

UNIVERSITY OF SASKATCHEWAN College of Medicine office of the vice-dean research medicine.usask.ca/research.php



#### UNDERGRADUATE SUMMER RESEARCH SHOWCASE

# 2022





1

Jesse Adrian Kenny Ta Jordan Bairos Hya El-Baroudy Kaitland Fior Haidyn Golinowski Lorynn Labbie Tony Li

2

Omer Munir Ella Guo Aidan Hydomako Jacob Pilon Genre Sanfuego Rayan Shafi Sanskriti Shrestha Noaah Reaume

3

Sergey Kens Hatem Alfarra Rachel Cey Justin Hall Haylen Langlier Bonnie Yang Kirk Haan

# 31



Kayla Abrametz Hannah Braun Monisha Chakder Amber Debnam Rebecca Iyoha Tanvir Minhas Nathan Seidel

2 Kyle Luo Amar Vir Singh Minhas Noah Willfong Mutjaba Ibrahim Emmy Ogunjimi Anya Sigurdson Mahdi Toliatzavareh Agnes Truc Nguyen

## 46



Tongchen Feng Raina Kim Alyx Orieux Evan Parchomchuk McKenzie Van Eaton Mikaela Vancoughnett Zakhar Kanyuka Jovana Miladinovic Flinn Herriot Thomas Lowe

## 56



Manojkumar Balakrishnan Revathi Nair Sam Savard David Kim



**60 EXAMPLE** 



Morgan Schatz Rachel Silverberg Abby Miller Trevor Oleniuk Michael Heynen





Romaisa Ismaeel Bryan Johnston Sydney Murray Azasma Tanvir Georgia Bailey Avani Saxena Dilpreet Bajwa





Orhan Yilmaz Samuel Boctor Taylor Dennison Mohamed Omar Karmen Simonson Lucas Fisher Amelia Gagnon **79** 



Aishwarya Gannamani Alex Chen James Macaskill Monica Ouellet Mimi Girard Teagan Holt Soumiya Suresh Olena Simko Mauz Asghar







Huzaifa Saeed Aleya Anderson Lexie Landreth Alexander Waslen

# 92



1

Prapti Patel Mark Wang Thomas Goldade Ryan Chan Kennedy Lewis Janan Ashique Kate Kopeck Stephanie Bigsby Nancy Cai

2 Allan Yang Khrystia MacKinnon Gavin King Jay Rabari Zoher Rafid-Hamed Zainab Sultan Grant Yao Jared Price



# 109



Claire DuVal Candelaria Aristizabal Londono Barzany Ridha Dinesh Kumar Hifsa Noor Yousef Omar



#### A Message From The Vice-Dean

#### Dear Colleagues,

Welcome to the 2022 Virtual Undergraduate Summer Research Showcase.

This is the nineteenth iteration of our undergraduate summer student research programming, which has grown to be a very important event in the University of Saskatchewan College of Medicine research calendar.

This year, we have poster submissions from 11 different biomedical and clinical research categories, for a total of 15 competition categories.

I am delighted to acknowledge an exceptional dedication and work of students, mentors, adjudicators and all who facilitated undergraduate student research programs. Even in these unprecedented times, our staff worked incredibly hard to ensure all students gained the research experience they desired.

I wish all of us in our college yet another unforgettable research experience!

With kind regards,

March Roston .



#### Anatomy, Physiology & Pharmacology



#### Jesse Adrian (Dr. John Howland)

Using machine learning to analyze behaviour

Behavioural neuroscience requires the quantification of behaviours exhibited by animals. The novel object recognition (NOR) task utilizes rodents' innate novelty-seeking behaviour to infer the functionality of working memory in these animals. This is done by recording the amount of time the animals spend exploring novel objects compared to familiar objects. The current method of manually analyzing this behavior is labour intensive, time-consuming, and subjective. We sought to utilize machine learning (ML) programs to automate the process of analyzing rodent behaviour. We trained two open-source ML programs, DeepLabCut (DLC) and Simple Behavioural Analysis (SimBA), to identify exploratory behaviour seen in rats performing NOR. DLC was trained to label body part positions using videos of Long Evans rats performing the task. Next, we used the output of DLC to train a classifier using the SimBA program. The classifier identifies and tracks the time spent by the rat exploring objects. We found that our classifier performs well on videos within its training dataset, however, we are currently optimizing the performance with the objective of generalizing this method to other behavioural tasks.





#### Kenny Ta (Dr. Brian Eames)

Homology on trabecular mineralization pattern in Chondrichthyes and Osteichthyes

Organisms can give rise to mineralized skeletal tissues such as bone and mineralized cartilage. by deposition of biominerals in extracellular matrix of their skeletal tissues. Two vertebrate groups that possess a mineralized skeleton with living representatives are Chondrichthyes (cartilaginous fishes) and Osteichthyes (bony fishes and tetrapods). Both groups shared a common ancestor. Chondrichthyes (skates, sharks and chimaeras) endoskeleton is lined by discretely organized mineralized cartilage termed tesserae. Interestingly, these tesserae can present a trabecular pattern (contains branching of rod-like struts), showing morphological similarities to the trabecular mineralization pattern of bone in Osteichthyes, forming from a cartilaginous scaffold. We hypothesize that the trabecular mineralization of tesserae in Chondrichthyes and the trabecular mineralization of bone in Osteichthyes are homologous. To test the hypothesis, we compared the process that form these mineralization pattern through various stages of development in the little Skate and chicken, using histological and molecular assays. Results show both processes began with a cartilaginous template, then maturing chondrocytes expressed Collagen type 10, alongside with mineralization of the cartilage template. However, trabecular mineralization of bone shows resorption of the cartilaginous template, while trabecular mineralization of tesserae does not. We conclude that the processes that form these mineralization patterns are not homologous.



#### Jordan Bairos (Dr. Scott Widenmaier)

Insight into metabolic factors that affect hepatocyte cholesterol crystallization

Background. Excess cholesterol is toxic and dysregulation of intracellular cholesterol is linked to cardiovascular and liver disease. As cholesterol level increases, the ability of cell membranes to carry cholesterol is compromised and can lead to precipitation of cholesterol crystals. Crystallization of cholesterol has been shown in atherosclerotic plaques and recently, cholesterol crystals were also found in hepatocyte lipid droplets in non-alcoholic steatohepatitis (NASH). Hence, defining factors that contribute to or protect against cholesterol crystallization may reveal novel insight into NASH and atherosclerosis.

Hypothesis. We hypothesized loading plasma membrane with excess cholesterol will promote cholesterol crystal formation via lipid droplet metabolic processing.

Methods and Results. To load plasma membrane with cholesterol, cultured Hep3B human hepatocytes were treated for 48 hours with cholesterol complexed to methyl- $\beta$ -cyclodextrin. Cholesterol crystallization was detected under polarized light in live cells with nuclear stain done in parallel to normalize cholesterol crystal area by cell number. Using this approach, we identified dose-dependent increase in Hep3B cholesterol crystals, with greatest effect at 200  $\mu$ M cholesterol treatment. Interestingly, using a pharmacological inhibitor of Acyl-Coenzyme A: Cholesterol Acyltransferase (ACAT), we discover that cholesterol esterification and subsequent lipid droplet localization is required for cholesterol crystal formation.

Conclusions. We anticipate gaining insight regarding factors that promote and that counteract cholesterol crystal formation, which is likely to be of relevance to NASH and cardiovascular disease.





#### Hya El-Baroudy (Dr. Anand Krishnan)

Development of a novel 3D model for screening potential therapeutic candidates for peripheral nerve repair

Peripheral nerve injuries often lead to loss of functions due to degeneration of distal axons. Studies indicate that sensory neurons enter apoptosis after distant axotomy. Hence, neuroprotective agents have high therapeutic value in nerve regeneration therapies. However, no in vitro model currently represents sensory neuronal apoptosis in response to nerve injury. Whole dorsal root ganglia (DRG) explant cultures are in place, but they represent a neurite extension model with no apoptosis induction in neurons. Developing an in vitro neuron apoptosis model may fast-track screening of novel neuroprotective agents. We characterized an in vitro model representing spontaneous sensory neuron apoptosis in response to nerve injury. We used adult lumbar DRG-nerve preparations to model the in vitro neuron degeneration. The DRG-nerve tissue preparation was embedded in an extracellular gel matrix containing growth factors to mimic a 3D environment. Immunohistochemical analysis of this preparation was performed at different time intervals to characterize the onset of axon degeneration, which was maximum at the early timepoints (1-5 days). We found that later intervals in this model have intact axons and healthy neurons, enabling screening of potential neuroprotectors. Overall, we developed a novel in vitro degeneration model, which can be used for screening nerve regeneration therapeutics.





#### Kaitland Fior (Dr. Michael Levin)

Elucidating novel mechanisms of antibody-mediated neurodegeneration in a model of multiple sclerosis

Multiple sclerosis (MS) is an autoimmune disease that results in neurodegeneration - the damage and death of neurons. Previous research has shown that neurodegenerative diseases, including MS, display abnormal RNA binding protein (RBP) function. Specifically, MS patients make antibodies to the RBP heterogenous nuclear ribonucleoprotein A1 (A1). Addition of A1 antibodies to primary mouse neurons leads to A1 dysfunction and subsequent neurodegeneration. However, the mechanisms behind A1-antibody mediated neurodegeneration are not well understood. Therefore, we aim to identify potential mechanisms underlying A1 antibody-mediated neurodegeneration based on previous RNA sequencing data. To do this, primary mouse neurons were treated with A1 antibodies or IgG control antibodies and assessed for changes in autophagy and stress granules, two pathways identified in RNA sequencing data, over a 6, 12 and 24-hour time course. Primary neurons were then analyzed using fluorescence microscopy. In contrast to IgG control antibodies, primary neurons treated with A1 antibodies showed increased formation and accumulation of autophagic vesicles over time, indicative of defects in the autophagy processing pathway as well as increased stress granule formation. These data suggest that A1 antibodies disrupt normal autophagic processes and thus, may be one of several mechanisms that underlie A1 antibody-mediated neurodegeneration in MS.







#### Haidyn Golinowski (Dr. Julia Boughner)

The Role of the p63 Gene in Vertebrate Tooth Formation

The evolutionarily ancient gene, p63, is expressed widely across vertebrates. The p63 gene has a role in the development of many body parts including limb, palate, urogenital tract, and teeth. Here, we are using a well-characterized fish model of tooth development, medaka (Oryzias latipes), to determine if genes bound and thus controlled by p63 will be expressed identically between oral (mouth) and pharyngeal (throat) dental tissue. Adjacent paraffinembedded embryo tissue slices were H&E stained to show tooth organ morphology and histology, and to help map protein expression to specific areas of the tooth. Immunohistochemistry was performed to label p63 and its targets FERMT1, CBLN1, KRT15, and PRSS8. Preliminary results indicate that p63 and a few of its targets including FERMT1 and PRSS8 are expressed in oral dental tissue. Protein labeling experiments continue to test and probe the location and quantity of expression of the p63 gene and many other target genes in the p63 network in the pharyngeal and oral dental tissue.





#### Lorynn Labbie (Dr. Michelle Collins)

Elucidating the Function of Pitx2c in Cardiac Conduction System Patterning

Pumping of the heart is coordinated by a specialized cellular network known as the cardiac conduction system (CCS). The transcriptional network that patterns the CCS is well conserved between humans and zebrafish. Mis-patterning of this network can lead to pathologies, including the common arrhythmia, atrial fibrillation (AF). Pitx2c is a key transcription factor in patterning a region of CCS pacemaker cells known as the sinoatrial node (SAN) and restricts SAN development to the right side of the heart. Thus, we hypothesized that pitx2c mutants display an enlarged SAN and AF phenotype markers. To characterize early SAN morphology, in situ hybridization (ISH) was performed on 72 hours post-fertilization (hpf) embryos from a pitx2c heterozygous in-cross for SAN transcripts, including tbx3a, tbx5a, and tbx18. Results suggest varied expression of tbx18 among different genotypes, while tbx3a and tbx5a expression remained relatively consistent. To examine the role of pitx2c on conductive cells in the cardiac muscle, immunohistochemistry was performed on adult heart sections to visualize expression of Cx40 and Cx43 gap junction proteins. Results indicated that expression levels may be decreased in wild type versus heterozygous adult ventricles. Future experiments will investigate these transcripts via ISH in 120 hpf embryos and adult zebrafish.





#### Tony Li (Dr. Yuliang Wu)

Effect of DDX41 deficiency on mRNA splicing of P-bodies genes EDC4, 4E-T and LSM14A

DDX41 is a DEAD-box helicase that is involved in pre-mRNA splicing and innate immunity. Mutations in DDX41 is associated with myelodysplastic syndromes (MDS) and acute myeloid leukemia (AML). Processing bodies (P-bodies) are membraneless organelles formed by ribonucleoprotein aggregates located in the cytoplasm under cellular stress. Three proteins, EDC4, 4E-T and LSM14A, are essential for P-bodies formation. We recently found that DDX41 is required for cGAS-STING pathways for type I interferon production, and its dysregulation leads to MDS/AML (a manuscript is under revision at Cell Reports). In addition, we found that there are reduced P-bodies formation and reduced protein expression of EDC4, 4E-T and LSM14A in DDX41 knockout (KO) cells under stress conditions, indicating DDX41 deficiency affects the expression of EDC4, 4E-T and LSM14A, which affects P-bodies assembly.







#### **Omer Munir (Dr. Francisco Cayabyab)**

The Dimer Caffeine-Indan Promotes Neuroprotection in a Novel Model of α-Synucleinopathy

This project tested the neuroprotective properties of a novel caffeine-indan dimer drug in an in vivo animal model of Parkinson's Disease. The dimer compound is hypothesized to reduce  $\alpha$ -synuclein levels in the brain as well as overall neurodegeneration levels via CPA induced neurodegeneration. Male Sprague-Dawley rats were used for the experiment and coronal brain slices were obtained for immunohistochemical staining with primary antibodies of DAPI, Tyrosine Hydroxylase and  $\alpha$ -Synuclein. Flouro-Jade C stain was carried out to measure overall neurodegeneration levels in the substantia nigra pars compacta and hippocampal CA1 region of the brain.







#### Ella Guo (Dr. Julia Boughner)

In vitro Tissue Differentiation and Deformity

Trp63 is a transcription factor in the Trp53 family that regulates cell differentiation, proliferation, and apoptosis during limb, urogenital, and other ectodermal organ development. p63 mutation leads to severe developmental defects in humans, including cleft palate, ectodermal dysplasia, and limb deformation. Recent data suggest that p63 and its gene-regulatory network, in addition to the functions previously outlined, may also influence cell dynamics by regulating adhesion, condensation, polarity, and migration of cells. The biophysical implication of p63-mutation during mammalian organogenesis can be examined by investigating the cytoskeleton organizational differences of the mandibular tooth bud between the wild-type, heterozygote and homozygote embryos using explant mandibular and facial organ cultures. Stereoscopic observation and 2-dimensional surface area analysis suggest Significant tissue deformity and flattening in both types of cultures, with facial culture demonstrating process formation during in vitro incubation. Histological staining further illustrated unusual and extensive cartilage development. Further investigation could explore whether the same phenomenon is observed in 3-dimensional tissue culture with Matrigel and if the addition of various cytokines promotes proper cartilage formation.





#### Aidan Hydomako (Dr. Scott Widenmaier)

Examining The Effect of Inflammation on HDL-Cholesterol Uptake by the Liver

HDL-cholesterol, commonly referred to as the "good cholesterol" is a circulating lipoprotein that plays a crucial role in reverse cholesterol transport (RCT). At the beginning of RCT, excess cholesterol in peripheral cells is picked up by circulating HDL particles and returned to the liver to be excreted or recycled. This flux of HDL-cholesterol into hepatocytes at the end of RCT is mediated by the receptor SR-B1. When HDL-cholesterol flux to the liver is reduced, as is the case under the chronic inflammation, cholesterol accumulates in peripheral arteries contributing to the development of atherosclerotic plaques and ultimately cardiovascular disease. Using a cultured Hep3B human hepatocyte cell line, treatments with proinflammatory cytokines like tumour necrosis factor alpha (TNFa) were performed. We discovered that both the gene and protein expression of SR-B1 was significantly downregulated following TNFa treatment. Utilizing fluorescently labeled human HDL, we find that SR-B1 deficiency under inflammatory conditions may translate to reduced HDLcholesterol uptake into hepatocytes. This research lays the groundwork for a future CRISPRbased genomic screen to identify mediators of inflammatory signaling that disrupt the uptake of cholesterol by the liver. These identified molecules could serve as potential targets for novel therapeutic interventions in obesity-linked cardiovascular disease.







