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College of Medicine
OFFICE OF THE VICE-DEAN RESEARCH
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UNDERGRADUATE SUMMER RESEARCH SHOWCASE

Abstracts

2023

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A Message From The Vice-Dean

Dear Colleagues,

Welcome to the 2023 Virtual Undergraduate Summer Research Showcase.

This is the twentieth 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 17 competition categories.

I am delighted to acknowledge the exceptional dedication and hard work of students, mentors, adjudicators and all who facilitated undergraduate student research programs. Our staff have 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,

Anatomy, Physiology & Pharmacology

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Ali Rivzi (Dr. David Cooper)

4D Tracking of Individual Trabecular Bone Remodeling Events Using Synchrotron Micro-CT

This project tracked individual changes in trabecular bone structure in the calcaneus of adult female New Zealand white rabbits over a two-week period using microcomputed tomography (micro-CT) techniques. While the linear nature of the linked processes of bone resorption and formation by basic multicellular units (BMUs) are well-characterized in cortical bone, this project explored the nature of this relationship in the trabecular bone using a rabbit model. The rabbits received either an ovariectomy or a sham surgery followed by differing doses of parathyroid hormone (PTH) to increase the rate of bone remodelling in the trabeculae. An initial micro-CT scan was performed in vivo on anaesthetized rabbit calcaneus bones using a synchrotron beamline and was followed two weeks later by an ex vivo desktop micro-CT scan. Subsequent co-registration of each set of scans allowed for a difference map to be created, which highlighted individual areas of resorption and formation. The success of the synchrotron micro-CT based technique over a comparatively short timeframe demonstrated proof of principle and the potential value of the technique. Furthermore, examination of individual remodelling events in the trabecular bone showed little evidence of linear BMU activity, in contrast to cortical bone.

Roya Emadi (Dr. Peter Hedlin)

Subarachnoid Block: Reasons for Insufficiency

Background: Subarachnoid block (SAB) using bupivacaine is the most common anesthetic choice for elective cesarean sections due to its reliability, rapid onset, and good postoperative pain control. Current literature suggests SAB failure rates of 0.5-6.4% in cesarean sections. Failed SABs are associated with poor sensory blockade and can result in a conversion to general anesthesia, which can have detrimental effects to the parturient and the neonate. SAB failure can be caused by provider factors (injection technique and dosing of bupivacaine), patient factors (physiological resistance to bupivacaine) and product factors (use of chemically altered bupivacaine).

Methods: Following local Research Ethics Board approval, a prospective observational study was conducted over 5 years. Consenting eligible participants included patients undergoing elective cesarean sections (with spinal blocks) at JPCH. Patient demographics and procedural data was collected. Buccal swabs, CSF samples, and leftover bupivacaine vials were collected for each participant.

Results: A total of 5 failed SABs were captured among 205 enrolled patients. Analysis of the collected CSF, buccal swabs, and bupivacaine samples has not yet been conducted.

Conclusion: Effective spinal analgesia leads to better clinical outcomes and maternal-neonatal bonding. We can better avoid future failed SABs by identifying the most prevalent mechanism for failed SABs.

Haidyn Golinowski (Dr. Julia Boughner)

The Role of the p63 Gene in Vertebrate Tooth Formation

The evolutionarily ancient gene, p63, is expressed across vertebrates. The p63 gene has a role in the development of many body parts including limb, palate, urogenital tract, and teeth. Since the first teeth ever to evolve may have been pharyngeal (throat) teeth, we used two well-characterized fish models, medaka (Oryzias latipes) and zebrafish (Danio rerio), to determine if genes bound and thus controlled by p63 are expressed identically between pharyngeal and/or oral (mouth) dental tissues. Adjacent paraffin-embedded embryo tissue slices were stained with H&E, and alizarin red, to show tooth organ morphology and histology, helping to map protein expression to specific areas of a developing tooth. Immunohistochemistry was used to label P63 and a few of its targets FERMT1, TRIM29, and PRSS8. Results indicate that P63, FERMT1, TRIM29, and PRSS8 are all expressed in both oral and pharyngeal dental tissues in medaka. Zebrafish results indicate that P63, FERMT1, TRIM29, and PRSS8 are expressed in pharyngeal dental tissue (oral teeth are absent). Protein labeling experiments continue to probe the location and quantity of expression of the p63 gene and other target genes in the p63 network. This work is giving new insight into the evolutionary origin of vertebrate teeth.

