclusions due to the large heterogeneity of study designs and interventions as well as the overall weak evidence from these studies. A multicenter randomised controlled trial would be of great value to better evaluate this issue. Furthermore, evaluating the cost impact associated with this probable reduction in length of stay would be helpful to include in this RCT.

References: Connors, A. F., Dawson, N. V., Desbiens, N. A., Fulkerson, W. J., Goldman, L., Knaus, W. A., ... & Sheehan, K. (1995). A controlled trial to improve care for seriously iII

hospitalized patients: The study to understand prognoses and preferences for outcomes and risks of treatments (SUPPORT). Jama, 274(20), 1591-1598.

Poster # 117 **Poster Session: 15:30 - 17:00**

Title: Intensive Care Unit Capacity in Low-Income Countries: A Systematic Review
Presenter: Aleksandra Leligdowicz, University of Toronto, Interdepartmental Division of Critical Care, Toronto, Canada.

Introduction: Access to critical care is a crucial component of a healthcare system. Inlow-income countries, the burden of critical illness is substantial, but the capacityprovide care for critically ill patients in intensive care units (ICUs) is unknown.

Objectives: To systematically review the published literature to estimate the current ICUcapacity of hospitals in low-income countries.

Methods: With a librarian's assistance, we searched 11 databases and included studiesof any design, published 2004-13, with data on ICU capacity for pediatric and adult patients in 36 low-income countries (defined by World Bank criteria; total population 850 million). Neonatal, temporary, and military ICUs were excluded. Data on ICU bed numbers, capacity for mechanical ventilation, and information about the hospital, including referral population size, public accessibility, and the source of funding were extracted. Two reviewers independently searched for relevant articles and extracted data from included studies; a third reviewer resolved disagreements. Analyses were descriptive, with continuous data summarized as mean (standard deviation, SD) or median (interquartile range, IQR) and categorical data as number (percent).

Results: Of 1,759 citations, 43 studies from 15 low-income countries met inclusioncriteria (Figure 1). They described 36 individual ICUs in 31 cities, of which 16 had population greater than 500,000 and 14 were capital cities. The median annual ICU admission rate was 401 (IQR 234-711, 24 ICUs with data) and median ICU size was 8 beds (IQR 5-10, 32 ICUs with data). The mean ratio of adult and pediatric ICU beds to hospital beds was 1.5% (SD 0.9%; 15 hospitals with data). Nepal and Uganda, the only countries with national ICU bed data, had 16.7 and 1.0 ICU beds per million population respectively, in contrast to high-income countries (Figure 2). Despite exhaustive search strategies, capturing national data in other countries was not possible due to the lack of relevant publications.

Conclusion: Low-income countries lack ICU beds, and more than 50% of thesecountries lack published data on ICU capacity. Most ICUs in low-income countries are located in large referral hospitals in major cities. A central database of ICU resources is required to evaluate health system access and performance, both within and between countries, and may help to develop related health policy.

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Poster # 118 **Poster Session: 15:30 - 17:00**

Title: BIOMARKERS IN SEPSIS: A SYSTEMATIC REVIEW

Presenter: Florence Morriello, Institute of Medical Sciences, Critical Care Medicine, Toronto, Canada.

Introduction: Sepsis is a common reason for admission to intensive care units (ICUs) throughout the world. During the past two decades, the incidence of sepsis in the United States has tripled and is now the tenth leading cause of death. As sepsis continues to impact negatively on critically ill patients, it is clear that early diagnosis and effective management could improve patient morbidity and mortality. Numerous studies have attempted to examine biomarkers and their ability to diagnose and prognosticate septic patients. Despite multiple efforts, currently there are no reliable markers that can effectively improve our clinical effectiveness in diagnosing and managing septic patients.

Objectives: The purpose of our systematic review was to evaluate the diagnostic and prognostic value of various biomarkers used in septic patients.

Methods: A systematic search of the literature was performed with MEDLINE, EMBASE, and the Cochrane Central Register of Controlled Trials databases using terminology selected for biomarkers (through to and including November 2013). All articles involving neonates and not in english were excluded. Inclusion was agreed on by two independent reviewers of abstracts or full text. Assessment was based on the biomarker's ability to diagnose septic patients and it's ability to predict mortality.