#### Jacob Pilon (Dr. Michael Levin)

Heterogeneous nuclear ribonucleoprotein A1 dysfunction activates cell stress and causes neurite loss in an in vitro cellular model of multiple sclerosis

Multiple sclerosis (MS) is an autoimmune disease characterized by demyelination and degeneration of neurons. There are many molecular mechanisms underlying these effects, one of which is the dysfunction (cytoplasmic mislocalization and clustering) of the RNA binding protein heterogeneous nuclear ribonucleoprotein A1 (A1) in neurons. We hypothesized that A1 dysfunction would induce neurite loss, which may involve the integrated stress response (ISR). Differentiated, neuron-like Neuro2A cells were transfected with an optogenetic plasmid containing wild-type A1 linked to Cryptochrome 2 and a mCherry fluorescence tag (OptoA1mCh). Transfected cells were stimulated by blue light (BL) to induce A1 dysfunction and were analyzed using immunocytochemistry to measure neurite loss and the activation of the ISR. Separately, cells were co-treated with the ISR inhibitor GSK2606414 (PERKi), to determine whether mitigation of the stress response improves neuronal/neurite viability. Compared to control cells, BL stimulated OptoA1 cells contained visible A1 mislocalization and clustering and had significantly reduced average neurite length. The addition of PERKi reduced neurite loss by ~25% in cells with A1 mislocalization. These data indicate that the mitigation of the ISR via PERKi, may reduce neurite loss caused by A1 dysfunction.





#### Genre Sanfuego (Dr. John Howland)

Effects of Gestational Cannabis Exposure on Measures of Maternal and Offspring

Recent amendments of laws on cannabis, its increasing popularity, and the burden of evidence with respect to its side effects resulted in the paradigm shift with regards to gestational use of cannabis, which equates it as safe. Since legalization, the general population has ease of access to high concentrations of  $\Delta 9$ \_Tetrahydrocannabinol (THC) and Cannabidiol (CBD). These phytocannabinoids are known to act on the endocannabinoid system (ECs), specifically cannabinoid receptor 1 (CBR1) and 2 (CBR2). Because of its therapeutic potentials, pregnant women have increasingly used it to alleviate the symptoms of pregnancy, despite its potential and wildly unknown impact on the offspring's health. Research indicates that pre-natal exposure to cannabis can have long lasting impact due to the regulatory function the ECs plays in the neurodevelopment of the fetus. These effects however have only been shown through intraperitoneal (i.p) injection, even though cannabis is often consumed through oils, edibles and/or through smoke. The purpose of this study is to determine how exposure to cannabis through smoke affects the physiological outcome of Sprague Dawley rats. Rats (n=13-16/treatment) were treated with high THC cannabis smoke (Skywalker), High CBD cannabis (Treasure Island), i.p injections of 3 mg/kgs THC or 10 mg/kg CBD daily from gestational day 6-20. Dams were weighed every 3 days. Upon birth, litters were weighed for relative pup weights. Following weaning, rats were weighed individually from adolescence to adulthood. Results showed no significant weight gain differences in adulthood with variability between sexes, however there were significant differences in gestational weight gain for the THC-treated group. These results are only one aspect of the current investigations in attempt to understand the physiological, cognitive, and behavioural side effects between smoke and i.p injection exposure during gestation.





#### Rayan Shafi (Dr. Brian Eames)

BMP signaling positively modulates fin ray, but not craniofacial bone ossification

Bone Morphogenic Proteins (BMPs) are key ligands involved in endochondral ossification by several mechanisms. While the role of BMPs is less defined in the intramembranous ossification, a study suggests that ectopic BMP expression increases the ossification of Opercle, a craniofacial dermal bone. Another study showed that the fin rays treated with chordin, a BMP ligand sequestrant, had less ossification compared to control. These results lead to the hypothesis that BMPs positively modulate dermal bone formation. In order to test the hypothesis, BRE:gfp transgenic lines were first used to show that BMP signaling was localized in Cleithrum and Opercle, but not in Parasphenoid in 5 dpf embryos. BMP receptors in zebrafish embryos were blocked using Dorsomorphin Homolog 1 (DMH1). DMH1-treated 5 dpf zebrafish had a similar amount of dermal bone formation compared to control, as indicated by the Alizarin Red staining. This result suggests that BMP signaling does not promote intramembranous ossification. Previous data from the lab on fin ray regeneration was also analyzed. Fluorescence was localized in the fin rays of adult BRE:gfp fish. Fish treated with DMH1 after caudal fin amputation had a lower length of fin regeneration, which suggests that BMPs positively modulates dermal bone formation.





#### Sanskriti Shrestha (Dr. Anand Krishnan)

*Sympathetic signals orchestrate proneural transcription factors to promote neuroendocrine differentiation of prostate cancer cells* 

Neuroendocrine prostate cancer (NEPC) is a treatment-resistant prostate cancer (PC) that develops due to neuroendocrine differentiation (NED) of PC cells in response to standard anti-androgen therapies. Our lab recently found that sympathetic signaling induces NED of PC cells, but the exact mechanism was unknown. Previous studies showed that proneural transcription factors (PTFs) contribute to NEPC. Therefore, here we examined if PTFs contribute to sympathetic signaling driven NED. A previous study also showed that sympathetic signaling activates dormant PC cells at the metastatic bone site. Hence, we also examined here, if inhibition of sympathetic signaling suppresses NEPC growth in the bone. We used LNCaP cells for the in vitro experiments. Testosterone (T) withdrawal from otherwise T and norepinephrine (NE) supplemented LNCaP cultures showed induction of the PTFs, Neurog2 and Pou3f2, suggesting that they may contribute to sympathetic signalingdriven NED. Our in vivo studies showed that sympathetic signal inhibition has no significant effect on NEPC growth in the bone due to lack of sufficient innervation, suggesting that high local innervation of sympathetic nerves in the primary prostate makes it a good target in the primary PC site. We will continue our studies focusing on the influence of sympathetic signaling in primary NEPC growth.





#### Noaah Reaume (Dr. Peter Hedlin)

Inadequacy of Subarachnoid Blocks in Caesarian sections: Is this a common problem?

Spinal anesthesia is commonly used in Cesarian sections. This procedure uses bupivacaine to achieve a subarachnoid block (SAB). A failed SAB can be defined as surgical pain/discomfort requiring further intravenous/inhalational agents, or conversion to general anesthesia. Previous studies report SAB failure rates of 0.5-6.4%. We aim to determine the rate of SAB failures among all Cesarian sections at Jim Pattison Children's Hospital (JPCH, Saskatoon) in 2020, along with patient and provider factors related to SAB failures.

Chart review (n=1488) was performed to collect patient factors (BMI, number of fetuses, GA, GHTN, GDM) and spinal anesthesia factors (bupivacaine baricity and volume, fentanyl and epimorph doses, insertion level, number of attempts, complications, time from SAB to PACU).

The SAB failure rate at JPCH in 2020 was 2.5%, consistent with previous literature. Based on preliminary results, we found cases resulting in SAB failure were more complex overall (e.g., longer cases, twins, urgent/emergent, SAB complications) and multiple insertion attempts were more likely (resulting in higher administered bupivacaine volumes). These findings will be used to inform an ongoing prospective study examining the causes of SAB failures and their association with patient, provider and/or product factors.





#### Sergey Kens (Dr. Changting Xiao)

Characterizing the Role of Mast Cell Activation in Lipid Mobilization in the Gut

#### INTRODUCTION / RATIONALE

Abnormal lipid metabolism is associated with metabolic syndrome, type 2 diabetes, and atherosclerosis. Thus, understanding the fate of dietary lipids including their handling in the gut and metabolism is crucial in tackling these conditions.

Dietary lipids, following absorption into intestinal enterocytes, are mostly packaged into lipoprotein particles (chylomicrons) that are secreted into the mesenteric lymph duct. The intestine also withholds some lipids for later release triggered by lumenal glucose or intraperitoneal glucagon-like peptide-2 (GLP-2). It was shown that upon absorption of dietary lipids, gut mast cells are activated. However, the precise role of gut mast cells in regulating lipid absorption and release into the lymph is unknown.

#### MAIN OBJECTIVE

We aim to demonstrate the activation of mast cells during lipid release and quantify the activated mast cell markers, PGD2 and histamine, in the lymph following glucose delivery into the duodenum or intraperitoneal injection of GLP-2.

#### **RESULTS / CONCLUSION**

In response to glucose or GLP-2 treatment, we observed increases in mast cell activation markers in the lymph. This suggests that the gut mast cells degranulate during active lipid release from the gut. The mechanisms and consequences of mast cell activation during lipid release warrant further study.





#### Hatem Alfarra (Dr. Asmahan AbuArish)

Deciphering the localization and expression of inflammasome components in healthy airway epithelial cells using quantitative imaging

Inflammation is a vital defense mechanism initiated by the immune system against allergens and invading pathogens. In the lung, immune cells respond to inflammatory triggers by assembling proinflammatory proteins into a complex, called inflammasome, that activates the production and release of cytokines. Airway epithelium (AE) functions to protect the respiratory system from inflammatory triggers by driving mucociliary clearance. Whether AE is also involved in inflammation regulation by expressing inflammasome components, assembling inflammasomes, and releasing cytokines is not established yet. We propose to investigate the NLRP3 inflammasome assembly in AE cells by investigating the endogenous localization and expression level of its components using immunolabeling technique, optimized fluorescence confocal imaging, and data analysis. To accomplish this, human AE challenged with a combination of inflammatory triggers, cells were namely lipopolysaccharides (LPS) and adenosine triphosphate (ATP) for different durations and at various concentrations. Immunolabeling of inflammasome components such as Caspase-1 and NLRP3 and performing confocal imaging and data analysis shows that AE cells express both inflammatory proteins in both the nucleus and the endoplasmic reticulum under healthy conditions, with a significant increase in their expression in response to inflammatory triggers. Our findings allude to an immune response by AE cells and supports our hypothesis.





#### **Rachel Cey (Dr. Michael Levin)**

Effect of T cell co-culture on neuronal RNA binding protein dysfunction

Inflammation, specifically autoreactive pro-inflammatory Th1 cells, and neurodegeneration are drivers of multiple sclerosis (MS) pathogenesis. Dysfunction of the RNA binding protein heterogeneous ribonucleoprotein A1 (A1) contributes to neurodegeneration in MS, however, the factors that cause A1 dysfunction during disease are incompletely understood. A recent study demonstrated that the addition of individual cytokines to mouse primary neurons induces A1 dysfunction. However, the addition of individual cytokines does not accurately model disease. Therefore, we sought to establish a disease-relevant T-cell and primary neuron co-culture system. Naïve T-cells from C57BL/6 mouse spleens were harvested, activated, and polarized to a Th1 phenotype in vitro then cultured with primary mouse cortical neurons. Flow cytometry confirmed that the T cells were correctly activated and polarized. Neurons were examined using immunocytochemistry and fluorescence microscopy for A1 mislocalization, an indicator of A1 dysfunction. We found that Th1 cells induced significantly more A1 mislocalization in mouse primary cortical neurons at both 72- and 96-hours post Tcell addition when compared to untreated neurons. These results indicate that we successfully established a relevant co-culture model system to mimic conditions in MS. Furthermore, we illustrated that pro-inflammatory Th1 cells drive A1 mislocalization and thus, contribute to A1 dysfunction in MS.





#### Justin Hall (Dr. Anand Krishnan)

The Effect of MANF and MIF on Neurite Outgrowth in vitro

Peripheral nerve injury often results in severe functional impairments. While peripheral neurons possess intrinsic regenerative capabilities, this process is often unsuccessful due to slow axonal growth and insufficient growth factors. Thus, there has been a need for therapeutics that can improve functional outcomes following peripheral nerve injury. In this study, we investigated the localization of mesencephalic astrocyte-derived neurotrophic factor (MANF), as well as the effects of MANF and macrophage migration inhibitory factor (MIF) on neurite outgrowth in vitro. While the Krishnan lab has already demonstrated the expression of MANF in sensory neurons, this study confirmed that MANF is not expressed in satellite glial cells, indicating that neurons are the primary source of MANF in sensory ganglia. Additionally, exogenous MANF treatment was shown to significantly increase neurite outgrowth parameters, such as neurite length and average number of branches. Conversely, treatment with exogenous MIF did not influence neurite outgrowth. Overall, these results suggest a potential role for MANF in peripheral nerve regeneration, and highlight the need for future in vivo studies to validate these findings.





#### Haylen Langelier (Dr. Andrea Lavoie)

Assessment of Clinical Outcomes in HFrEF: A Comparison of an Optimized Clinic to Standard Care

Heart failure is a burdensome condition for both patient and healthcare system with high morbidity and mortality. Notably, many patients with heart failure are not on optimal pharmacotherapy. The Canadian Cardiovascular Society released updated guidelines on optimal medication therapy (OMT) for individuals with HFrEF. Patients have been shown to have improved outcomes with OMT and with multi-disciplinary clinics involving physicians, nursing, pharmacists, and dieticians. However, clinics of this nature are often unfeasible. The purpose of this study is to determine the influence of an ambulatory, nurse-physician optimization clinic on OMT and outcomes associated with HFrEF.

In this retrospective cohort study, 326 participants were categorized into two groups. The optimization clinic group (N=154) was 68% male with an average age of 70.5(10.9). Participants in this group received nurse physician care and were optimized according to the 4 pillars of pharmacologic care recommended by the CCS. Group 2 (N=172) had standard care with no nurse involvement. This group was 72% male with an average age of 66.1(15.1). Chart review was used to gather data on patients with HFrEF regarding demographics, risk factors, blood markers, medications, and hospital visits.

Preliminary results suggest that the optimization clinic group may have an increased ejection fraction and have spent fewer days in hospital relating to heart failure. Logistic regression will be used to further analyze the relationship between variables and outcomes of interest.





#### Bonnie Yang (Drs. Julia Montgomery and Anderson Tyan)

Validation of Flow Measurement in a Negative Pressure Ventilator for Prototyping of a Novel Transbronchial Biopsy Tool

Background: For the prototyping of a Novel Transbronchial Biopsy Tool (NTBT), a Negative Pressure Ventilator (NPV) was developed by RMD Engineering to simulate physiological ventilation mechanics ex vivo. The NPV allows testing of the NTBT in an environment that resembles in vivo conditions prior to its use in animals and humans. A crucial part of the NPV is the flowmeter, which calculates total lung volume by integrating the flow signal over time. To ensure the accuracy of the RMD designed flow meter, we validated it against an industry gold standard using regression analysis.

Study objective: To validate the RMD Engineering variable orifice flow meter against the Zephyr HAF series flow meter from Honeywell, which is an industry gold standard.

Results: Seventeen trials were performed, each consisting of a calibration phase and a validation phase. The calibration phase outlined the relationship between the RMD flow meter's detected pressure and calculated flow and had an R2 value of 0.98. The validation phase outlined the relationship between the RMD and Zephyr flow meter generated flow curves and had an R2 value of 0.91.

Conclusion: Since the R2 values for the calibration and validation phases were above 0.9, we conclude that the RMD flow meter can accurately measure flow.

29



#### Kirk Haan (Dr. Thomas Fisher)

Colocalization of Syt-11 and ΔN-TRPV1 in Rat Supraoptic Neurons

Humans and other mammals maintain the salt concentration in their body fluids within very narrow limits by regulating the intake and output of water and salt. Deviating from these narrow limits of salt concentration (i.e., osmolality) can lead to damage to the kidneys, brain, and other organs. We regulate our body fluids through two main mechanisms: the behavioural sensation for thirst, and the regulation of urine output, which is largely regulated by a hormone called vasopressin (VP). VP is released from specialized nerve cells in the hypothalamus called MNCs, where it then travels to the kidneys to promote water reabsorption and prevent further increases in osmolality from occurring until fluids can be ingested. This process is known as osmoregulation. MNCs possess unique volume regulation mechanisms to change the amount of VP released based on how much the osmolality is changed. Recent findings from our lab suggest that a key protein in MNCs called DN-TRPV1 moves from inside the cell to the cell membrane (i.e., translocation) during sustained increases in osmolality. We now show that the exocytic protein synaptotagmin-11 (syt-11) is colocalized with DN-TRPV1 and translocates to the membrane during sustained increases in osmolality.



#### Biochemistry, Microbiology & Immunology



#### Kayla Abrametz (Drs. George Katselis and Jay Shavadia)

Application of Serum Proteomics to Investigate Clinical Outcomes Following ST-Elevated Myocardial Infarction

ST-Elevated Myocardial Infarction (STEMI) occurs due to the complete occlusion of a coronary artery and despite improvements in treatments, it remains a major cause of mortality worldwide. Classical risk models that only rely on clinical variables are insufficient to predict the risk of adverse post-STEMI outcomes. Therefore, the prediction of cardiogenic shock and heart failure following STEMI is an unmet clinical need. Advances in proteomics can allow us to identify biomarkers to predict the occurrences of post-STEMI outcomes. We need to consider multiple methods, including multi-biomarker strategies, to stratify the risk of post-STEMI outcomes.

In this study, we sought to determine if there are any significant differences in protein expression between diabetic (DB) and non-diabetic (NDB) STEMI patients, since there is evidence that an association exists between type II diabetes and STEMI. We used mass spectrometry (MS)-based proteomics to profile and compare the serum proteome of both DB and NDB STEMI patients. We were able to identify proteins that were significantly upregulated and downregulated in diabetic STEMI patients compared to non-diabetic STEMI patients (control). Of these differentially expressed proteins, twenty-four are related to the association of diabetes, inflammation, and myocardial infarction and have been chosen for validation using targeted proteomics.