Tye Morin (Dr. Justin Botterill)

TRAPing Context Specific Fear Memory

In this work, we sought to study how a brain region known as the hippocampus contributes to contextual fear learning and memory. We took advantage of a recently developed transgenic mouse model known as Targeted Recombination in Active Populations (TRAP2) which provides permanent genetic labeling of recently active cell populations in a tamoxifen-dependent manner. TRAP2 mice were crossed with a tdTomato reporter mouse (TRAP2 X Ai9) so that permanently labeled 'TRAPed' neurons would express tdTomato. Mice received a single injection of the tamoxifen metabolite 4-OHT (50mg/kg, i.p.) and were placed in a fear conditioning chamber 90 minutes later. Mice received 5 foot shocks (0.5mA) or no foot shocks (controls) over 8 minutes. After training, mice were returned to their colony room and left undisturbed for 2 weeks. Contextual fear memory was tested 14 days later by placing mice in the same fear conditioning chamber for 8 minutes. No shocks were given during retrieval. Mice were euthanized 90 minutes later. Our results showed that foot shocks significantly increased in freezing during training and memory tests compared to no shock controls. Our future direction will be to count cells in the hippocampus that were active during fear learning and retrieval.

Hassaan Sabir (Dr. John Howland)

Incidental Memory for Objects and Odours: Task Optimization and Neural Substrates

What do you remember about your commute to the university today? Such memory is termed incidental memory, a memory acquired without conscious intention. For my summer project, I helped develop and optimize tests to the study the capacity of incidental memories for objects and odours in rats. Ongoing experiments are using the immediate early gene c-fos to correlate activation of cortico-limbic brain regions that underlie performance of these incidental memory tests.

Prachi Shrestha (Dr. Asmahan AbuArish)

Molecular Origins of COPD: Cigarette Smoke and its effect on KEAP-1, NRF-2 and DJ-1 Expression in Airway Epithelium

Chronic obstructive pulmonary disease (COPD) is primarily caused by prolonged exposure to cigarette smoke which contains substantial amounts of reactive oxygen species inducing airway oxidation. To better understand the molecular mechanisms underlying COPD pathogenesis, we investigated the behaviour of key proteins involved in maintaining oxidant/antioxidant balance (NRF-2, KEAP-1 and DJ-1), by investigating their endogenous expression and localization in human bronchial epithelial cells. Cells were exposed to 10% cigarette smoke extract (CSE) for 2, 4, and 6 hours and compared to corresponding vehicle controls. Our results reveal that following CSE exposure, NRF-2 translocates to the nucleus and exhibits significant increase in its total and cytoplasmic expression. This is consistent with NRF-2 role as a transcription factor in upregulating antioxidants production, implying its active role in maintaining antioxidant/oxidant balance in the airway. Interestingly, under control conditions, KEAP-1 and NRF-2 don't colocalize. We hypothesize that this could potentially be attributed to challenges in epitopes accessibility by antibodies within closely associated proteins. Finally, DJ-1 nuclear, cytoplasmic, and total expression consistently increased post-CSE treatment suggesting its involvement in oxidative stress regulation. However, as DJ-1 and NRF-2 didn't colocalize, it remains uncertain whether DJ-1 acts alongside the NRF-2/KEAP pathway or not due to the aforementioned reasons.

Caleb Hammond (Dr. Anand Krishnan)