Results: Of 5257 articles identified, all abstracts were screened, and 750 full text articles were selected for review. These included primarily randomized controlled trials, cohort studies and postmortem studies. Of 49 biomarkers examined, 72% of the studies examined Procalcitonin. Comparing the serum of septic patients with that of controls, most biomarkers were elevated in septic patients, even though only a few had high sensitivity (>85%) and high specificity (>80%). It was often difficult to compare study group with control group as the control group patients were usually not healthy controls.

Conclusion: Overall the heterogeneity of studies, small sample size and the lack of 'true' healthy controls influenced the ability to use the biomarker for prognostication of a septic patient. Furthermore the lack of healthy control raises the question of redefining a selection criteria in order to better study septic patients.

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Poster # 119 **Poster Session: 15:30 - 17:00**

Title: Pressure Control versus Volume Control Ventilation in Acute Respiratory Failure: A Physiology-Based Systematic Review and Meta-analysis

Presenter: Nuttapol Rittayamai, Keenan Research Centre and Critical Department, St. Michael's Hospital, Critical Care, Toronto, Canada.

Introduction: Mechanical ventilation is a cornerstone in the management of acute respiratory failure (ARF). Both volume control ventilation (VCV) and pressure control ventilation (PCV) are used, the latter being increasingly used. Epidemiological data suggest that VCV remains overall the most commonly used ventilator mode, but its recent use has declined and replaced by pressure-targeted modes. Potential advantages of PCV over VCV have not been elucidated. We performed a systematic review and meta-analysis to determine whether PCV has advantages over VCV in ARF. We introduced physiological criteria as quality indicators for selecting the studies. No previous review exists to date.

Objectives: To compare the physiologic effects and clinical outcomes between PCV or inverse ratio PCV (PC-IRV) and VCV in mechanically ventilated patients with ARF.

Methods: We searched MEDLINE, EMBASE, CENTRAL, and conference proceedings for studies comparing VCV to PCV or PCIRV. The inclusion criteria were critically ill patients over 18 y-o, receiving invasive mechanical ventilation from ARF, and trials reporting on respiratory system compliance (Crs), gas exchange, hemodynamic parameters, work of breathing and clinical outcomes. We excluded studies concerning intra-operative ventilation and using APRV. The Cochrane tool for risk of bias was used to assess methodological quality and we established rules for physiological quality data assessment for our included trials. We kept only studies with high physiological quality. Outcome measures included Crs, gas exchange (P/F ratio, oxygenation index and PaCO2), hemodynamics (mean arterial pressure [MAP], cardiac output), patient work of breathing and clinical outcome (ICU mortality, ICU length of stay, and days of mechanical ventilation). In addition, we specified subgroup analyses for the subgroups of PC-IRV and ARDS patients populations a priori. Analyses were done with RevMan5 using random effects models.

Results: From 1989 to 2013, 37 studies met inclusion criteria, and 34 were used. Many studies were at high risk of bias or had poor physiological quality criteria. The meta-analysis results demonstrated that no difference existed for Crs (figure 1) and oxygenation, with PC-IRV studies providing non-significant trends towards improved P/F ratio [15.54, 95% CI (-6.75, 37.84)] (figure 2) but poorer calculated oxygenation index [3.77, 95% CI (-1.08, 8.61)]. PCV showed a trend towards reduction in PaCO2 and patient work of breathing, but there were not statistically significant. There was no difference between PCV or PC-IRV versus VCV in terms of hemodynamics (MAP, cardiac output), or clinical outcomes (ICU mortality, ICU length of stay, and days of mechanical ventilation). This results were consistent in subgroup of PC-IRV and ARDS.

Conclusion: The literature does not provide any evidence for a difference between PCV or PC-IRV versus VCV in terms of physiological outcome or mortality. Our study has strengths and

weaknesses: we included all identified trials, enhancing generalizability and pragmatism and entered only good physiological quality trials into the meta-analysis. However, trials were small and varied considerably in quality. This work may impact the choice of ventilation of ICU patients with ARF.

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Poster # 120 **Poster Session: 15:30 - 17:00**

Title: Ischemic Stroke Risk for New Onset, Non-Valvular Atrial Fibrillation In Critically lll Patients – A Systematic Review

Presenter: Stephanie Sibley, Queen's University, Critical Care Medicine, Kingston, Canada.

Introduction: New onset atrial fibrillation is common in medical/surgical intensive care unit (ICU) patients and is associated with morbidity and mortality. Despite the known risk of stroke in patients with atrial fibrillation in other populations very little data guide stroke risk assessment or its prevention in critically ill patients with new onset, non-valvular atrial fibrillation.