#### Hannah Braun (Dr. Jenny-Lee Thomassin)

Identification of Exoproteins Secreted by the Klebsiella pneumoniae Type II Secretion System

Klebsiella pneumoniae causes hospital-acquired infections and is increasingly difficult to treat due to emerging multi-drug resistance. This bacterium uses a nanomachine called a type II secretion system to secrete proteins out of the cell. These secreted proteins, called exoproteins, are usually involved in host colonization and nutrient acquisition. Type II secretion systems in most bacteria recognize 7-25 exoproteins. To date, the only identified K. pneumoniae exoprotein identified is an enzyme called pullulanase. We hypothesize that like other bacteria, K. pneumoniae secretes more than one exoprotein. Mass spectrometry was previously used to identify putative K. pneumoniae exoproteins. My project was to validate the mass spectrometry findings by cloning a select subset of exoprotein genes into low copy vectors and assess secretion by in vitro assay and visualizing exoproteins on Coomassie blue gels. Putative exoproteins were not readily visualized by Coomassie blue stain, therefore, a FLAG tag was fused to the C-terminus. Future work will focus on assessing secretion and detecting putative exoproteins by western blot. This study will be the first to identify additional proteins secreted by the K. pneumoniae type II secretion system. The identification of additional exoproteins may provide novel therapeutic targets to treat multi-drug resistant K. pneumoniae infections.







#### Monisha Chakder (Dr. Yuliang Wu)

Exploring the role of DDX41 in RNA virus infection

DEAD-box helicase 41 (DDX41) is a member of superfamily 2 RNA helicase. Dr. Wu's lab and others have shown that DDX41 acts as a DNA sensor that regulates the cGAS-STINGinterferon pathway in the response of DNA virus infections. However, the role of DDX41 in RNA virus infection remains unknown. Using HeLa wildtype (WT) and DDX41 CRISPR knockout (KO) cells infected with Zika virus (strain MR766) that contains positive-sense RNA genome, we examined several key molecules at mRNA level by qPCR and protein level by Western blot after viral infection. 24 hours post infection with Zika virus (Multiplicity of infection [MOI]=1), qPCR analysis showed that there was no significant difference in the expression level of IFN-stimulated gene 56 (ISG56) between WT and DDX41 KO cells; however, the expression level of Interferon Beta 1 (IFNβ1) gene was significantly higher in DDX41 KO than WT cell (p <0.05). 24 hours post infection with lower MOI (MOI=0.1), qPCR analysis showed that there was no significant difference in the expression level of both IFNB1 and ISG56 genes between WT and DDX41 KO cells (p>0.05). From Western Blot analysis we found that the expression of phosphorylated-TBK was lower but phosphorylated-IRF3 was higher in DDX41 KO cells compared to WT cells at 24 and 48 hpi. In conclusion, our qPCR and Western Blot analysis yielded inconclusive results regarding the involvement of DDX41 as an RNA sensor. We believe that it is very dynamic for the host innate immune responses to viral infections, and, in the future, we will use more time points (4, 8, 12, 24, and 48 hpi), under multiple doses of Zika virus infection (e.g. MOI=0.1, 1, 5), and determine the key molecules' expression.





#### Amber Debnam (Dr. Jo-Anne Dillon)

The Effects of Mutating Conserved Residues in the N-Terminus Linker Region of Ftsl in Neisseria gonorrhoeae

Neisseria gonorrhoeae's cell division proteins, FtsW and FtsI, were analyzed for their ability to interact with one another and bind penicillin, respectively. FtsINg was mutated at three conserved amino acid residues, R75, R167, and E193, in the linker region of the N-terminus to determine if these mutations affect penicillin binding and FtsINg ability to interact with FtsWNg. Penicillin binding assays tested if these FtsINg mutations affect penicillin binding. GST-pulldowns and Co-immunoprecipitation methodologies were developed to test the interaction between FtsWNg and FtsINg mutants. The penicillin binding assays indicated that R75 with an alanine or glycine mutation was shown to be statistically different when compared to wildtype FtsINg with penicillin binding percentages of 119% and 123%, respectively. The GST-pulldown methodology exhibited pGEX-5X-1-FtsWNg, pGEX-6P3-FtsWNg, and pGEX-2T-FtsWNg constructs, and work is on going. The Coimmunoprecipitation methodology indicated a putative interaction between His tagged FtsWNg and FtsINg. Increased penicillin binding was discovered, and kinetics would be beneficial to quantify the rate of penicillin binding between the wildtype FtsINg and mutants. Mutated FtsINg and FtsWNg putative interaction could be tested further to determine if disruptions in cell division proteins contribute to penicillin binding in Neisseria gonorrhoeae.







#### Rebecca Iyoha (Dr. Erick McNair)

Assessment of Proteome Changes in the Development of Acute Kidney Injury following Cardiopulmonary Bypass-supported Cardiac Surgery

#### Background

Acute Kidney Injury (AKI) affects up to 40% of patients undergoing cardiopulmonary bypass (CPB)–supported cardiac surgery. CPB provides support by circulating blood throughout the body while the heart is stopped. During this period damage to the kidneys may occur. Currently, serum creatinine is the biomarker to diagnose AKI. The problem with creatinine is its slow rise in circulation, its low sensitivity, and specificity.

#### Hypothesis

We hypothesized that characterization of the proteome of urine samples collected at specific time intervals from patients undergoing CPB surgery will reveal early biomarkers for AKI and pathophysiological pathways that develop in the kidneys during the surgery.

#### Objectives

- Determine protein profiles in AKI and non-AKI patients.
- Compare urine proteins in the two groups.
- Explore protein pathways in patients who develop AKI.

#### Methods

We performed mass spectrometry-based proteomics analysis on urine samples collected from 10 non-AKI and 12 AKI patients at pre-CPB, 10 minutes post-CPB, and 4 hours post-CPB intervals.

#### Results/Conclusion

Data revealed significant differential expression of specific proteins that may be early biomarkers for AKI. We also discovered 8 proteins that provided insight into the possible pathophysiological pathways that lead to AKI, ranging from protein up- or down-regulation, inflammation, oxidative stress, and cellular injury.




#### **Tanvir Minhas (Dr. Linda Chelico)**

The On-Going Conflict Between APOBEC3 Immune Factors and HIV-1 Vif

Given Saskatchewan's alarmingly high HIV case rates, ones well above the national average, it is evident that ongoing research is required to inform approaches to treatment. Our focus on the APOBEC3 (A3) protein family is therefore relevant; such cytosine deaminases impact HIV's proviral DNA to ultimately restrict intercellular HIV transmission. The inhibitory effect of A3s is thwarted by their viral antagonist, Vif, however. Our work aimed to test if coexpression of A3G and A3F, two types of A3 proteins in humans, confers higher resistance to Vif-mediated degradation in A3Fs. While this phenomenon was previously proven using lab adapted isolates, our focus was on transmitted founder virus strains to inform clinical significance. Plasmids containing Vif gene inserts from clinical isolates were produced using standard cloning methods. Eight of the eleven clinical isolates of interest were successfully cloned. 293T cells were transfected with Vif- and APOBEC3-containing plasmids. Immunoblotting of cell lysates informed protein abundance. Results from clinical isolate TF40 displayed a four-fold increase in protein abundance of A3F in the presence of 50ng of Vif when expressing A3F with A3G as opposed to A3F alone. Studies thus confirmed the protective effect of co-expression of A3F and A3G in a clinical setting.





#### Nathan Seidel (Dr. Kerry Lavender)

Effect of IFNa Subtypes on NK Cell Responses to Target Cells

Interferons are a family of endogenously produced immunomodulatory proteins. Interferon alpha (IFNa) has been identified as having potent anti-HIV effects, specifically by stimulating Natural Killer cells (NK). NK cells are members of the innate immune system that specialize in recognition and killing of dysfunctional and virus infected cells. IFNa2 has been trialed as a HIV treatment however, our previous data has indicated that the IFNa14 stimulates more potent NK cell mediated cytotoxicity toward MHC I deficient target cells. To understand how IFNa14 stimulates increased target cell killing, flow cytometry was employed to observe markers of cytotoxic activity, Including CD107a a marker of degranulation and Granzyme B, a potent cytolytic mediator. NK cells were isolated from PBMCs using magnetic separation, then treated overnight with either IFNa2 or IFNa14. Treated cells were co-incubated with target cells for 5 hours prior to flow cytometric analysis. Data from two female and two male donors exhibited consistent expression of GrzB over background but no difference between IFNa2 and IFNa14 treatment was observed. Expression of CD107a was at background apart from one donor. This suggests that greater IFNa14 killing may not be linked to cytolytic granule release but other mechanisms such as direct receptor mediated killing.







#### Kyle Luo (Dr. Jenny-Lee Thomassin)

Identification of Novel Type II Secretion System Exoproteins from Klebsiella pneumoniae

Klebsiella pneumoniae is a Gram-negative bacterium that causes many hospital-acquired infections. K. pneumoniae strains encode a conserved type II secretion system (T2SS). T2SSs are used to secrete folded proteins (exoproteins) from the bacterial intermembrane space (periplasm) outside the cell. While most bacteria use T2SSs to transport 7-25 exoproteins, K. pneumoniae is only known to secrete 1 exoprotein called pullulanase. We hypothesize that K. pneumoniae uses its T2SS to secrete more than one exoprotein. Quantitative mass spectrometry analysis comparing proteins secreted by K. pneumoniae identified over 80 putative exoproteins. The purpose of this study was to validate the mass spectrometry results by cloning select putative exoprotein encoding genes were cloned, and secretion by western blot. Five putative exoprotein encoding genes and the stability of FLAG tagged proteins was verified by western blot. In addition, we determined that cellular accumulation of one of the novel secreted exoproteins was toxic in the presence of copper. In conclusion, we present evidence that the K. pneumoniae T2SS secretes more than 1 exoprotein. Future work will focus on identifying additional exoproteins and characterizing their function.







#### Amar Vir Singh Minhas (Dr. Anil Kumar)

Interaction of Eastern Equine Encephalitis Virus Capsid Protein with the Nucleopore Complex of the Host Cells

Eastern equine encephalitis virus (EEEV) is a new world alphavirus endemic to eastern Canada and the United States. Immunoprecipitation mass spectrometry analysis of EEEV capsid protein done previously had identified its interaction with nucleopore complex (NPC) proteins. The objective of this study was to validate the interaction of EEEV capsid with NUP214, a component of the NPC, and if an interaction was observed, determine the effect EEEV presence has on nuclear import/export. EEEV capsid localize to the nuclear envelope along with NUP88, NUP93, NUP153, and NUP188. These findings revealed a novel EEEV host-cell interaction, indicating a possible functional interaction between the EEEV capsid and host NPC. Immunofluorescence microscopy revealed that EEEV capsid presence inhibited nuclear import. Further research is needed to examine the biological relevance to EEEV virus life cycle.







#### Noah Willfong (Dr. George Katselis)

Characterization of Biological Mechanisms of Insecticide Resistance

Rhodnius prolixus, an insect of the Triatominae family, is a major vector of Trypanosoma cruzi, which causes Chagas disease. Increased insecticide resistance poses a threat to effective control of Chagas disease that affects roughly 7 million people and kills 50,000 annually, according to the World Health Organization. Greater knowledge of the molecular basis of Triatominae resistance to pyrethroid insecticides may contribute to the development of improved insect control alternatives. In this study, we investigated which proteins are differentially expressed (up-regulated or down-regulated) in R. prolixus exposed to the pyrethroid deltamethrin compared to non-exposed insects. Mass spectrometry (MS)-based proteomics was used to determine presence of specific proteins and their MS spectra intensity levels in insect samples. Results revealed a number of differentially expressed proteins in samples that received doses of deltamethrin compared to controls without deltamethrin exposure. These proteins may play a role related to the insecticide resistance mechanism. Differentially expressed proteins included: two ATP-binding cassette proteins; ten cytochrome-related proteins; three multidrug resistance-associated proteins; six putative cuticle proteins. These proteins are chosen for future validation studies using targeted proteomics and physiology assays, although there are many more identified from this study that should be investigated for their relationship to insecticide resistance.



## Mutjaba Ibrahim (Drs. Ahmed Mostafa, Fang Wu, and Pouneh Dokouhaki)

Cytokine Assay at Presentation Could Help Triage Patients with COVID-19

COVID-19 management is practically limited by its lack of adequate triaging tools. This leaves room for uninformed decision-making from clinicians, on which patients end up having a worse disease outcome, and therefore require more healthcare resources. This project aimed to answer the question of how practical cytokine measurement would be in assessing risk of severe disease outcome in the province of Saskatchewan. This would be inferred based on the discovery of a correlation between the cytokine profile on hospital admission, and the outcome of a COVID-19 infection for a Saskatchewan group of patients. Using a bead based Luminex xMAP multiplex technology, cytokines were measured of a group of 60 consecutive COVID-19 patients on admission, and results were analyzed for any link to severe disease metrics. The results of an ANOVA analysis of the data demonstrated a notable correlation between IL-6 serum concentrations, and more severe COVID-19 outcomes. This research demonstrates that in a Saskatchewan population, IL-6 can be an early indicator for how a patient's COVID-19 will progress.







#### Emmy Ogunjimi (Dr. Camille Hamula)

Trends in Provincial Blood Culture Utilization and the Effects of COVID-19

Blood cultures are the most critical specimen in a clinical microbiology laboratory. Every hour of delay in empiric antibiotic therapy results in a 6-7% increase in mortality for patients with sepsis. There are standard blood culture collection and utilization guidelines published by the Clinical Laboratory Standards Institute (CLSI)[CH1], however suboptimal blood culture collection persists in many institutions. The aim of this study is to assess blood culture utilization in the province of Saskatchewan including turnaround times, contamination rates, and whether standard collection guidelines are being followed in all laboratory locations (referred to as A,B,C,D,E,F,G,H, I). Our analysis covers three years (2019-2021); during which the COVID-19 pandemic started. We identified the diagnostic yield of blood cultures regionally and determined the five most common pathogens causing bacteremia: Escherichia coli, Staphylococcus aureus, Klebsiella pneumonia, Staphylococcus epidermidis and Streptococcus pyogenes. Our last goal is to determine whether ICU COVID-19 patients with concomitant pneumonia had a higher number of blood sets collected in a 24-hour period







# Anya Sigurdson (Dr. Brian Le)

Povidone Iodine Rectal Swab Prior to Ultrasound Guided Prostate Biopsy

Background: Infection following transrectal ultrasound (TRUS) guided prostate biopsy is increasing in the current literature and can be a serious complication. This study examined the rate of infection within two weeks of biopsy in Regina, the percentage of infections caused by fluoroquinolone resistance bacteria, and if use of povidone iodine just prior to biopsy affects rate of infection.

Methods: A retrospective cohort study was conducted where we utilized a retrospective chart review of all patients who underwent a TRUS guided prostate in Regina from August 2020 to June 2022.

Results: A total of 1213 patient's charts were reviewed, and the mean age of the patients was 66.5±8.1 years. The overall infection rate following TRUS guided prostate biopsy was 5.2%. One practitioner in Regina currently administers povidone iodine just prior to biopsy. The infection rate for this provider was 1.8%. In patients with infection, 71.9% of cultured bacteria was resistant to ciprofloxacin on sensitivity testing.

Conclusion: The risk of infection following TRUS guided prostate biopsy is not uncommon in Regina. Povidone iodine administration just prior to biopsy may be a simple method to reduce infection rates. Additional research is needed to assess infection rates following other practitioners implementing this method.





#### Mahdi Toliatzavareh (Dr. Yuliang Wu)

Identifying Protein-Protein Interactions of DDX41 by BioID

Helicases are known as enzymes that unwind double-stranded nucleic acids by hydrolysis. DEAD-box helicases are characterized by having an Asp-Glu-Ala-Asp sequence in their motif II hence their name, which is a required motif for ATP binding and hydrolysis.

DDX41 is categorized under DEAD-box helicases with a multitude of functions such as being an intracellular DNA sensor in myeloid dendritic cells1 as well as responding to bacterial secondary messengers (c-di-GMP or c-di-AMP) to trigger a type 1 interferon immune response2. Not long ago, Dr. Yuliang Wu's lab discovered the utilization of cyclic GMP–AMP synthase for the assembly of dsDNA from ssDNA by DDX41 as well as the unwinding ability of this helicase enzyme for cGAS inactivation3. Mutations in DDX41 are linked with myelodysplastic syndrome (MDS) and acute myeloid leukemia (AML).6 The most recurring mutations in DDX41that lead to AML or MDS are c.1574G>A and R525H. There is limited research done on the protein interaction of DDX41, thus the focus of this poster will be on the proximate protein interaction of DDX41.







#### Agnes Truc Nguyen (Dr. Janet Hill)

Development of a Method for Accurate Quantification of Microbial Genomes in Microbiome Samples

Rationale: Microbiome characterization usually focuses on proportional abundance but neglects total population size. A popular method for population quantification, 16S rRNA quantitative real-time PCR (qPCR), may not be optimal because of the 16S rRNA gene varying in copy number and the use of single species standard curve. We hypothesized that qPCR with a single copy gene, cpn60, and a "custom" standard curve representing main species in the microbiome of interest would be more accurate.