Exploring the MANF-NPTN Axis in Peripheral Nerve Regeneration

Peripheral nerve injury affects millions of people worldwide. Severe injuries often result in long-term disabilities in affected individuals. However, no therapies are currently available for restoring the full functions after nerve injuries. This raises the need to identify potent growth-promoting agents favouring axon regeneration and functional recovery. Our lab recently found that the Mesencephalic Astrocyte-derived Neurotrophic Factor (MANF) is a potential growth-promoting agent for peripheral neurons. For example, we and others recently found that MANF induces neurite outgrowth in vitro and axon regeneration in vivo. However, the mechanism for MANF's neurotrophic and neuroprotective actions is unknown. A recent study showed that MANF interacts with Neuroplastin (NPTN), a member of the immunoglobulin superfamily. Therefore, we hypothesized that MANF-mediated peripheral neurite outgrowth may depend on the NPTN receptor. Our experiments showed co-localization of MANF and NPTN in adult rat dorsal root ganglia (DRG). Further, we found a significant parallel upregulation of MANF and NPTN in injured DRGs, indicating a corresponding expression profile for MANF and NPTN. In addition, siRNA-mediated knockdown of NPTN reduced the outgrowth of primary sensory neurons, indicating that NPTN may mediate neurotrophic signalling. Overall, our data suggest that the MANF-NPTN axis may exist in peripheral neurons, facilitating neurotrophic actions.

Aidan Hydomako (Dr. Scott Widenmaier)

Examining the effects of inflammation on the expression of cholesterol metabolism genes

HDL-cholesterol, often referred to as the 'good cholesterol,' plays a critical role in reverse cholesterol transport (RCT), helping to remove excess cholesterol from peripheral cells and transport it to the liver for excretion or recycling mediated by the receptor SR-B1. Chronic inflammation can disrupt this process, leading to cholesterol accumulation in peripheral arteries and the development of atherosclerotic plaques. This prompts questions regarding how inflammation may be regulating genes relevant to cholesterol metabolism. To investigate this, treatments with cytokine-rich media derived from an LPS-conditioned macrophage culture were performed on human hepatocytes. We discovered that both gene and protein expression of SR-B1 was downregulated following exposure to the inflammatory conditions. Gene expression of multiple SREBP target genes was also found to be downregulated indicating an altered synthetic program. Additionally, gene expression of the receptors CD36 and LDL-R was modulated. When the stress-adaptive transcription factors NRF1 and NRF1 were knocked out the secretion of ApoA1, the primary structural and functional protein of HDL, was reduced. Suggesting that NRF1 and NRF2 may serve as important factors in regulating HDL metabolism. Further research in this area could provide insights into potential therapeutic targets for managing cardiovascular health in the presence of chronic inflammation.

Navod Madampage (Dr. Julian Tam)

Improving Mucociliary Clearance in Muco-Obstructive Lung Diseases by Combining Nebulized Hypertonic Saline with TRPV4 Agonists

Cystic fibrosis (CF) is an autosomal inherited disease resulting from mutations in the gene responsible for the cystic fibrosis transmembrane conductance regulator (CFTR). CF symptoms occur due to the impaired transportation of chloride and other ions, resulting in the creation of thick/sticky secretions like mucus in a variety of organs including the respiratory tract. Nebulized hypertonic saline (HTS) has been shown to benefit people with CF by improving airway hydration leading to improved mucociliary clearance. A calcium permeable channel called transient receptor potential vanilloid 4 (TRPV4) is expressed in the respiratory tract and induces ciliary beating via increased intracellular calcium levels. We propose that merging HTS with TRPV4 agonists, including substances like 4α-phorbol-12, 13-didecanoate (4αPDD) and GSK1016790A (GSK), could amplify mucociliary clearance (MCC) in comparison to HTS alone. Freshly dissected swine trachea samples were used to carry out assays for measuring MCC. An MCC assay included the use of tantalum disks (250 µm diameter), krebs solution, and nebulized trachea slices with four treatments [1. HTS, 2. HTS+4αPDD, 3. HTS+GSK, 4. Isotonic Saline (ITS)]. Data showed the mean max speed of treatment 2 was significantly greater than treatments 3 and 4, however, between treatment 1 and 2, there was no significance.

Mahboubeh Pordeli (Dr. Francisco Cayabyab)

Adenosine A1 Receptor Signaling Regulates Equilibrative Nucleoside Transport Expression: Role of Protein Kinase CK2

This study investigates the regulatory interplay between adenosine A1 receptors (A1R) and equilibrative nucleoside transporters (ENT1), with a specific focus on the role of protein kinase CK2. The central hypothesis posits that chronic A1R stimulation leads to receptor desensitization and consequent downregulation of CK2, ultimately impacting ENT1 phosphorylation. This molecular cascade is proposed to play a significant role in the dysregulation of adenosine signaling observed in Parkinson's disease (PD).