Objectives: We conducted a systematic review to determine the in-hospital and 5 year stroke risk for ICU patients with new onset, non-valvular atrial fibrillation. We searched for validation studies of stroke risk and bleeding scores in ICU patients. We assessed if they had a decrease in ischemic stroke or mortality or increased bleeding complications with anticoagulation compared with standard care.

Methods: The effectiveness and outcomes of anticoagulation for atrial fibrillation in adult ICU patients were reviewed using MEDLINE, Cochrane Database of Systematic Reviews, Cochrane Central Register of Controlled Trials, CINAHL, Scopus, ISI Web of Science, and the International Pharmaceutical Abstracts databases for original data from 1950 onwards.. Key words incorporated anticoagulation, heparin, atrial fibrillation, critical care, intensive care, critically ill and stroke. The search was limited to English. The references of selected studies and review articles were also searched. Eligibility criteria included all study designs that reported on the incidence of atrial fibrillation in ICU, rate of ischemic stroke and mortality, and outcomes of anticoagulation. Cardiac surgery studies were excluded.

Results: 15 published articles and 1 conference abstract met eligibility criteria. There were no randomized control trials. Atrial fibrillation occurs in 3.4 -30% of non-cardiac surgery critically ill patients. It is associated with a greater risk of in hospital stroke (2.6% vs. 0.6%, adjusted OR, 2.70; 95% CI, 2.05-3.57; $P < .001$). The five year risk of hospitalization for ischemic stroke was elevated in patients with new onset AF (5.3% vs 4.7%; HR 1.22 (1.10-1.36)). In-hospital mortality was elevated (56% vs 39%; adjusted relative risk, 1.07; 95% CI, 1.04-1.11; $P < .001$). In septic patients with new onset atrial fibrillation there was an increased overall mortality (44% vs 22%) compared with septic patients in sinus rhythm. The five year risks for AF occurrence post discharge were higher in new onset AF (54.9%) vs no AF (15.5%). One study evaluated the anticoagulation of patients with severe sepsis and found no ischemic strokes in the non-anticoagulated group but increased bleeding complications in the anticoagulated group. 51.4% of anticoagulated patients were in therapeutic range less than 50% of the time.

Conclusion: Atrial fibrillation is associated with increased stroke risk and mortality. There have been no validation studies for stroke or bleeding risk scores in critically ill patients. There is a paucity of data regarding outcomes for patients who are anticoagulated for new onset atrial fibrillation and further studies are warranted to determine the risks and benefits of anticoagulation.

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Poster # 122 **Poster Session: 15:30 - 17:00**

Title: International guideline development for the treatment of calcium channel blocker poisoning

Presenter: Maude St-Onge, University of Toronto, Clinical pharmacology and toxicology, Toronto, Canada.

Introduction: American poison control centres report cardiovascular drugs as the substance category with the third rate of increased exposures (Bronstein et al., 2012). A retrospective study conducted in two Canadian cities underlined that CCB poisoning is associated with a morbidity of 50% and a mortality of 6% (St-Onge et al., 2012). The same article also found only 42% adherence to the current Poison Control Centre's recommendations (St-Onge et al., 2012). This lack of adherence can be interpreted as a care gap, although given that the current recommendations are not evidence-based and vary from one poison control centre to another, it could also reflect practice variation.

Objectives: The objective was to develop a guideline for the treatment of CCB poisoning endorsed by international critical care, emergency medicine and toxicology associations in order to decrease practice variation and care gap.