Methods: We created synthetic communities of cloned cpn60 barcodes with different GC levels. Quantification of these communities by single species and the "custom" standard curve were compared to known concentrations.

Results: GC contents of template DNA affected the efficiency and detection limit of cpn60 qPCR, with high GC templates having lower efficiency and analytic sensitivity. Quantification by the "custom" standard curve was the most accurate method, while high GC single species standard overestimated and low to medium standards slightly underestimated community size.

Conclusion: With findings supporting our hypothesis, current work focuses on application to genomic DNA synthetic mixtures and microbiomes to further validate the protocol.

# Community & Indigenous Health



# Tongchen Feng (Dr. Niels Koehncke)

Blood Lead Levels in Workers Exposed to Surface Lead on Radiology Shielding

A previous study found high surface lead on the inside of lead gloves worn by veterinary workers during radiography, raising concern for contamination of hands and risk of ingestion.

The objectives of this study were to measure surface lead on workers' hands before and after use of lead gloves, to compare hand surface lead between workers who did and did not wear disposable gloves under lead gloves, and to compare blood lead between workers using lead shielding and a control population.

Workers' hands were sampled using lead wipes before and after use of lead gloves in 51 instances. Blood lead was measured for 28 workers who handled lead shielding in the preceding 3 months, and 25 controls.

Overall, median hand surface lead was  $2.71\mu g$  prior to lead glove use, and  $13.77\mu g$  after lead glove use. Surface lead was > 500 $\mu g$  in 35% of workers and > 1000 $\mu g$  in 22% of workers. The median surface lead after lead glove use was  $5.47\mu g$  in workers who wore disposable gloves under the lead gloves, and 869.65 $\mu g$  in workers who did not.

Veterinary workers using lead radiology gloves should wear disposable gloves and clean hands with a wipe designed to remove surface lead.





#### Raina Kim (Dr. Nazeem Muhajarine)

How did children of equity-seeking families fare during the COVID19 pandemic compared to children from mainstream families?

COVID-19 pandemic has negatively impacted children, youth and their families in Saskatchewan in various ways, especially their mental health. This SUHU 1.0 study examines how children of equity-seeking families have managed and coped during the pandemic compared to children from mainstream families. It focuses on COVID-19 effects on mental health of the young population in Saskatchewan, and their coping strategies, as well as their need to access mental health services. Quantitative and qualitative data were collected from parent-child dyads to determine mental health outcomes of the pandemic, including anxiety, depression, overall life changes and mental health changes. We found that children's experience in the first year of the pandemic were shaped by their family background (immigrant parent(s) were more likely to agree about change in mental health and their need for mental health help since the COVID-19 pandemic compared to children from nonimmigrant families. The findings of this SUHU study further builds on our knowledge on the effects of COVID-19 on the mental health of children in Saskatchewan.





## Alyx Orieux (Dr. Rachel Engler-Stringer)

Unintended Learning Lessons from a Universal, Curriculum-Integrated School Food Program

Nutrition is essential for children's health, wellbeing, and learning. School-age children spend more time in school than in any other environment but tend to eat nutritionally poor foods while at school. Canada is one of the only Organization for Cooperation and Development (OECD) countries without a nationally funded school food program. The Good Food for Learning Project is a CIHR-funded population health intervention study of a universal, curriculum-integrated school lunch program in two intervention schools. The two-year pilot project aims to examine the implementation and impacts of a universal school food program and model a national program. Through participatory observation and semi-structured interviews, unintended learning lessons from the first year of implementation were gathered to inform changes for the next year of the intervention. Results describe key themes including learning through peers, school-wide assemblies, increased school attendance, environmental sustainability, and workload. Recommendations for year two were developed from the themes and further data will be collected throughout the final study year to assess intended and unintended intervention outcomes and answer the four research questions.



#### Evan Parchomchuk (Dr. Gregory Hansen)

How Canadian Pediatric Intensive Care Units Adapted for Critically III Adults during the COVID-19 Pandemic

Background: The COVID-19 pandemic overwhelmed Canadian hospitals with adult admissions. A large number required critical care therapies, putting significant strain on hospital resources. In order to decompress adult Intensive Care Units (ICUs), Pediatric ICUs (PICUs) introduced adapted models of traditional care to lessen these burdens.

Methods: A survey containing 40 questions was sent to the 14 PICU medical directors in Canada. The survey was designed to gain perspective on the various adaptations PICUs instituted during the COVID-19 pandemic.

Results: From 13 respondents (93%), ten PICUs (77%) participated in at least one or more adaptations to support the influx of COVID-19 adult admissions. Central challenges included disorganization, loss of autonomy and compromised patient care. Significant advantages from these adaptations were a sense of learning and comradery.

Conclusions: Our findings highlight an unpreparedness for critical care surge capacity. During COVID-19, adaptations rapidly emerged in Canada that involved PICUs with adult care. In the future, preplanned adaptations to optimize robust critical care services should be developed from what has been learned through COVID-19.



#### McKenzie Van Eaton (Dr. Rachel Asiniwasis)

Indigenous Pediatric Atopic Dermatitis in Western Canada: A Retrospective Chart Review

Cross-sectional and population-based Canadian studies demonstrate that atopic dermatitis (AD or 'eczema') and the atopic triad (asthma and allergies) are consistently documented as the most common chronic health condition seen in Indigenous children (4,5,6). However, Indigenous skin disease in North America remains under-researched and poorly understood. A retrospective chart review was performed on Indigenous (status First Nations or Metis self identified) pediatric AD patients (N= 103) seen between 2018-2022 in rural reserve land outreach clinics, and as urban outpatients in southern Saskatchewan. Demographics, personal or family history of atopy (asthma or allergies), clinical severity, history of AD complications and bacterial skin infections (BSI), comorbid skin diseases, and disease burden were extracted from patient charts. Of the initial 63 patients, 47.6% were children (age 1-11), 81% were assessed on reserve land, 25% had a personal history of atopy, and 27% reported a family history of atopy. 66% of patients had moderate to severe AD on initial clinical assessment, and 71.4% had a past history of documented BSI. Of those having BSI, 24.4% presented to hospital due to BSI complications, 63.4% experienced multiple infections, and 31.1% were documented MRSA cases. Given these results, it is apparent that AD exists in Indigenous populations with high disease severity and burden, suggesting the need to develop and advocate for strategies to address the burdens of AD that are deeply ingrained in health disparities faced by Indigenous peoples in Canada.



#### Mikaela Vancoughnett (Dr. Gary Groot)

Exploring cultural healing and mental wellness in a northern Saskatchewan First Nations community: A photovoice project

Significant health disparities exist between Indigenous and non-Indigenous populations in Canada as a result of colonization which aimed to disconnect Indigenous peoples from their land, language, and connection to community. Despite the negative effects of colonization, we are beginning to recognize the important role that reconnecting to culture has in enhancing mental wellness of Indigenous individuals and communities. This project explores the role that culture has in promoting mental wellness for First Nations individuals from the Lac La Ronge Indian Band (LLRIB). In collaboration with a Community Advisory Committee, five participants from the LLRIB (two males, three females) were recruited to partake in a twopart Photovoice project. Participants captured photographs that represented their connection to culture, then participated in a one-on-one discussion where storytelling was used to share the meaning behind each photograph. These discussions were audio-recorded, transcribed verbatim, and analyzed using a narrative analysis. From this analysis, narratives were organized into 5 categories: hope, belonging, meaning, purpose, and other. Through these narratives, it was evident that Indigenous peoples are incredibly resilient and have their own cultural knowledge and means of achieving wellness. We hope to disseminate what we have learned from this project with each of the LLRIB communities.



#### Zakhar Kanyuka (Drs. Paul Babyn and Ivar Mendez)

Production of a training video for patient site assistants for telerobotic ultrasound

Ultrasound is an especially attractive imaging modality for expanding diagnostic imaging services in remote, isolated, and low-resource settings. Telerobotic ultrasound empowers a sonographer to scan patients hundreds of kilometers away with the help of a remotely controlled robotic arm, video conferencing system and a patient site assistant. The goal of this project is to design a brief training session for site assistants describing key procedures, maneuvers, and anatomy involved in the telerobotic scan to enhance effectiveness, efficiency, and capability of remote scanning.

While several training protocols have been described in the literature for telementored ultrasound, no such training has been offered for patient site assistants in telerobotic ultrasound. We reviewed and identified key elements of two training curricula targeted for those who assist with telementored ultrasound. Learning from these practices as well as feedback to an initial script from a variety of individuals, we developed a fourteen minute video designed to introduce patient site assistants to telerobotic ultrasound. This video provides a technical overview and includes information about relevant anatomy and scanning techniques.

Next steps will include evaluation of the video by a focus group including three remote sites in Saskatchewan, Canada where telerobotic ultrasound has been established.





#### Jovana Miladinovic (Dr. Nazeem Muhajarine)

COVID-19: Mental health experiences of rural and urban children and youth in Saskatchewan in the first year of the pandemic

In 2020, many children experienced worsening mental health as measures implemented to curb the spread of COVID-19 - like school closures - restructured their daily lives and routines. Using a mixed methods approach, this project aimed to answer the question: in the first year of the COVID-19 pandemic, how did children from rural communities in Saskatchewan fare compared to children living in mid-size towns and urban centres? Along with one of their caregivers, 510 children and youth aged 8-18 completed an online crosssectional survey about COVID-19 and their mental health and wellbeing. 31 dyads from the quantitative study also completed a semi-structured interview about their pandemic experiences. Associations between place of residence and mental health-related outcomes of interest were examined using Pearson's chi square tests. Logistic regression models were fitted to determine factors associated with the outcomes. The qualitative interviews were analyzed using thematic analysis. There were significant associations between place of residence and: emotional dysregulation, quality of life, life changes, and mental health. Interviews with individuals from rural communities revealed unique experiences; for example, while rural youth experienced challenges accessing formal mental health services, they also reaped mental health benefits from living an active lifestyle year-round.







# Flinn Herriot (Dr. Donna Goodridge)

"You have to fight": A Qualitative Study of the Adaptations in Patients with Persistent Post-COVID Symptoms

Background: One of the most underappreciated and under-studied aspects of the COVID-19 pandemic has been the long-term disability and symptomatic burden experienced by nearly one in five COVID-19 survivors aged 18-64, and one in four aged 65 or older. This project sought to describe the process of adaptation experienced by individuals with persistent post-COVID symptoms.

Methods: Focus groups were conducted using a semi-structured interview format. Audio was recorded and transcribed, then coded using NVIVO software and thematic analysis informed by interpretive description. There were 41 participants (28f) of mean-age of 47.9 years (SD = 104, 29-83) with a mean time-elapsed since initial infection of 15.8 months (SD = 6.4, 3-27).

Results: The following four themes were identified: a) the unique burdens of persistent COVID; b) the complex nature of patient work; c) erosion of trust in healthcare; and d) the process of adaptation.

Interpretation: This poster focused on the process of adaptation, whereby participants found themselves evolving new strategies for managing their chronic conditions, and adapted to changing identities. Often, participants felt abandoned and exhausted from the need for self-advocacy. Long COVID patients need increased supports in managing the emotional, physical, and psychological effects of their illness experience.



#### Thomas Lowe (Dr. Donna Goodridge)

"I hope this isn't the rest of my life": A Qualitative Study of The Unique Burden of Patients Living with Long COVID

Introduction: approximately one in four people will experience persisting symptoms beyond their initial COVID infection (long COVID), with more than 60 identified physical and mental symptoms. This has a significant impact on patient quality of life, healthcare utilization, and ability to work. Therefore, this qualitative study aimed to describe the experience and care needs of patients living with long COVID.

Methods: 41 participants (13M + 28F) were recruited from a previous COVID study to participate in semi-structured virtual focus groups and share their experience living with long COVID symptoms. Transcripts were entered into NVivo software and analyzed using Braun and Clarke's thematic analysis method and an interpretive descriptive approach.

Results: four central themes were identified: 1) the unique burden of living with long COVID symptoms; 2) the complex nature of recovering from long COVID symptoms; 3) erosion of trust in the healthcare system; and 4) the process of adaptation.

Conclusion: the multi-dimensional burden of living with long COVID involves significant physical, emotional, cognitive, social, and functional impact. A multidisciplinary approach to care that integrates physical and occupational therapy, mental health care, and social work alongside primary care is key to address the unique needs of patients living with long COVID.



#### Manojkumar Balakrishnan (Dr. Jonathan Gryspan)

Arterial Spin Labelling in the Setting of Acute Stroke: Development of a Clinical Imaging Protocol

Stroke management requires rapid and accurate neuroimaging like CT angiography and diffusion-weighted MRI. However, significant percentage of patients still have negative imaging findings(1). Arterial Spin Labelling (ASL), a non-contrast-based perfusion MRI, has shown potential to improve stroke diagnosis compared to conventional imaging(2,3). To determine the utility of ASL in stroke, an optimized ASL imaging protocol for the clinical setting has been developed for Regina, SK. The protocol was determined via imaginsg experiments conducted through volunteer MRI scans (n=3). A 130mm ASL label thickness was selected over a larger 300mm label as it resulted in similar signal-to-noise while minimizing imaging errors. An 8mm slice thickness was selected as it provided adequate spatial resolution while maintaining high temporal resolution for arterial transit time maps (ASL specific map useful in stroke diagnosis). A Stealth T1 sequence was selected for structural imaging as it enabled high quality partial volume estimates and image registration while reducing scan times by 161s compared to conventional 3DT1. Finally, an automated image processing code capable of advanced image analysis otherwise unavailable at a clinical scanner was also developed. The optimized protocol and advanced code will be evaluated in a clinical study to determine whether ASL can improve stroke diagnosis.







# Revathi Nair (Dr. Taofiq Olusegun Oyedokun)

Optimizing ED Ultrasound Visits: A Quality Improvement Initiative

Introduction: After hours Ultrasound (US) imaging in the ED presents a challenge that places considerable strain on the patient and the already scant resources in the ED. Implementation of an alternate clinical pathway that utilizes the US clinics in the community for non-emergent scans may help alleviate some of these stressors.

Methods: After doing a Root Cause Analysis using a fishbone, a multidisciplinary team designed an alternate clinical pathway, implemented ED, using community radiology clinics to perform Next-Day US (NDUS). Retrospective chart reviews then assessed the differences in usage of the NDUS in the ED pre- (2019-21) and post-implementation (2022) of the new clinical pathway.

Results: There was a 54% decrease in the percentage of ED patients returning to the ED the next day for an US. The patients referred to community clinics were able to get their scans done in time.

Conclusions: The clinical pathway was able to reach the SMART goal of reducing the number of patients returning to the ED for an US scan by 50% within 6 months. Continued streamlining of this pathway could help drive a further decrease in ED traffic and overall wait times in the future.





## Sam Savard (Dr. Phil Davis)

Urban vs Rural Trauma Outcomes – A Saskatchewan Perspective

Background: Approximately 60% of the Saskatchewan population lives more than one hour from a tertiary care centre. Unfortunately, trauma still happens in remote areas, and the literature suggests this can cause disparate outcomes. To our knowledge, trauma outcomes of rural patients in Saskatchewan have never been evaluated.

Methods: We identified a historical cohort of all Level 1 trauma activations presenting to Royal University Hospital (RUH) from April 2020 - 2022. All charts were reviewed, and variables of interest extracted. The cohort was divided into two groups (Urban and Rural) based on the the trauma location. Descriptive and univariate analysis was performed for factors associated with our outcomes of interest.

Results and Discussion: Our data demonstrates that rural trauma patients were younger (34.1 vs. 37 years: p=0.002), more likely to be male (80.3 vs.74.4%; p=0.040) with higher injury severity scores (12.3 vs. 8.3: p<0.0001). Urban trauma patients were more likely to sustain penetrating trauma (42.5 vs. 28.5%; p<0.0001). There were no differences in morbidity and mortality between the two groups, however rural trauma patients had longer lengths of stay (7.0 vs. 8.0 days; p<0.0001). We hope our Saskatchewan specific data can be used to inform resource allocation decisions to better serve our unique patient population.



#### David Kim (Drs. George Katselis and Jay Shavadia)

Clinical Characteristics and Outcomes of Young compared with Older Patients with STsegment Elevation Myocardial Infarction in Northern Saskatchewan

Background: Young compared to older patients presenting with ST-segment elevation myocardial infarction (STEMI) have different risk profiles. In Northern Saskatchewan wherein exist high rates of both traditional and non-traditional cardiovascular risk factors, compounded by geographical challenges of delivering reperfusion, how outcomes of STEMI compare between the young and older patients is unknown.

Methods: Between March 15/2019 and May 31/2022, we prospectively evaluate consecutive STEMI admissions at the Royal University Hospital. Categorized by young (£45years) and older (>46years), we describe presenting demographics and one-year outcomes. Categorical and continuous variables are represented respectively as frequencies and median (25th, 75th percentile) and compared using the chi-square and Mann Whitney U test.

Results: Of the 1127 patients, 6.47% patients were £45 years. Younger patients were more likely to have a higher body mass index, current smoking, illicit drug use and a trend towards lower proportions with diabetes; otherwise, baseline risk including presentation in cardiogenic shock/arrest, infarct territory, reperfusion and one-year outcomes were comparable (Table 1).