To test this hypothesis, a 7-day regimen of chronic A1R agonist CPA injections, both with and without co-administration of DPCPX, was employed in an animal model. Coronal brain slices were generated, and confocal microscopy was utilized for imaging.

The results unveiled a series of interconnected events: prolonged A1R stimulation led to A1R desensitization, followed by the downregulation of CK2, a phenomenon often implicated in neurodegenerative diseases. Remarkably, the highest colocalization between A1R and phosphorylated ENT1 (pENT1) in control samples indicated a potential physical or functional association mediated by CK2.

In conclusion, the desensitization of A1R and subsequent CK2 downregulation appear to be pivotal factors contributing to reduced pENT1 levels. These findings shed light on a novel mechanism governing adenosine signaling in the context of neurodegenerative disorders, particularly PD.

Joanne Jibu Zachariah (Dr. Heather Szabo-Rogers)

Identification of Genes Involved in Nasal Septum Development

Orofacial clefting is the most common congenital anomaly that affects 1/700 Saskatchewan babies. Orofacial clefting refers to the formation of a cleft or gap in the midface, and is modeled using the Prickle1Beetlejuice (Prickle1Bj) mouse line. We performed immunolocalization and in situ hybridization experiments on wildtype mice embryos to determine the location of prechondrogenic cells, and the expression of genes including Prickle1, FOCAD, Dvl3, Collagen2, Sox9 and MoxD1 in the medial nasal prominences (mnp). In situ hybridization results show the co-expression of mRNA for Prickle1, FOCAD, Collagen2 and Dvl3 in the prechondrogenic cells. Expression patterns of Sonic hedgehog (Shh), Fibroblast growth factor8 (Fgf8), Sox9 and Collagen2 in the whole mount suggest the role of these factors in the developing nasal septum. Experiments will continue to test the location of these signaling factors in mutant mice.

Maria Zafar (Dr. Scott Widenmaier)

Investigating Avasimibe as a Novel Therapeutic for Targeting Hepatic Cholesterol Crystallization

Non-alcoholic steatohepatitis (NASH) is a highly prevalent, more aggressive form of nonalcoholic fatty liver disease (NAFLD) characterized by inflammation and high levels of lipid accumulation. Both animal models and patients with NASH have been found to have high levels of cholesterol. Cholesterol is converted to cholesterol esters by sterol-Oacyltransferase (SOAT1) at the lipid droplet. Excess cholesterol can precipitate at the lipid droplet of hepatocytes and form cholesterol crystals. These crystals are proinflammatory and may therefore contribute to the inflammation seen in NASH. Avasimibe is a SOAT1 inhibitor, making it a possible target for preventing crystal formation. We investigated whether treatment with Avasimibe prevents cholesterol crystals in a murine model of NASH generated by hepatocyte specific deletion of stress related defense genes, NRF1 and NRF2. We treated knockout and control mice with either Avasimibe or vehicle for ten days. Cholesterol assays indicated that cholesterol esterification was significantly reduced in the Avasimibe group. As expected, treatment with Avasimibe resulted in no cholesterol crystal formation. Next steps involve histological analysis confirming the effect of Avasimibe on inflammation present in NASH. This study revealed that Avasimibe shows promise as a novel therapeutic for the cholesterol crystallization seen in patients with NASH.

Brynne Stebbings (Dr. Rashmi Bhargava)

Hematocrit as a Predictor of Late-Onset Preeclampsia

Hypertensive disorders are the most common disorders of pregnancy, in which high blood pressure can be dangerous for both the mother and fetus. Preeclampsia is a pregnancy complication that occurs after 20 weeks' gestation and is capable of progressing to end organ damage. Preeclampsia is characterized by new onset hypertension with the presence of one or more adverse outcomes. Elevated hematocrit is a known sign of preeclampsia but has not been well investigated as a predictor of preeclampsia, despite being a component of routine complete blood cell counts (CBCs) performed throughout pregnancy. Our study aimed to look at hematocrit values collected during routine CBC's completed after 24 weeks gestation. We hypothesized that women who developed late-onset preeclampsia would have higher hematocrit values during routine CBC's. Analysis of hematocrit values collected between 3 time points showed that there was no statistical significance between preeclamptic and control patients. However, there was a positive association between blood pressure and hematocrit values. The relationship between hypertension and hematocrit warrants the proposition that hematocrit could be elevated in hypertensive disorders of pregnancy other than preeclampsia. Controlling for hypertensive disorders other than preeclampsia is a realistic consideration for future research directions.