Methods: The guidelines look at what type of interventions should be recommended for patients poisoned with a CCB (asymptomatic, symptomatic, refractory to conventional treatment or in cardiac arrest) who consult in a hospital. Target users comprise bedside physicians, consultants (at the bedside or on the phone) and the poison control centers. The guidelines answers the following key questions: 1) Is there evidence that one (or more than one) intervention(s) improves health outcomes (mortality, functional outcomes, hospital LOS, ICU LOS)?; 2) Do a patient's characteristics influence the intervention(s) provided and the outcomes?; 3) Is there evidence that one (or more than one) intervention(s) improves intermediate outcomes?; 4) Are intermediate outcomes associated with health outcomes?; 5) Does one (or more than one) intervention(s) results in adverse effects or is not cost-effective? THE EVIDENCE was underlined by a systematic review (St-Onge et al., accepted to Clin Tox 2014). It showed a possible benefit of high-dose insulin on hemodynamics and on mortality at the risks of hypoglycemia and hypokalemia (low QOE); a possible role for VA-ECMO in patients in severe shock or in cardiac arrest to improve survival at the cost of bleeding, thrombosis, or limb ischemia (low QOE with some indirectness). It also showed that calcium, dopamine, norepinephrine, or epinephrine may improve hemodynamics (very low QOE); that lipid emulsion may improve hemodynamics and; that atropine, glucagon, the use of pacemaker and plasma exchange demonstrated inconsistent results. THE COST was evaluated by a cost-effectiveness analysis conducted from a societal perspective. It supported the use of VA-ECMO in the treatment of cardiotoxicant poisonings if its effectiveness is confirmed (St-Onge et al., submitted to CCM 2014). THE RECOMMENDATIONS were developed by representatives of international associations in critical care, emergency medicine and toxicology. All workgroup members filled out and declared financial and non-financial conflict of interest. The process was not externally funded. Sub-groups first built a document detailing the level of evidence, the risks, the benefits and the circumstances in which the recommendations may not apply. Then, the recommendations were developed and the strength of the recommendation was established with

a modified Delphi method (RAND/UCLA). Two face-to-face meetings were / will be also held (Brussels in May 2014 & New Orleans in October 2014). An external review will be done and results will be disclosed. THE VALUES AND THE PREFERENCES of the workgroup members influencing the vote were reported. Moreover, once approved by the associations, the draft of recommendations will be posted on a blog (www.poisoningsguidelines.com) to obtain comments and suggestions from decision makers, guidelines users, patients, and their relatives. THE IMPLEMENTATION of the guideline will be facilitated by an implementation tool to promote adherence to key recommendations.

Results: Recommendations will be available in October 2014. Areas for future research will aslo be targeted.

Conclusion: With the use of good implementation strategies, this guideline for the treatment of CCB poisoning endorsed by international critical care, emergency medicine and toxicology associations may decrease practice variation and improve care gap.

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Poster # 124 **Poster Session: 15:30 - 17:00**

Title: Extracorporeal membrane oxygenation (ECMO) as a treatment strategy for severe acute respiratory distress syndrome (ARDS) in the low tidal volume era: A systematic review

Presenter: Bourke Tillmann, London Health Sciences Centre, Critical Care and Emergency Medicine, London, Canada.

Introduction: The mortality associated with severe acute respiratory distress syndrome (ARDS) remains high at 52%. A recent clinical trial demonstrated a significant increase in disability-free survival when patients diagnosed with severe respiratory failure were transferred to a centre with an extracorporeal membrane oxygenation (ECMO) based management protocol.

Objectives: The primary objective of this systematic review was to determine the hospital mortality rate as reported in the literature. Length of stay (LOS) in the intensive care unit (ICU), hospital LOS, ECMO complications, indications for initiation of ECMO, and ventilation settings during ECMO therapy were also described.

Methods: Electronic searches of Medline, EMBASE, Cochrane Central Register of Controlled Trials were conducted and reference lists for relevant articles were hand searched. Randomized controlled trials (RCTs), retrospective and prospective cohorts, case control studies and case series with at least 10 patients reporting the use of ECMO in adults (age ≥16 years) with ARDS published in any language were included. Studies were excluded if patients did not receive low tidal volume lung protective ventilation strategies or the diagnosis of ARDS was not in keeping with the Berlin definition. Two reviewers independently screened the titles and abstracts, assessed the quality of the studies, and independently extracted data.

Results: The search strategy identified 1782 studies, and 32 studies met the inclusion criteria. These studies represented a combined total of 2192 patients; 1209 patients received ECMO, totaling 1210 ECMO ‘runs’, and 983 received conventional therapy. One of the studies was a RCT, 8 were cohort studies, and 23 were uncontrolled case series. Of the 32 included studies, 5 were determined to have a low risk of bias. Hospital morality for patients on ECMO was reported in 19 studies with a median of 37%. In the studies with a low risk of bias the median morality for patients on ECMO was 37% while median mortality for patients who received conventional therapy was 50.7%.

Conclusion: Although of relatively poor quality, the current data supports the use of ECMO for the treatment of severe ARDS. To improve the quality of existing literature future studies should focus on controlling standard therapy and ensuring appropriate comparability between exposed and control groups.

References: N/A