Conclusion: Nearly 1 in every 20 STEMI admissions in Northern Saskatchewan is £45years old, and associates with a 2-8-fold higher premorbid use of cigarettes, cocaine or intravenous drugs. While the outcomes of young are comparable to older STEMI patients, our findings identify an important primary prevention opportunity for young patients in Northern Saskatchewan.

# **Family Medicine**



#### Morgan Schatz (Dr. Cathy MacLean)

Access to Family Practice in Saskatoon

Introduction: Accessible care is a pillar of the Patient's Medical Home (PMH) vision created by the College of Family Physicians. Access to family practice services in urban centers such as Saskatoon is not well understood. However, a basic understanding is necessary for accurate resource management and necessary recruiting.

Methods: To assess current access to family practice we conducted a phone-based practice survey where we interviewed 27 clinic managers or receptionists about Saskatoon FP's practices (n = 167), and a provider fax survey that was completed individually by Saskatoon FP's (n = 34).

Results: New patients were reported as unconditionally accepted by 2.9-3.6% FP's. Mean waittimes were 1.02 days for an urgent appointment and 16.20 days for the third next available appointment. Of provider respondents, 94% reported spending more than 20 hours in community based primary care. Plans to leave family practice or retire were reported by 47.06% of respondents on the provider survey.

Conclusion: Access to family practice is an issue with long wait-times for appointments and few providers accepting new patients. There is a timely need for more accurate resource planning as 47.06% of FP's reported they have plans to leave.







#### Rachel Silverberg (Dr. Donna Goodridge)

*"It's Like an Endless Cycle": A Qualitative Study of the Lived Experience of People Experiencing Persistent Post-COVID Symptoms* 

Background: 20-30% of COVID-19 survivors have a new condition attributable to SARS-CoV-19. Clinical management strategies and government policies must meet the needs of the increasing number of persons living with Long COVID. The goal of this theme was to describe the patient work involved in recovery from post-COVID symptoms.

Methods: We conducted in-depth, semi-structured virtual focus groups. Data were entered into NVivo software and analyzed using thematic analysis. We met with participants twice for respondent validation.

Results: This study had 41 participants (28f) with a mean age of 47.9 years (SD=104, 29-83) and a mean time elapsed since their acute infection of 15.8 months (SD=6.4, 3-27). Four themes were identified: a) the unique burdens of living with persistent post-COVID symptoms; b) the complex nature of patient work in managing symptoms and seeking treatment during recovery; c) erosion of trust in the healthcare system; and d) the process of adaptation, which included taking charge and transformed self-identity.

Interpretation: Support networks alleviate patient's burden, but many personal, systemic, & societal factors impede recovery. Work related to self-advocacy and seeking treatment is critical but taxing. Participants wish the government would provide more information about Long COVID and listen to physicians' advice.





#### Abby Miller (Dr. Danielle Frost)

Stability of Self-criticism, Self-compassion and Grit in Professional Triathletes in Training

When looking at endurance sports as its own domain, triathlon is an endurance sport unlike any other, in that it is both an endurance sport, and a three-sport multisport. Self-compassion (SC) has been negatively associated with self-criticism (SCr) in sport specific contexts and is associated with a balanced perspective that enables athletes to learn from mistakes and persevere towards long-term goals in sport3. This research focused on the psychological variables of self-criticism, self-compassion and grit (Gr) employing a single case design (SCD) methodology with a multiple baseline approach4 assessing whether these variables were affected by periods of not meeting expectations within a professional triathletes training program. This was done through means of daily surveys with previously validated scales, and completed by two participants. Results were minimal days where athletes did not meet expectations of workouts. However, based on individual results there were observable differences between the two subjects with observable fluctuations between days within subjects. Visual analysis of individual results show that there is still necessary research to be done to get a better picture of how these fluctuations in SC, SCr and Gr are affected by the daily pressures and expectations put on professional long distance triathletes.





#### **Trevor Oleniuk (Dr. Eleanor Francis)**

On-call frequency in rural Saskatchewan

This project considers on-call demand and workload and their impacts on physician wellbeing, burnout, and retention in rural communities.

We surveyed family physicians that completed the Saskatchewan International Physician Practice Assessment (SIPPA) practice ready assessment, on four components: (1) demographic information; (2) well-being index (WBI); (3) on-call demand; and (4) retention. Categories were scored and compared to assess correlation between components. Pearson correlation coefficient was used to measure the relationship between WBI score, on-call demand score, and retention score.

We received 56 responses (54%) before the deadline. Most completed 24-hour call shifts (80.4%), and the mode frequency was 1 in 5 (30.4%). 22 respondents (41.5%) had WBI score  $\geq$ 4, suggesting burnout. There was a negative correlation between the WBI and retention, as well as between on-call demand and retention, with a calculated Pearson r of -0.376 (P=0.0056) and -0.276 (P=0.045), respectively.

The results suggest that on-call workload and demand affect burnout and retention among rural family physicians in Saskatchewan. The data from this survey suggests that subjective perception of burnout is multifactorial, and that future efforts may be made to address the demands on rural family physicians to increase retention.







#### Michael Heynen (Dr. Donna Goodridge)

Self-Management of Post-COVID Condition Symptoms and Satisfaction with Health Services in Saskatchewan

Since the start of the pandemic, there have been over 140,000 cases of COVID-19 in Saskatchewan. Many people who are infected with SARS-CoV2 continue to have symptoms for months or years after the acute infection resolves. The experience of persistent symptoms is described as Long COVID or Post-COVID conditions (PCC). A recent meta-analysis estimates the global prevalence of Post-COVID conditions to be 34-54%. As a novel condition, there is little guidance available for healthcare providers or patients to manage symptoms. This study reports on a cross-section of preliminary data collected through longitudinal survey of individuals self-identifying with PCC. The most commonly reported symptoms were fatigue, memory problems, brain fog, issues with sleep, headaches, joint pain, and shortness of breath. Participants presented healthcare professionals one-half to one-third of the time for these symptoms. Of those accessing healthcare providers for treatment of each symptom, only one-half to one-third were satisfied with the care received. Joint pain and headache were most likely to be treated with over-the-counter products, while OTC use for shortness of breath, brain fog and fatigue was much less common. The novelty of PCC and lack of guidance for management may present a barrier to patient satisfaction and effective self-management.

# Medical Education

#### Romaisa Ismaeel (Dr. Brent Thoma)

*Bias in Observed Assessments in Medical Education: A Scoping Review* 

Competency-based programs utilizing observed assessments are being implemented widely in medical education. However, studies have found bias in the evaluation of these assessments. We conducted a scoping review of the literature to map evaluations of these tools investigating bias related to observable social identity characteristics including gender, gender non-conformance, race/ethnicity, religious expression, physical disability, and religious expression. The PRISMA-ScR guidelines described by Arksey and O'Malley informed our methodology. We searched the MEDLINE, Embase, ERIC, PsychINFO, Scopus Web of Science, and Cochrane databases for articles in all levels of medical education (UGME, PGME, and CME) that explored bias in observed assessments related to observable social identity characteristics. Data was exported to Covidence for screening and full-text review to identify articles that met our inclusion criteria. Seventy-three articles were included after the full-text review. None investigated gender non-conformance, physical disability, or religious expression. Majority of the included studies evaluated gender bias were conducted in postgraduate medical education and used quantitative methodologies. While work is being done to evaluate bias in these assessments, it has had a narrow focus to date. This review identified gaps in the literature that require further study. Further analysis describe the methodologies that have been used to investigate.





#### Bryan Johnston (Dr. Anurag Saxena)

Exploring leadership developmental readiness on leader development, practice and effectiveness in postgraduate medical education

Background: Leadership development in physicians is necessary to effect change within the healthcare system. Leadership developmental readiness (LDR) is a conceptual framework used to measure leadership development potential; those with higher scores are more likely to excel at leadership development.

Aims: We explored the impact of organizational factors on LDR within the context of postgraduate medical education. These discoveries will be used to inform future resident training policies.

Methods: Medical residents (N=12) participated in semi-structured qualitative interviews and transcripts were analyzed using qualitative data analysis software (NVIVO).

Results: At all stages of leader development, effective mentorship was associated with improved outcomes and an increased motivation to lead. Successful leadership outcomes could be further optimized by offering formalized leadership training, supporting resident wellness, and facilitating succession planning. Unsuccessful leadership was associated with communication difficulties, feelings of limited support and system issues. Interestingly, the organizational culture seemed to be program dependent.

Conclusions: Leadership development was positively associated with access to effective mentorship and negatively associated with communication barriers and feelings of limited support. Future studies should be expanded to consider the impact of program-specific cultures on leadership development.





#### Sydney Murray (Dr. Paul Olszynski)

*Remote Supervision of Clerkship Trainees using POCUS Handheld Devices Provides Opportunity for Feedback and Skill Development* 

Background: Feedback on Point of Care Ultrasound (POCUS) skills is essential for skill development. Providing feedback can be difficult in a large province with several distributed medical education (DME) sites. Through the use of handheld PoCUS devices and a cloud-based work platform, we assessed the quality of images and feedback provided to students.

Methods: Volunteer MS3 students were given access to POCUS devices at various DME sites. Trainees were encouraged to upload training scans to their accounts where they received written feedback from faculty. All relevant images were then randomized and reviewed by a blinded expert using a global rating scale (1-5). Written feedback was also analyzed. Finally, students completed a questionnaire on technology-enhanced learning.

Results: An independent-sampled t-test comparing mean ratings for initial images submitted prior to any feedback with those submitted after three rounds of feedback showed significant effect on image scores (2.60 vs 3.50, d=.93). Feedback included 4 performance domains (indications, image generation, interpretation, and integration). Students found the technology easy to use and felt feedback was tailored to their learning needs.

Conclusion: We observed that feedback provided to medical students through a cloud-based work platform can be effective for enhancing POCUS skills.



#### Azasma Tanvir (Dr. Sarah Oosman)

Walking the Talk: Addressing Anti-Black Racism in University of Saskatchewan's College of Medicine

Anti-Black racism is a recurring scourge within Canadian institutions, including medicine. Growing academic literature points to racist experiences faced by black medical students and physicians in Canada. An Ontario based study revealed that 70% of the participants (black physicians and medical students) had experienced poor treatment due to their race and this often came in the form of discrimination and differential treatment, both from patients and other professionals.1 The aim of our study was to contribute to the emerging literature on anti-black racism in Canada in the setting of medicine through a Saskatchewan based study. We interviewed 17 black participants (medical students, residents, and staff) about their experiences with anti-black racism in University of Saskatchewan's College of Medicine. We also conducted literature searches relating to anti-black racism in Canadian medical schools. Our findings reveal that anti-black racism is all too present in Usask's College of Medicine, with poor systems in place for resolving recurring incidents of poor treatment. Qualitative analysis and coding of the study's results are still in progress. We hope this study brings attention to a sensitive issue and will pave the way to creating a more respectful, anti-racist environment in medicine both in Saskatchewan and across Canada.





#### Georgia Bailey (Drs. Regina Taylor-Gjevre and Roona Sinha)

Exploring Undergraduate Medical Curriculum on Caring for Adults and Children with Physical, Cognitive, and other Disabilities

Currently, the undergraduate MD curriculum across Canada provides learners with a basic understanding of the provision of healthcare through a sociocultural lens. There is recognition that this approach provides a learning opportunity for enhancing communication, access, and care for a diverse population. The increasing awareness of Equity, Diversity, and Inclusion has identified students' values in developing their skills to support individuals with disabilities. Survey data from the University of Saskatchewan College of Medicine suggests that medical students lack confidence when caring for people with disabilities, furthermore the survey highlighted the interest of students to enhance their ability to care for this population. Thus, a change in the University of Saskatchewan MD undergraduate curriculum will be necessary to allow students to better provide high-quality care to individuals with disabilities. A set of four learning objectives has been proposed based upon survey results and current literature with the goal to enhance students understanding and confidence when caring for this population. Furthermore, detailed suggestions for how to incorporate disability curriculum into the university of Saskatchewan's MD program have been proposed based upon the four learning objectives.







#### Avani Saxena (Dr. John Witt)

A Thematic Analysis of SIPPA ER Clinical Field Assessment Reports to Inform IMG Practice Readiness Assessment Programs

Introduction: Practice readiness assessment (PRA) programs, such as the Saskatchewan International Physician Practice Assessment (SIPPA), are alternative licensure pathways for international medical graduates (IMGs). These programs are utilized to help address physician shortages in underserved areas of Canada. The lack of literature on PRAs warrants attention to ensure competent and safe care, especially regarding rural emergency room (ER) practice by IMG family physicians. This study aims to identify IMG strengths and challenges during the SIPPA ER assessment to inform PRA programs.

Methods: De-identified Clinical Field Assessment reports (n=100, 2019-2021) on SIPPA candidates' performance during 8-10 ER shifts within one six-week block were analyzed. Narrative comments were inductively analyzed for themes, followed by categorization of themes into Family Medicine CanMEDS roles. Descriptive statistics were used to summarize the communication/professionalism checklist.

Results: Strengths included general clinical skills and knowledge, safe care, communication, professionalism, self-directed learning, and collaboration. Areas for improvement included procedural skills (notably casting, ATLS, and airway management), clinical experience (particularly ER-specific), and confidence.

Conclusion: We offer three recommendations based on our findings: a) address procedural skill gaps through courses (Casted, ATLS, and Airway Management), b) increase ER exposure to improve ER practice-readiness, and c) improve confidence through mentorship and coaching.





#### Dilpreet Bajwa (Dr. Susan Petryk)

*Virtual Follow-up Appointments by Residents in Developmental Pediatrics: Expediting Clinical Care and Enriching the Learning Experience* 

Background: Extended wait times is a long-standing concern in Canadian healthcare, leaving patients without clinical guidance and unfavourable patient outcomes (1,2). Resident-run clinics is gaining recognition in decreasing wait times without compromise to patient satisfaction (3).

Objective: We aimed to evaluate a novel model of resident clinics for follow-up care in Developmental Behavioural Pediatrics and Child Psychiatry to expedite access to specialist guidance.

Methods: This mixed methods (interviews and surveys) study was conducted from Child and Youth Services Clinic in Regina, Saskatchewan. Resident follow-up clinic was piloted in October 2021. Descriptive statistics was computed using R software (version 4.0.3). Thematic analysis of qualitative data for the survey and semi-structured interviews was conducted to identify recurring concepts.

Results: High acceptance (Caregivers: n=81, 75%, Residents: n=8, 34.8%) and satisfaction (Caregiver: n=14, 60.9%, p=0.018) from the resident clinic model was noted among caregivers and residents. Caregivers mentioned benefits in faster and ease of access with this model. Residents viewed this as a valuable learning tool. Lack of care continuity and guided supervision were common disadvantages for caregivers and residents respectively.

Conclusion: Resident clinics can be advantageous in pediatrics, family medicine, and psychiatry residency programs, and may assist in resident education and increasing patient satisfaction.


#### Orhan Yilmaz (Drs. Gary Groot and Ekaterina Dadachova)

Cancer Radiobiology of Alpha- and Beta-Emitters in Relation to Skin Cancers

Skin cancers (non-melanoma and melanoma) are the most common type of cancers worldwide and make up one-third of cancers in Canada (1). The worldwide prevalence of non-melanoma skin cancer (basal-cell carcinoma and squamous-cell carcinoma) was over 1,100,000 and melanoma was over 320,000 in 2020 (2). In Canada, 76,000 people were diagnosed with non-melanoma skin cancer and over 400 died in 2014 (3), whereas 6,800 people were diagnosed with melanoma and 1,200 died in 2016 (1).

Radioimmunotherapy is becoming increasingly common in the treatment of various cancers, where mainly alpha and beta-emitters, are bound to antibodies or other immunogenic molecules to exert their effect on the target both through radiation and chemical means (4). For a given research study, alpha or beta-emitter selection depends on: target ligand half-life, cost and availability of radioisotopes, chelator effectiveness, organ toxicity, and monoclonal antibody availability, affinity and specificity (5) (6) (7). Radiobiology and cancer are intertwined through: reoxygenation (angiogenesis and metastasis), and repair, repopulation, radiosensitivity and redistribution (avoidance of destruction) (8).

Given the global demand of most radioisotopes and the difficulties in their production and transportation, our research group has turned to Holmium-166 and Lead-212 as therapeutic compounds to address these concerns. The new collaboration between Dr. Dadachova's basic science lab focusing on radioisotopes and Dr. Groot's clinical practice involving skin cancers is an important step towards treating skin cancers. This review lays out the therapeutic evidence of both radioisotopes in the treatment of skin cancers.





#### Samuel Boctor (Dr. Dean Chamberlain)

Precision Medicine in Cancer using Omics Data and Artificial Intelligence

The role of artificial intelligence in precision medicine in cancer therapy has been explored by multiple studies using preclinical cell lines and their drug responses as training data for machine learning models. Due to the limited availability of clinical drug responses, it has been a challenge for researchers to train models on preclinical data and have precise predictions of clinical data. Our goal is to identify a suite of biomarkers that, in a clinical setting, are feasible to assess and have beneficial influence on drug therapy choices. To overcome the paucity of available clinical data, we are exploring two different methods: 1) creating tumour masks that convolute the preclinical training data to a degree that is closer to what would be expected from a real tumour; 2) building upon existing preclinical-trained models that have the highest levels of predictive accuracy on clinical samples. In either case, feature data distributions will be compared between the sensitive and resistant cell sample groups as predicted by a given drug model and features will be removed if non-contributory to the model as determined by distributions not significantly differing between groups. What we hope remains is a small set of highly predictive biomarkers.