Adam Wandzura (Dr. Julia Boughner)

Regulation of the p63 gene network in non-human primates

The transformation related protein Tp63 (p63) gene is well characterized in mice and humans due to the role of this transcription factor (TF) in congenital syndromic defects and other diseases including cancer. Less is known about this gene and its targets in non-human primates largely because tissue samples from monkeys, apes and prosimians are rare. Just as it is in humans, the p63 gene is likely important for the proper development of multiple primate systems and organs including teeth. Teeth are not only telling of diet and ecology amongst living primates but also of extinct primates who are often best (or only) represented by discoveries of fossilized teeth.

Here we take a two-pronged bioinformatic and molecular approach to investigate the role of p63 in primate development and evolution, with a particular focus on the dentition. We compared and contrasted the four domains of the p63 genomic sequence across 4 primates. Also, among the same primate species we tested for conservation of binding domains amongst a subset of genes known and suspected to be primary targets of the p63 TF protein. Using immunohistochemistry, we probed for conserved expression P63 and target gene products in sectioned dental tissues.

Ali Hussain (Dr. Darrell Mousseau)

Human Brain Organoids Express Protein Profiles More Similar to the Adult Human Brain than the Mouse Brain after 90 Days of Culture

Brain organoids are three-dimensional cultures of neurons and glia generated from induced pluripotent stem cells which are able to fold up and layer themselves similar to an actual human brain. Several brain organoid protocols exist already, although organoids generated with these protocols do not often have microglia (the innate immune cells of the brain), limiting the study and knowledge gained from these models. Our brain organoid protocol gives rise to homeostatic microglia innately, thus serving as a better model than previous ones.

Kirk Haan (Dr. Thomas Fisher)

Osmotically Induced ΔN TRPV1 Translocation in Supraoptic Neurons

ΔN-TRPV1 channels are mechanosensitive and are activated in the osmosensitive neurons of the hypothalamus (ON) by cell shrinkage. Increases in ΔN-TRPV1 activity can increase vasopressin (VP) release from ONs, which enhances water reabsorption at the kidneys to prevent further increases in osmolality. ONs do not undergo acute volume regulation and ΔN-TRPV1 channels instead remain active while the osmotic stimulus is present causing sustained VP release. Unlike other cell types, ONs undergo hypertrophy in response to increases in osmolality lasting tens of minutes or longer. We examined the mechanisms by which ONs maintain ΔN-TRPV1 activity during sustained exposure to high osmolality (e.g., longer than 1 hour). We utilized live cell immunocytochemistry to determine whether plasma membrane ΔN-TRPV1 changed in response to high osmolality. We discovered a process by which ΔN-TRPV1 translocates to the plasma membrane following sustained high osmolality exposure and that the timing coincides with that of ON hypertrophy. We also discovered that ΔN-TRPV1 translocation requires a specific version of an enzyme called phospholipase C d1 (PLCd1). These findings are important contributions to our understanding of how our bodies regulate osmolality and of how dysfunction of certain steps within the process can lead to detrimental outcomes.

Aiden Glass (Dr. John Howland)

Mischief in Memory Tasks: Reevaluating cheating strategies in the odour span task in rats

The odor span task (OST) infers working memory capacity (WMC) by requiring rodents to discriminate between familiar and novel scents and perform a specific action to obtain a hidden food reward. To determine whether rats use mitigating strategies in the OST, rats' responses to novel scents and food cues were assessed. Rats accurately responded to novelty, but also reliably responded to the food scent alone, and performed at chance when both cues were presented in separate locations. Collectively, these results demonstrate the need for rigorous tests of potential mitigating strategies and hold wide implications for rodent odor discrimination-based behavioral tasks.