#### **Taylor Dennison (Dr. Moftah Younis)**

Head and neck squamous cell cancer of unknown primary treated with radical radiation outcomes in Saskatchewan

It is becoming increasingly recognized that head and neck cancer of unknown primary rises from HPV infection. Given the uncertainty behind the location of the primary tumor site in this cancer, the majority of Saskatchewan physicians include the entire pharynx in the radiation field. However, data on how this treatment is effective in terms of locoregional control and disease-free survival is limited to observational studies. Several Scandinavian studies have shown that the prognosis of this cancer, when treated with curative-intent radiation, was similar to that of known primary site, with a survival of 71%. Thus, the purpose of this study was to not only evaluate the outcome of head and neck cancer patients with unknown primary tumors who were treated with curative-intent radiation therapy in Saskatchewan, but also compare prognosis both to that of Saskatchewan patients treated for a known primary, and to that published in prior studies. As data collection is still in progress, the outcome of this study is not yet known. However, with the increasing prevalence of HPVrelated cancers in Saskatchewan, the knowledge from this study will allow physicians to better guide patients concerning prognosis once diagnosed with HPV-positive head and neck cancer of unknown primary.





#### Mohamed Omar (Dr. Ibraheem Othman)

Western Canadian Province experience on the rate of VTE in MM patient-retrospective study chart review analysis

Among the hematological malignancies, Multiple Myeloma has been associated with the highest rate of thrombosis. Venous thromboembolisms are a detriment to the MM patient, significantly worsening the prognosis. The literature indicates that the current immunomodulatory agents used such as thalidomide and lenalidomide increase the risk of thrombosis, especially when combined with steroid use1. To augment this increase in risk, the use of thromboprophylaxis such as low-molecular weight heparin, fixed low-dose warfarin, and aspirin, are acceptable strategies2. A retrospective chart review was carried out to collect health data from the Saskatchewan Cancer Agency through Citrix and ARIA. All patients diagnosed with VTE among MM patients from 2015-2021 were extracted. Data involved demographic data, laboratory markers, medical history and medication history. The primary outcome of interest was the rate of diagnosis of VTE among MM patients. Descriptive statistics were used to analyze the data for the 33 patients who were diagnosed with Multiple Myeloma and VTE after starting treatment. There were 360 Multiple Myeloma patients sampled. From these patients, 33 patients between 2015-2021 developed VTE.







#### Karmen Simonson (Dr. Nelson Leong)

Incidence, Patterns of Practice and Outcomes of Patients Diagnosed with High Grade Glioma at the Saskatchewan Cancer Agency

High grade glioma (HGG) are a collection of rare CNS tumors that include anaplastic glioma and glioblastoma. The prognosis for patients diagnosed with these malignancies is quite guarded and treatment involves a multidisciplinary approach including surgery, radiation therapy, and chemotherapy. The treatment approach can vary for complicated patients or upon recurrence of the disease. This study investigates patterns of practice and subsequent outcomes provincially and explores whether there are institutional or provider differences in the provision of treatment. This is a retrospective review of patients diagnosed with HGG in Saskatchewan from January 2012 to December 2017. Data collection is still ongoing, but the results of the study thus far include demographical information on the patients diagnosed with HGG in Saskatchewan. The total number of patients in the study is 295, with a F:M ratio of 41%:59%. The incidence is 49.2 new cases per year (95% CI = 7.9) which equals 5 per 100,000 and is comparable to previous studies which reports 5-7 cases/100,000. The median survival time after diagnosis is 9 months. Combined with future work on this project, this study will help guide clinician recommendations for patients and will provide Saskatchewan HGG patients with valuable information regarding their diagnosis.







#### Lucas Fisher (Dr. Shahid Ahmed)

Outcomes of Male Breast Cancer in Saskatchewan: A Multicenter Population Based Cohort Study

Breast cancer (BC) is the most common cancer diagnosed in women, with more than 27000 being diagnosed in Canada each year. Although rare, male BC cases account for 1% of this total. Due to the sparsity of cases, there is a paucity on prospective and randomized clinical trials investigating male BC. This study aims to examine the outcomes of male BC diagnosed in Saskatchewan over the past 20 years. Using a multi-center, retrospective cohort approach, we evaluated outcomes based on contextual, pathological and clinical factors that correlate with overall survival, with a specific emphasis on the outcomes of rural versus urban patients. Baseline characteristics of the patients were obtained and there was no significant difference between the urban and rural group. We found that increased age, performance status, and cancer stage correlated with lower overall survival (OS). Additionally, receiving adjuvant therapy increased OS in comparison to forgoing treatment. Surprisingly, we found that time-period of diagnosis had no impact on OS. Interestingly, there was no statistically significant differences were found comparing place of residence, further research into this topic is warranted due to the low case numbers for this rare disease.







## Amelia Gagnon (Dr. Dean Chamberlain)

Developing 3D Tumour Microtissue Hypoxia Models

Background – Triple negative breast cancer (TNBC) is an aggressive and hard to treat form of breast cancer. TNBC makes up 10-15% of breast cancer cases and is characterized by rapid growth, increased rates of metastases, and poor prognosis. "Triple negative" refers to the fact that the cells are missing three receptors commonly found in other forms of breast cancer. Cancer therapies that target these cell receptors cannot be used for TNBC. An alternate target that shows promise for TNBC treatment are breast cancer stem cells.

Purpose and Methods – This project aims to study the effects of hypoxia (low oxygen) on tumour composition by using three-dimensional tumour models known as microtissues. The tumour microtissues are produced in vitro using varying cell densities of a TNBC cell line (1, 5, and 10 million cells/ml) to induce varying degrees of hypoxia. Hypoxia, cell proliferation, cell viability, apoptosis, and cancer stem cells within the microtissues are examined over three weeks. Tumour models to better simulate and understand the effects of hypoxia are crucial for developing further treatments for TNBC.

Results - The initial microtissue cell density impacts microtissue morphology.





#### Aishwarya Gannamani (Dr. Krista Baerg)

Supporting Youth in School with Chronic Pain: A Scoping Review

Chronic pain in adults is recognized as a public health concern; approximately 15-20% of children and adolescents, most commonly girls, have chronic pain. There is little research that directly addresses how to support youth functioning in school. Youth with chronic pain face challenges in school resulting in higher rates of arriving late to, leaving early from, or entirely missing school. Strategies that support staying in school can include classroom accommodations that change the presentation, timing, or setting of information taught in school to support the youth's needs. The objective of this scoping review is to identify classroom accommodations that support academic achievement, school functioning, and school attendance in school amongst youth with chronic pain. This includes school-based accommodations, training for educators, models of course delivery, and individual pain coping strategies. The full study protocol is available at: www.osf.io/hnq4u. We identified 12 papers eligible for inclusion in our study with 6 studies reporting academic achievement outcomes, 8 studies reporting school functioning outcomes, and 9 studies reporting school attendance outcomes. Despite the large body of evidence for multimodal pain management and pain coping strategies, school absence remains high and little information is available to inform accommodations and optimize school attendance and participation.





## Alex Chen (Dr. Susan Petryk)

Improving the Fidelity of Virtual Photographs for use in the Screening of FASD

Background: The diagnosis of FASD is challenging for those in rural communities. Current tools that aid in the diagnosis of FASD are validated only for in-clinic photographs. Delay of diagnosis is a barrier to accessing necessary support services. The use of virtual photography using screenshots can expedite the diagnostic process for families in rural communities.

Objective: To develop an image processing and computer vision tool that can aid with clinician FASD measurements, and to investigate its role in future automated measurements.

Methods: MATLAB was used to develop a tool to detect and highlight facial features. Unsharp and deconvolution were used to sharpen images of poor quality. A classification model was constructed to extract facial features using the Viola-Jones algorithm. The Canny edge detection algorithm was used to highlight the relevant facial features.

Results and Conclusion: Image processing and computer vision algorithms are highly effective at detecting and highlighting facial features. Computer based tools can be beneficial to aid in the diagnosis of FASD in remote and rural communities. Further evaluation is warranted to assess the real-world efficacy of such a tool. Such a tool could potentially be used to automate the measurement of sentinel features.

80





#### James Macaskill (Dr. Jonathan Gamble)

Passive Leg Raise for Pediatric Peripheral IV Placement

#### Introduction

Establishing pediatric peripheral intravenous (PIV) access is challenging even for skilled practitioners with an approximately 50 percent first-pass success rate. A passive leg raise (PLR), raising a supine patient's legs to 45 degrees, auto-transfuses lower extremity blood and may increase the volume of upper extremity veins.

#### Methods

Following ethical approval, a randomized controlled trial was conducted on pediatric patients undergoing elective procedures. Participants were randomized and antecubital vein diameter measured by ultrasound three times: at baseline, with a venous tourniquet, and after intervention.

#### Results

Two hundred thirty-four patients were enrolled. There is a significant difference between the control and PLR groups in change (Z=-5.74, p<0.001) and percent change (Z=-5.84, p<0.001) in vein diameter following tourniquet placement. The median [interquartile range] peripheral vein diameter increased by 9% [5%-17%] in the PLR group and 4% [0%-8%] in the control group.

#### Discussion

In situations of cannulation difficulty or less experienced providers, a PLR is a simple means of increasing vein diameter that may decrease the number of PIV attempts and cannulation time.





#### Monica Ouellet (Dr. Krista Baerg)

Retrospective Chart Review of Outcomes at Discharge or Transition from Pediatric Chronic Pain Care

Many people experiencing chronic pain as children and adolescents often continue to have pain in adulthood and thus must make the transition from pediatric care to adult care. However, few studies have described the clinical features and outcomes of children at discharge from a pediatric complex pain clinic or identified the risk factors for continued functional impairment into adulthood post treatment from a tertiary care clinic. Thus, 35 patient charts from a tertiary care clinic (mean age 15.4 at intake) were retrospectively evaluated, 27 female and 8 male. Despite high rates of moderate to severe pain interference and functional disability at clinic intake, the majority of patients were assessed as suitable to return to primary care with or without additional therapy support in community at transition from pediatric pain care.



#### Mimi Girard (Drs. Regina Taylor-Gjevre and Roona Sinha)

Development of a Toolkit for Learning Pediatric Preventative and Anticipatory Care

The University of Saskatchewan has developed a new medical curriculum that has began this fall in the year of 2022. Opportunities for strengthening the new curriculum have been identified for education on what is "normal" in pediatrics growth and development. Other areas that have been identified for strengthening include preventative and anticipatory care for pediatric patients. To provide enhancements in the new medical curriculum, it is anticipated to provide more education on pediatric care. This will likely include topics such as the normal pediatric developmental stages, values of anticipatory care and health promotion principles.

This project aimed to develop a resource toolkit to support medical students learning towards understanding components and principles of anticipatory care in children, including how to identify health concerns/risks and prevent injuries/diseases. After the development of the toolkit, a survey was developed using survey monkey. The questions on the survey reflected the feedback that would be valuable to refine the toolkit. We have sent surveys to pediatricians asking their feedback on the developed toolkit. The feedback from pediatricians are not yet fully analyzed.

We hope to analyze the feedback received and make changes to the toolkit to provide a better resource for students.





#### Teagan Holt (Dr. Susan Tupper)

Development and Evaluation of a Resource Document for Primary Care Assessment and Management of Pediatric Chronic Pain

Chronic and recurrent pain is common in childhood and negatively impacts academic performance, school attendance, leisure activities, social engagement and developmental outcomes. Pain is reported in 15% of primary care visits by children or their caregivers. Clinical pathways provide guidance on best practice treatment approaches and ensure timely, effective, and appropriate healthcare for patients. A provincial needs assessment in 2021 identified several gaps could be addressed by the creation of a clinical pathway for pediatric chronic pain for primary care providers. A Saskatchewan based pediatric chronic pain pathway document, followed by a national template document that could be adapted to local jurisdictions, were created in 2021. An online descriptive survey was created to gather feedback from stakeholder's including: youth living with chronic pain, their caregivers, healthcare providers and health services decision makers. A total of 40 survey responses were analyzed. Overall, participants rated the pathway as having the right amount of information, being very clear, being very useful, and well organized. Recommended changes include reducing the busyness of the pathway or creating a patient/family friendly version with less information, changing the colors, changing "Problem-based" to something more positive, and translating to French. Multi-stakeholder feedback was used to inform final revisions to the clinical pathway and guide next steps for dissemination, implementation, and monitoring.





#### Soumiya Suresh (Dr. Polya Ninova)

Outcomes of Neonates Born to COVID-19 Positive Mothers: A Retrospective Chart Review

Background: Determining the impact of maternal COVID-19 infection on neonates is necessary to inform targeted care and policies, and educate caregivers to make informed decisions about the care of their newborn. This study aimed to characterize the outcomes of newborns born to COVID-positive mothers and specifically whether maternal COVID infection was associated with negative outcomes. A secondary aim was to determine the impact of COVID-19 severity on neonatal outcomes.

Methods: We conducted a retrospective chart review of 214 mother-baby dyads at the Regina General Hospital in Regina, Saskatchewan between January 1st, 2020 and January 31st, 2022. Data on maternal and neonatal variables was collected using a standardized form on REDCap. Statistical analysis was conducted using R.

Results: Apart from skin-to-skin contact (p=0.005), there were no significant differences in neonatal outcomes between COVID-positive and COVID-negative mothers' neonates (p>0.05). When analyzed based on the severity of maternal illness, significant differences were noted in gestational age, Apgar scores, respiratory distress, resuscitation, NICU admission, and length of hospital stay (p<0.05).

Conclusions: This data contributes to growing evidence suggesting an association between neonatal outcomes and severe COVID illness. This can be used to educate expectant parents and promote COVID vaccination among the unvaccinated pregnant population.

85





#### Olena Simko (Dr. Sarah Wood)

Are honey bees a suitable model for fetal alcohol syndrome in humans?

Fetal Alcohol Syndrome (FAS) is the leading cause of preventable intellectual disability worldwide. Prenatal ethanol exposure causes developmental delays, distinct facial morphology, and social deficits. An optimal FAS animal model must be able to assess both the disease's physiological and behavioral aspects. Previous studies have shown that invertebrates (Drosophila) can be used to study physiological aspects of FAS. Recently, honey bees were found to be a suitable model for human psychiatric disease, with the advantage of being highly social animals, like humans. Therefore, we hypothesize that honey bees could be an excellent model to study the physiological and social aspects of FAS. We grafted one-day-old honey bee larvae from 6 genetically diverse hives and reared the larvae in vitro. The larvae were exposed to incremental doses of ethanol (0%, 3%, 6%, 9%) through their diet over 5 days. Larva reared on diet containing 6% and 9% ethanol had significantly decreased survival to pupation and adulthood compared to the control. Furthermore, larval ethanol exposure was associated with delayed pupation and gross motor deficits in adult bees. In conclusion, honey bees are a promising animal model for future FAS studies with potential applications in drug discovery to ameliorate prenatal ethanol exposure effects.



#### Mauz Asghar (Dr. Susan Petryk)

*Virtual vs In-clinic Visits in Developmental-Behavioral Pediatrics: Evaluating Patient's Preferences* 

Background: COVID-19 transformed the delivery of medicine. Canada was forced to find a solution to delivering healthcare to their patients in a manner that would prevent the spread of SARS-CoV-2. Telemedicine was one of the solutions. The rapid need of efficient virtual care accelerated the development of telemedicine globally. Telehealth will be embedded into the health care system for the near future. There is limited research on the factors that affect patients' inclination towards choosing virtual care over in person clinical visits. This study will try to determine the factors that influence choice of care for developmental pediatric patients.

Method: A retrospective cohort study was conducted on over 280 patients and over 1000 appointments were analyzed between the time frame of August 2021 to June 2022. Age, number of medications, experience with virtual appointments, distance from clinic, and whether the appointment was a group appointment were factors taken into account.

Results/Conclusion: General preference for pediatric developmental patients was virtual care. Increase in the distance from the clinic saw an increase in preference for telemedicine. Additionally, previous exposure to virtual care increased the likelihood that a patient would choose virtual care in the future. As developmental pediatric patient age increased, patients' preference transitioned from virtual to in person care. Patients heavily preferred group appointments to be done virtually.

# Physical Medicine & Rehabilitation



#### Huzaifa Saeed (Dr. Susan Tupper)

*Recreation Therapists' Perspectives of Virtual Reality for Dementia Care* 

Virtual reality (VR) has been identified as a novel technology to support well-being among persons living with dementia (PLwD). Family caregivers (FCGs) and PLwD identified recreation therapists (RTs) as optimal delivery agents to support VR implementation in geriatric care setting. To support implementation of VR into geriatric care settings with the help of RTs, it is important to identify RTs perspectives on VR and barriers and facilitators to implementation. The primary research questions that guided this qualitative research study were: 1. What are RTs perspectives on the acceptability, feasibility, appropriateness, and utility of VR videos for PLwD and 2. What are the barriers and facilitators to implementation of VR headsets and videos in geriatric care settings? 16 practicing RTs in geriatric care settings in the SHA were recruited through study announcements and snowball sampling. RTs borrowed the headset for 1 week and provided the interview after. Interviews were transcribed followed by qualitative inductive thematic analysis and content analysis. This small sample of RTs viewed VR as a favourable addition to therapeutic programming for PLwD. RTs perceived certain barriers with implementation, mainly financial costs for equipment and the need for a large suite of videos to be tailor to individual interests.



## Aleya Anderson (Dr. Brian Le)

MRI Hip at 3T versus MRI Hip Arthrography for Detecting Labral Tears

Objective: To compare the diagnostic accuracy of conventional magnetic resonance imaging (MRI) to MR arthrography (MRA) performed at 3T in the identification of hip labral abnormalities in patients requiring hip arthroscopy.

Hypothesis: MRI Hip at 3T will have similar accuracy to 3T MRA in the detection of labral tears.

Methods: A retrospective review of 126 cases of individuals that received both their imaging and arthroscopic surgery in the Regina Qu'Appelle Health Region (RQHR) between 2015 and 2022. The findings from the operative report and radiology report obtained from Sunrise Clinical Manager are compared with one another to determine the sensitivity and specificity of both MRI and MRA hip across various field strengths, including 3.0T.

Results: 3.0T MRA performed better than 3.0T MRI, with a sensitivity of 1.0 vs. 0.95 and specificity of 1.0 vs. 0.96. In terms of the diagnostic accuracy of MRA compared to MRI across all the scanners (3.0T, 1.5T, and 1.0T), MRA has a greater sensitivity of 0.99 vs. 0.97, but MRI demonstrates an advantage in terms of its specificity with 1.0 vs. 0.56 for MRA.

Conclusion: MRA Hip at 3T performs slightly better than conventional MRI in the detection of labral abnormalities.





#### Lexie Landreth (Dr. Sarah Donkers)

Optimizing Walking in Multiple Sclerosis (MS): An Evidence-based review

Background and Purpose: MSBEST is a unique collaboration of clinicians and researchers across North America who combine evidence-based reviews with expert input to design mobilization modules to enhance clinical uptake for evidence-based rehabilitation in MS. Walking and balance impairments are very common in MS, and lead to many complications. We aim to synthesize and report the latest literature addressing interventions for walking and balance in people with MS as part of the MSBEST collaboration.

Methods: After an initial online database search, articles were uploaded to Covidence review software. Articles underwent title/abstract and full-text screening, and included articles were categorized by intervention type. Data extraction tables will be created for the walking outcomes of included studies and quality assessed using the PEDro tool. Level of evidence statements will be created using the Modified Sackett Scale with expert interpretation provided from MSBEST collaborators.

Results: 250 full text articles focusing on controlled trials for walking interventions in adults with MS were included, grouped by intervention type: exercise (n=61), physiotherapy (n=60), pharmacological (n=35), robotics (n=16), virtual reality (n=13), muscular electrical stimulation (n=13), whole body vibration (n=12), exergaming (n=12), non-invasive neuromodulation (n=8), body cooling (n=8), rhythmic auditory cueing (n=7), and 'other' (n=5). Data extraction is ongoing. Preliminary results for neuromodulation and rhythmic auditory cueing were extracted and summarized during this project.

Conclusion: Development of a walking and balance module is ongoing. Based on a small number of high quality RCTs, there is inconclusive evidence for the effects of non-invasive neuromodulation and for rhythmic auditory cueing to enhance walking outcomes in MS.

90



#### Alexander Waslen (Dr. Angelica Lang)

Age-related effects on upper limb kinematics during functional task performance

Age-related effects on the shoulder include rotator cuff tendinopathy and degenerative changes, and upper-limb kinematic differences have been shown to exist between younger and older groups for specific tasks. To date, there has not been a quantification of age-related effects on scapular and humeral kinematics for a functional task protocol. The purpose of this investigation was to compare differences in shoulder kinematics between young and middle-aged groups during a functional task protocol. Thirty healthy participants between the ages of 18-35 were recruited for the younger group and thirty between the ages of 36-65 for the middle-aged group. All participants completed a series of eight functional tasks (the WRAFT protocol) while their upper limb kinematic data was recorded with the Vicon system. Scapular and humeral angles were calculated, and waveforms were compared between groups. It was found that the younger and middle-aged groups had similar shoulder kinematics in most of the functional tasks performed, with slight differences in the "wash axilla" and "forward transfer" tasks. These results show that increasing age does not seem to play a major role in upper limb kinematics for functional tasks.

## **Quality Improvement**



#### Prapti Patel (Dr. Tim Bradley)

A Retrospective Review of Single Ventricle Pathway Management in Saskatchewan

Background: Children born with single functional ventricle anomalies of the heart undergo a series of surgeries, including the Fontan procedure, which completely bypasses right heart circulation creating chronically elevated systemic venous pressures and decreased cardiac output. This can predispose these children to cardiac and end-organ complications. The aim of this study was to assess if children being followed in Saskatchewan after the Fontan procedure were receiving appropriate outpatient management, as recommended by the 2019 American Heart Association (AHA) guidelines.

Methods: We conducted a retrospective chart review of all children being followed in Saskatchewan after the Fontan procedure. We collected data on the dates of clinic visits and investigations such as ECG, echocardiography, exercise tolerance tests, Holter monitoring, cardiac MRI, and bloodwork screening for end-organ dysfunction.

Results: Of 73 children included (mean age  $3.3\pm0.8$  years, 46 males), we noted most were receiving yearly clinic visits ( $83\pm9\%$ ), ECGs ( $79\pm10\%$ ), and echocardiograms ( $82\pm10\%$ ) as recommended by the guidelines. Cardiac MRIs ( $2\pm4\%$ ), exercise tolerance tests ( $18\pm17\%$ ), Holter monitoring ( $46\pm5\%$ ) and blood work ( $61\pm25\%$ ) were all done less frequently than recommended.

Conclusions: Our current outpatient management strategies for children being followed in Saskatchewan after the Fontan procedure do not comply with the 2019 AHA Guidelines.



#### Mark Wang (Dr. Paul Babyn)

Appropriateness in Virtual Care

Introduction: Appropriateness is a key tenet of all healthcare provisions whether in-person or virtual. Since the COVID-19 pandemic, the dissemination and use of virtual care has exploded, providing patients and physicians the opportunity for in-person, virtual, or a combination of in-person and virtual care interactions. Little is known about how to consider which type of patient-provider interaction is most appropriate for specific patient needs to avoid delay in treatment or unnecessary care. We examined the literature for guidelines on when the choice of virtual care was most appropriate. Our goal was to develop a framework to appropriately guide the use of in-person, virtual, or hybrid care.

Methods: We conducted a systematic review of Medline/OVID for articles published between 2013 and 2022 related to virtual care and appropriateness. After screening, sixteen articles were included.

Results: Four common factors were identified for appropriate virtual care usage: level of risk, purpose of visit, patient factors, and clinician judgement.

Conclusion: A strong understanding of when it is appropriate to choose in-person care, virtual care, or hybrid care is essential with telemedicine's growing popularization. An effective approach can maximize virtual care's benefits to our healthcare system and avoid low-value care.





#### **Thomas Goldade (Dr. Jeremy Reed)**

Efficacy of Nocturnal Analgesic Administration for Shoulder Associated Pain

Patients with debilitating pre-operative shoulder pain often report losing sleep to the point that it leaves them obtunded and irritable the next day. Non-narcotic management of this nocturnal shoulder pain is crucial to limit quality of life reductions while negating the high risk of addiction that opioid and more aggressive analgesics are associated with. Therefore, a push for optimizing NSAID (Advil) + Acetaminophen (Tylenol) regimens before resorting to opioid analgesia should be a primary goal. This research project attempts to investigate the benefits of a wake-to-take regimen for NSAID use. The wake-to-take regimen involved participants receiving a standard of care dose of 500 mg Tylenol and 400 mg of Advil. This was compared to a standard control regimen of 500 mg Tylenol and 400 mg of Advil taken before bed, and then attempting to sleep throughout the night. The goal of this research question is to discover if nocturnal pain is reduced by the wake-to-take methodology, but also to see if sleep quality is improved by this regimen as well. Sleep quality has massive effects on patient quality of life. While the research is ongoing, if wake-to-take regimens see a statistical difference this could be highly generalizable in clinical medicine.





#### Ryan Chan (Drs. Annabelle Wanson and Katelyn Halpape)

Characterization of Patients Developing Venous Thromboembolism while admitted to the Dubé Centre for Mental Health

Background: Venous thromboembolism (VTE) is a common source of preventable morbidity and mortality among hospitalized patients. The incidence of VTE in psychiatric inpatients ranges between 2-25%. Within the past 15 years, the Dubé Centre for Mental Health (DCMH) clinical team has identified an ongoing trend of patients developing acute VTE requiring urgent intervention during admission.

Objective: This study aims to identify risk factors associated with VTE development in psychiatric inpatients which will inform the development of a VTE prophylaxis risk stratification tool.

Methods: A retrospective case-control chart review of patients admitted to DCMH from January 2007 to December 2021. Cases were identified through the inpatient hospital pharmacy software by screening for individuals aged 18 and older who received anticoagulation. Cases were initially screened to select patients who received anticoagulation for VTE treatment. Controls were randomly selected from the pool of patients with a discharge diagnosis other than VTE. The extracted data was audited by a sub-investigator.

Future Direction (ongoing): The data will be coded for statistical analysis and descriptive and comparative statistical analysis will be completed. The analyzed results will be summarized and ultimately aid in the development of a risk stratification tool.



#### Kennedy Lewis (Drs. Beverley Karras and Roona Sinha)

Developing a Focus for the 2nd UGME Course Review Cycle

Course review is a vital part of updating the undergraduate medical school curriculum and ensuring the education provided fits with priorities. At the University of Saskatchewan, the Curriculum Quality Review Committee (CQRSC) is determining priorities for the next cycle of course review. Using information collected from the literature review and curriculum committee input, a survey for students and faculty was created.

Results showed students and faculty prioritized course delivery methodology, social accountability, and generalism/family medicine. Within social accountability priorities, students and faculty ranked equity in patient treatment and cultural competency highly. Both groups ranked pre-recorded lectures within course delivery highly. There was a difference in ranking for inquiry-based learning, which students highly ranked and faculty ranked lowest. Students and faculty indicated that removal of redundant and/or less relevant content and/or assignments would be beneficial. In-person lectures and flipped-classrooms were prioritized by faculty, but not students. There was strong desire indicated by students to be actively involved in the next review cycle.

These findings will assist the CQRSC in identifying direction for the second course review cycle.

96





#### Janan Ashique (Dr. Susan Petryk)

Parents/Guardians Positively Respond to Interdisciplinary Care and Procedure for Assessing Neurodevelopmental Disorders in Children and Youth

Neurodevelopmental disorders (NDDs) are multifaceted conditions characterized by impairments in cognition, communication, behavior and/or motor skills resulting from abnormal brain development and thereby requiring a diverse approach to clinical intervention. Assessments for these disorders are done by an interdisciplinary team which can lead to some diagnostic delay, prolonged wait times and increased number of appointments. The goal of this study was to receive feedback from participants regarding their experiences with the team and the diagnostic process for quality improvement purposes. Quantitative data was collected by surveying the caregivers of patients with NDD's, and qualitative data was collected by conducting interviews. The clinical team's performance was positively assessed by parents/guardians (ranging from 72.7-81.8% approval and 0-13.6% disapproval on all questions). There were 13.6% of the surveyees that felt the report did not accurately describe their child's/ youth's difficulty but still positively reviewed the clinical team (66.7-100% approval and 0% disapproval on all questions). The overall assessment was found to be worthwhile (90.9%; 0 disagree), valuable for their child/youth (81.8%; 0 disagree) and recommended for others (81.8%; 4.5% disagree). Preliminary analysis of the survey and interview results indicated a very positive response from caregivers for an interdisciplinary diagnostic assessment of NDD's.





#### Kate Kopeck (Dr. Vijayalakshmi Udayasankar)

The Appropriateness of Blood Transfusion in Obstetrics in Prince Albert: Based on "Using Blood Wisely" from Choosing Wisely Canada, a Quality Improvement Initiative

Blood transfusion is a common intervention in obstetrics, often ordered in cases of both active and non active bleeding. Guidelines surrounding obstetrical transfusions in the event of both active and non-active bleeding are limited, and as a result, avoidable transfusions are often administered. The objective of this retrospective study was to assess obstetrical transfusion practices and appropriateness in Victoria Hospital, Prince Albert, Saskatchewan. A retrospective chart review of 73 obstetrical patients who received blood transfusion between 2019 and 2021 was conducted. Utilizing best transfusion practice criteria as set out by Choosing Wisely Canada, other obstetrical transfusion guidelines, and a similar study conducted in Regina, Saskatchewan, transfusions were deemed either appropriate or avoidable. Results revealed that in actively bleeding patients, 21/23 (91.3%) transfusions were deemed appropriate. 9 of these were single unit transfusions, all of which were deemed appropriate. In the non-actively bleeding patients, 50 transfusions took place. 11/20 (55%) single unit transfusions in non-actively bleeding patients were deemed appropriate. 30/30 multi-unit transfusions in non-actively bleeding patients were deemed avoidable, primarily due to a lack of reassessment between transfusions. Limitations include the retrospective nature of the chart review method, including potential for incomplete or inaccurate chart information and thus potential inconsistencies. Altogether, appropriateness of obstetrical transfusions in Victoria Hospital was found to be the lowest in the non-actively bleeding patient who received multiple units of pRBC with no reassessment between units. Education of Obstetric staff on 'Choosing Wisely Canada tool kit' has the potential to safely avoid unnecessary obstetrical blood transfusions.





#### Stephanie Bigsby (Dr. Alysa Poulin)

Evaluation of Synoptic Reporting for Placental Pathology in Saskatoon

The placenta is a key factor in predicting and understanding maternal and perinatal outcomes in pregnancy. When the placenta develops abnormally or does not function as expected during pregnancy, numerous adverse outcomes for both the mother and baby can arise. Experts in perinatal and pediatric pathology have developed a classification system for placental pathology, the Amsterdam Criteria, which defines 4 major categories of placental injury which comprise the majority of diagnoses: acute chorioamnionitis, villitis of unknown etiology, fetal vascular malperfusion, and maternal vascular malperfusion (1). Placental pathology reports since 2016 were analyzed and data was collected pertaining to these 4 categories. Currently, Saskatoon does not have a standardized reporting system in place for the pathologic examination of placentas and our study revealed significant variability in terminology used in reports. The lack of a standardized reporting system may affect the ability of physicians and midwives to interpret the results in a manner that leads to appropriate treatment for the mother and/or the child and could affect future pregnancy outcomes. We propose that the implementation of a placental synoptic reporting system would streamline the reporting process for pathologists, facilitate report interpretation, and result in more meaningful discussion with patients regarding health outcomes.







## Nancy Cai (Dr. Donna Goodridge)

"They don't even want to hear it; they don't look further into these alternatives": A Qualitative Study of the Erosion of Trust in the Healthcare System Among Patients with Long-COVID Symptoms

Background: The COVID19 pandemic has left many of its victims with chronic, disabling sequalae, and our current healthcare system is not effectively serving the needs of these Long COVID patients. This qualitative study aims to capture the lived experiences of these patients, and thereby identify and address areas of shortcoming within the healthcare system.

Methods: 41 participants were divided into 10 focus groups, each undergoing 90 minutes of semi-structured interview, which were transcribed, coded, and interpreted by the research team using thematic analysis and interpretive description methods.

Results: Four major themes were identified – in this project, I chose to elaborate on the theme "erosion of trust in healthcare". Important subthemes include individual physician issues such as gaslighting and lack of guidance, as well as systemic shortcomings such as fragmentation of care and public health chaos. Recommendations to address each of these issues include enhancing physician education and awareness, familiarize with local resources, establish multidisciplinary clinics, and stronger directions from the government.

Conclusions: We hope this qualitative study will rise more awareness in the public health sector and among physicians on what our patient's concerns are through description of their lived experiences and point the way for future investments that can promote better patient outcomes.

#### Allan Yang (Drs. Pouneh Dokouhaki, Ninad Mehta, and Fang Wu)

PROVE

Do We "Choose Wisely" with PSA Testing

Prostate cancer is the most diagnosed non-cutaneous cancer amongst Canadian men. The Prostate-Specific Antigen (PSA) is a test often used for screening prostate cancer. Yet, many guidelines recommend against routine PSA screening for all patients due to the harms and limited benefits the test may provide. We examined PSA testing and prostate biopsy data within the former Saskatoon Health Region between 2016-2019. Over this period, 136,151 PSA tests were performed. The majority of PSA tests, over 80% were normal (<4.0 ng/mL). Ordering patterns with regards to volume, age, and test results were remarkably consistent year on year. We determined that the number of inappropriate PSA tests performed could be as high as 30% of all tests ordered. The potential cost savings this would amount to would be \$1,195,320. 1,388 prostate biopsies were performed between 2017 to 2019. The prostate cancer detection rate as per biopsy stood at 67.93%. Statistical analysis found that the detection of prostate cancer upon biopsy has no significant correlation with the last PSA result prior to biopsy. We intend to use the results of this study to develop educational resources and algorithms to aid clinicians and promote more judicious laboratory utilization.





#### Khrystia MacKinnon (Dr. Eric Sy)

Impact of a Rounding Checklist on Patients Admitted to an Intensive Care Unit

Background: ICU rounding checklists have been widely introduced, despite mixed literature on their effectiveness. This systematic review and meta-analysis aim to evaluate the effectiveness of ICU rounding checklists on patient outcomes.

Methods: We searched electronic databases for primary studies evaluating the effect of ICU rounding checklists compared to no checklists on patient outcomes. Our primary outcome was in-hospital mortality, while secondary outcomes included ICU mortality, 30-day mortality, hospital length of stay (LOS), ICU LOS, duration of mechanical ventilation, catheter-associated urinary tract infections (CAUTI), central-line-associated bloodstream infections (CLABSI), and ventilator-associated pneumonia (VAP). Tertiary outcomes included provider qualitative feedback. Outcome data was extracted and synthesized into a meta-analysis using RevMan 5.4. Study quality was assessed using the RoB2 and ROBINS-I tools, while certainty of evidence was assessed using the GRADE methodology.

Results: Out of 6523 studies identified, we included 29 studies (29239 patients from 28 observational studies and 1 RCT). ICU rounding checklists were not associated with improved in-hospital mortality (6 studies, 8286 participants, relative risk [RR] 0.88, 95% CI 0.76-1.03). However, checklists were associated with improved 30-day mortality (6 studies, 5164 participants, RR 0.86, 95% CI = 0.79-0.94). There were no differences in any other patient outcomes. Healthcare providers had improved job satisfaction and perception of patient care.

Conclusion: ICU rounding checklists were associated with reduced 30-day mortality; however, they were not associated with improvements in other patient-related outcomes. Overall, healthcare providers had positive perceptions on the usefulness of checklists. Further research is required into the development of checklists and evaluation of their effectiveness.





#### Gavin King (Dr. Jeremy Reed)

Patient Concerns and Antibiotic Use with Absorbable vs. Non-Absorbable Monofilament Suture for Closure of Arthroscopic Portals: A Randomized Control Trial

To date, there is no standard technique for the closure of portals for arthroscopic orthopedic surgery. Available suture options include the use of absorbable (Monocryl<sup>®</sup>) sutures or nonabsorbable (Prolene®) sutures. Absorbable sutures negate the necessity for surgical removal at a healthcare facility, but they may increase patient and/or primary health care provider concern with the formation of an inflammatory "sterile abscess" at the wound site. This may lead to inappropriate initiation of antibiotics and poor antibiotic stewardship. Several previous authors have studied outcomes related to portal closure choice and functional outcomes or cosmesis of the wounds, but there is not significant data to show the rate of patient concerns with the closure, primary physician's concern for infection, or the inappropriate use of antibiotic therapy. This study proposes a randomized control trial assessing patient or physician concern with arthroscopy portal wounds when absorbable vs. non-absorbable sutures are used. This study will take the reported level of concern of patients receiving arthroscopic surgery and the presumed concern of their primary care providers to provide evidence to help surgeons choose which arthoscopic closure type will lead to better patient satisfaction, decreased unnecessary access of primary care services, and decreased inappropriate antimicrobial use.





#### Jay Rabari (Dr. Camille Hamula)

Effect on patient outcomes with multiplex gastrointestinal PCR implementation in the clinical microbiology laboratory

Introduction: Multiplex gastrointestinal (GI) pathogen panels (GIPPs) are specific, sensitive, rapid and less labor-intensive compared to traditional methods. Use of GIPPs can greatly improve turnaround time for the detection of GI pathogens, guide antimicrobial treatment, prevent unnecessary procedures, imaging studies, and shorten hospital stay. Other studies have indicated limitations to GIPPs. They are unable to differentiate between viable, nonviable and colonized pathogens, leading to increased incidence and treatment in the absence of appropriate stewardship. This study aims to compare patient and testing outcomes prior to and after GIPP implementation at Royal University Hospital.

Methods: A retrospective chart review of 106 inpatients prior to and after GIPP implementation in November 2020. Testing outcomes included pathogen recovery, ID and turnaround time. Patient outcomes included length of stay, antimicrobial therapy and length, and imaging studies.

Summary and Future Direction: GIPP implementation improved sensitivity of pathogen detection, decreased TAT by 8.2 hours and led to a 4.2% reduction in imaging studies. There was no relative difference in patients admitted or their length of stay. Samples with CT values in the range of 26 to 33 were likely to be reported GIPP positive and subsequently grow in culture. The clinical significance of GIPP positive samples without culture growth remains to be determined. The study findings were limited due to sample size and health record availability. Further studies require a larger and equal sample size to determine the significance of current findings and to comment on antimicrobial use.





#### Zoher Rafid-Hamed (Dr. Jay Kalra)

Medical Error Disclosure: An Ethical and Legal Dilemma?

The quality of health care is an emerging concern worldwide. Disclosure of an adverse event is an important component in managing the consequences of a medical error. Despite best intentions and competencies, health care remains a human endeavor in which mistakes will inevitably be made. This study aims to review and compare the disclosure policies implemented by health authorities in the western Canadian provinces. We evaluated each policy based on the following guidelines: avoidance of blame, support to the staff, an apology or expression of regret, avoidance of speculation, some form of patient support, and education/training for healthcare workers. In reviewing and comparing the medical error disclosure policies of the western Canadian provinces, we found that many of the provinces had certain weak points and shared some with others. However, when taking the average across western Canada, the main lacking point of many of the policies was training/education for the staff. As preventable medical errors and adverse events become a growing concern and cost, appropriate processes must be executed. Further work in the future will look toward completing a review of all the Canadian provinces' policies on disclosure to create a best practice model for medical error disclosure across Canada.





# Zainab Sultan (Drs. Bindu Nair, Regina Taylor-Gjevre, and Anthony King)

Quality Assessment of Online Self-Management and Self-Efficacy Resources for People with Osteoarthritis

Objectives: Osteoarthritis is a degenerative disease of the joints, affecting over 302 million individuals globally. Treatment often includes pharmacological and surgical options. Self-management strategies include disease education, symptom control, and skill-building. This study aims to create an inventory of online resources for self-management of osteoarthritis and to assess each program's quality, understandability, actionability, accessibility, and transparency.

Methods: Three search entries ("osteoarthritis self-management," "how to manage osteoarthritis," and "treatment of osteoarthritis") were conducted on Google, Yahoo, Bing, and DuckDuckGo. Programs were assessed with the DISCERN, PEMAT, SMOG and FOG tools.

Results: A total of 110 results were obtained from the searches. After applying inclusion and exclusion criteria, 12 resources remained. The mean DISCERN score (M=4.22) equates to high quality, the PEMAT scores for understandability and actionability were 85% and 58%, and the SMOG and FOG scores (9.33 and 12.5) indicate difficult reading levels. All programs met transparency criteria.

Conclusion: Online resources for osteoarthritis self-management achieved good scores with the DISCERN and PEMAT tools. The reading levels are higher than the current recommendations for health information and may pose barriers to patient accessibility. Overall, online resources may be valuable tools for patients and healthcare providers in the self-management of osteoarthritis.



#### Grant Yao (Dr. Niels Koehncke)

Effect of Hands-Free Training on Worker Radiation Exposure

Introduction: Veterinarians are often present in the radiographic room during X-ray exposures to manually position and restrain animals. Repeated exposure over time poses serious radiation risk to veterinarian workers. This warrants exploration into alternative methods for restraining animal movement to obtain high-quality radiographs while simultaneously protecting workers from radiation exposure. Hands-free radiography is a technique for imaging animals that relies on restraining equipment as well as specific patient handling techniques, which enables technicians to leave the room during exposures and minimize their X-ray exposure.

Methods: A hands-free radiography training was provided to 40 Western College of Veterinary Medicine (WCVM) workers in March 2022. 24-hour video footage of the main radiology room was recorded before and after the training course to observe the effect of the training course on exposure variables, such as the number of workers in the room at exposure and use of material restraints. Additional patient variables (species, age, weight, sedation status) and study variables (anatomical location imaged, regular hours or after-hours) were also recorded.

Preliminary Results: Data collection is currently still in-progress. Preliminary results indicates reliance on sedation/anesthesia (80.5% of studies). Data analysis of exposure variables is expected to take place shortly after completion of data collection.




#### Jared Price (Dr. Ankit Kapur)

Prehospital Standards for Point of Care Ultrasound: A Brief National Review

Today's overburdened healthcare system relies heavily on quality prehospital care. This care is often provided by paramedics, whose roles have grown in scope heavily in recent years. Despite this however, the establishment of clearly defined standards of practice has lagged behind the clinical picture. One such role is in diagnostic imaging through POCUS, a skill heavily reliant on operator skill and experience, but with incredible insight into medical conditions. A near-comprehensive survey of Canadian provincial paramedic accrediting bodies was undertaken and their standards of POCUS were queried. Overwhelmingly, most provincial organizations have minimal or absent standards of accreditation or practice with POCUS despite listing it as a required competency in some paramedic profiles. Interestingly, the responsibility of training and competency falls onto individual paramedic employing companies which occupy a large share of paramedic services in Canada. This corporate structure and lack of provincial oversight has led to a limitation of POCUS' role in prehospital care due to disparate and minimal standards. From this data, we realize there is an urgent need to develop a national set of quality assurance measures and competency standards for paramedicine regulatory bodies who include POCUS as part of their scope of practice.



# Surgery



#### **Claire DuVal (Dr. Michael Kelly)**

Expanding Stroke Imagery into the Third Dimension

Stroke is a leading cause of death and disability in Canada, and better treatments are needed for this condition. Stroke research in animal models requires the quantification of stroke lesion volume in order to assess severity of the stroke and evaluate efficacy of interventions, but traditional methods of calculating volume using many slices through the lesion are time-consuming and render the tissue unusable for additional imaging. The ABC/2 model is a clinically used method for estimating stroke lesion volume using a single slice based on the assumption of a hemiellipsoid shape, and we propose that this may be useful for estimating stroke volume in our models of stroke. A protocol of serial cryosectioning of brain tissue, and subsequent light microscopy, synchrotron-based imaging, and three-dimensional volume reconstruction was used to compare the traditional method of volume estimation with the ABC/2 model in three different surgical models of stroke. Analysis revealed that the ABC/2 method of volume estimation performed best in the photothrombotic model, and performed poorly in the middle cerebral artery occlusion and intracranial hemorrhage models. These findings have the potential to be applied to future stroke studies, particularly for the photothrombotic model.





#### Candelaria Aristizabal Londono (Dr. Jeremy Reed)

Does Postoperative Vitamin C Improve Pain and Range of Motion Following Arthroscopic Surgery of the Shoulder? An RCT

Complex Regional Pain Syndrome (CRPS), previously Reflex Sympathetic Dystrophy (RSD), has been a topic of interest in both the fields of orthopedics and pain management for many years as it frequently impacts patients' post-operative quality of life. CRPS is a chronic condition characterized by both autonomic and inflammatory features (1). It impacts approximately 7% of patients following trauma to nearby musculoskeletal structures (1). Treatments for CRPS have accumulated over the years and vary based on the chronicity and severity of the condition (2). In recent years vitamin C has gained significant recognition as a possible treatment option. It is not only an inexpensive alternative to the current treatment strategies, but also has an excellent safety profile (3). Vitamin C is also thought to offer protective benefits against the development of CRPS (3). Existing research has looked at the efficacy of vitamin C as a treatment for CRPS following a variety of orthopedic surgeries, but additional studies are needed in order to address many unanswered questions. This randomized control trial will look at the efficacy of vitamin C as a prevention strategy for CRPS following arthroscopic surgery of the shoulder.







#### Barzany Ridha (Dr. Daryl Fourney)

Which Baseline Clinical Factors and Clinical Indications are Most Correlated with Outcome after Lumbar Fusion Surgery?

OBJECTIVE: In lumbar fusion surgery the relationship between baseline patient characteristics which predict long term pain and clinical indication is still unknown. The Saskatchewan Spine Pathway classification (SSPc) is a reliable and valid clinical classification system which informs the clinical indication for lumbar fusion surgery. The objective of this study is to evaluate which clinical factors and which of four SSPcs correlate most with longer term patient self-reported pain, functional outcomes, or quality of life scores after lumbar spine fusion.

METHODS: A retrospective review of adults (>18 years of age) who underwent elective lumbar fusion surgery between 2011-2019 was performed for 263 patients. Each patient had a SSPc assigned. Baseline and follow-up outcome measures used to quantify pain and quality of life included the Oswestry Disability Index (ODI), EuroQol Group 5-Dimension Self-Report (EQ5D), and Visual analogue pain scores for back and leg. Outcomes were evaluated at 6-8 weeks and 18-24 months post-operatively.

RESULTS: In our multiple linear regression model, SSPc1 was significantly associated with improved VASBack Scores, and SSPc3 with better VASLeg scores. Furthermore, of the baseline patient characteristics, opioid use predicted worse VASBack scores. For ODI outcomes, there was a statistically significant improvement of outcomes for patients with a diagnosis of SSPc pattern 1 or 3.

CONCLUSION: The SSPc may be useful as a prognosticating tool for patient outcomes and may guide pain management, and treatment accordingly.

111





### Dinesh Kumar (Dr. Rashmi Bhargava)

The effect of nurse experience on the incidence of intrapartum Cesarean section rate

Background: In Canada, the increased awareness of the health and socio-economic costs of C-Sections has triggered a shift in focus towards how to reduce these rates. Nurses play a crucial role by providing care in a one-on-one environment with labouring patients. The aim of this research is to examine the association that exists between incidence of intrapartum C-sections birth and the experience level of nurses and physicians involved in the patient-care.

Methods: The study is a quantitative comparative analysis involving a retrospective chart review (200 charts). De-identified data was aggregated, and statistical analysis was performed using IBM SPSS statistics 22. A comparison of vaginal deliveries and intrapartum C-section were performed using independent t-tests, Chi-square tests, and Mann-Whitney tests.

Results: : The effect of nurse experience on the incidence of intrapartum Caesarean section rate was not statistically significant(p = .44). Similarly, no statistical significance was found between different levels of physicians experience and the incidence of intrapartum C-section rates(p = .49).

Conclusion: Based on these results, this study concludes that there was no association between the level of nursing nor physician experience and risk of intrapartum C-section births.





## Hifsa Noor (Dr. Gary Groot)

Variation in number of axillary sentinel lymph nodes collected by Breast Surgeons in Saskatoon

Background: Sentinel lymph nodes (SLNs) are the first to receive drainage from a given primary tumor. As such, sentinel lymph node biopsy (SLNB) has become the standard of care for breast cancer staging in clinically node negative and DCIS (requiring mastectomy) patients. The optimal number of SLNs for SLNB is a very important question for breast surgeons and their patients, but currently there is no well-established standard.

Methods: This was a retrospective cohort study of all patients who underwent a SLNB for breast cancer between January 2020-January 2021. Variation in number of SLNs collected by breast surgeons was determined.

Results: A total of 350 patients were included in our study; on average surgeons collected 1.6-4.1 SLNs. Malignancy was found in 22.2% specimens from the left axilla and 18.0% from the right axilla. For both axillae the results of the fisher exact test were insignificant (p>0.0001).

Conclusion: There was no significant difference between the surgeon performing the SLNB and malignancy found in the LNs. Our results show that different numbers of SLNs can be effective for detecting malignancy in SLNs. Determining the relationship between the number of SLNs and cancer subtype and biopsy technique are some future aims.





#### Yousef Omar (Dr. Russell Murphy)

Olfactory Dysfunction Following Covid-19 Infection

Background: In May 2020, olfactory dysfunction was listed as a symptom of SARS-CoV-2 infection. Although largely transient, this reduced olfactory sensation has been known to persist for months in many cases. Insight into the prevalence and severity of this olfactory dysfunction is imperative for patient counselling and clinical understanding of the illness process. Although subjective survey results have been described in literature, little quantitative psychophysical testing of olfactory sensation has been done post-SARS-CoV-2 infection.

Methods: Following exclusion of prior causes of microsmia, we administered a Burghart-Messtechnik 12-item smell test (BM12) to 100 participants who have at one point received a positive PCR or antigen COVID-19 test. Chi-square testing was conducted to compare rates of microsmia in the study population to the general population.

Results: 56% and 5% of study participants exhibited microsmic and anosmic BM12 scores, respectively, (mean [95% CI] BM12 score: 9.78 [9.01, 11.00]). Proportion of olfactory dysfunction is significantly higher in the study population compared to the general population (61% vs. 22%, P<0.0001). Odds of having olfactory dysfunction is 448% higher in the study population compared to the general population (OR:5.48, 95% CI: 3.67-8.19, P<0.0001).

Conclusion: Practitioners should screen for and recognize microsmia as a possible symptom of COVID-19 even long after infection.

114







UNIVERSITY OF SASKATCHEWAN College of Medicine office of the vice-dean research medicine.usask.ca/research.php