Khizra Haq (Dr. Michelle Collins)

Exploring Zebrafish Heart Dynamics: Transcriptional Regulation of Cardiac Morphogenesis and Function

Cardiac morphogenesis and function are tightly controlled by transcriptional regulators, as disruptions can lead to phenotypes similar to those found in cardiovascular diseases. Studying disruptions in transcriptional regulators not only provides insights into their role, but also aids in cardiovascular disease treatment. In this study, two transcriptional regulators were investigated: transcription factor EB (TFEB) and pitx2c. Zebrafish were chosen to model cardiac function due to their high genomic resemblance to humans. Pitx2c is a transcriptional regulator involved in the positioning of cardiac structures by repressing left-sided sinoatrial node pacemaker activity. Thus, it is hypothesized that pitx2c mutants will exhibit smaller atrial areas. Whole-mount in-situ hybridization was performed on pitx2c heterozygous in-cross zebrafish at 72 and 120 hours post fertilization (hpf), labeling the atria. Results supported that pitx2c mutants displayed reduced atrial areas, implying pitx2c plays a critical role in early cardiac development. The other transcriptional regulator, TFEB, is involved in the biogenesis of cardiac endosome and lysosome calcium channels. Cardiac calcium channels facilitate calcium movement necessary for heartbeats, so tfeb mutants are hypothesized to have weakened cardiac function. Heart movies from tfeb heterozygous in-cross zebrafish at 120 hpf were analyzed, but the results showed no clear trends among tfeb mutants.

Blisspreet Bhandal (Dr. Juan Ianowski)

Na+/K+-ATPase role in encoding ion flux for apical and basolateral membrane crosstalk in insect Rhodnius prolixus renal epithelia

Epithelial cells are asymmetrically separate into apical and basolateral membranes to allow for the generation of electrochemical gradient for ion transport or ion flux. The coordination between apical and basolateral membranes is driven by Ca2+ oscillation. Ca2+ oscillation encode ion flux information on one membrane surface as Ca2+ frequency and amplitude and the second membrane surface decode Ca2+ oscillations to maintain constant intracellular homeostasis and secretions. It is suggested Na+/K+-ATPase serves as a signal transducer to encode information about changes in ion flux to Ca2+ signaling. In this study, we will determine the role of Na+/K+-ATPase as a possible signal transducer in Rhodnius prolixus Malpighian (renal) tubules epithelia through secretion assays by utilizing Na+/K+-ATPase blocker Ouabain and changes in K+ concentrations from 14.5mM K+ to 2.0mM K+. Secretion droplets were collected from secretion assay every 10 min intervals and measure for diameter to calculate secretion rate (uL/min). The results illustrated that blockage of Na+/K+-ATPase by Ouabain at 100µM and 250µM decreased secretion rate after transfer to lower 2.0mM K+ compared to control groups. Preliminarily the results conclude Na+/K+-ATPase possible serve a role as a signal transducer of ion flux information.

Kaitland Fior (Dr. Michael Levin)

Elucidating mechanisms of neuronal uptake of A1 antibodies in a model of multiple sclerosis (MS)

MS is a neurodegenerative disease that results in the loss of neurons. One characteristic of MS pathology is abnormal RNA binding protein (RBP) function, specifically of the RBP heterogenous nuclear ribonucleoprotein A1 (A1), which MS patients make antibodies against. Addition of anti-A1 antibodies to neurons results in endogenous A1 dysfunction and neurite loss. Previous work by our lab showed that anti-A1 antibodies enter neurons, however the mechanisms mediating anti-A1 antibody entry into neurons are poorly understood. We hypothesize one pathway of anti-A1 antibody uptake into neurons occurs through antibody binding the FcγRIII(CD16) receptor. Neuro-2a cells and primary mouse neurons were treated with anti-A1 antibodies, which were found within cells as early as 15 minutes post-addition. Addition of anti-A1 antibodies to both cell types resulted in a 50% increased band density of FcγRIII expression by Western blot compared to untreated cells. Preliminary evaluation of FcγRIII function was performed showing Neuro-2a cells treated with anti-A1 antibodies had increased intracellular calcium fluorescence compared to those pre-treated with a FcγRIII blocker, indicative of anti-A1 antibodies binding FcγRIII receptors. These data highlight one potential mechanism of anti-A1 antibody entry into neurons occurs through FcγRIII, which may contribute to the pathogenesis of antibody-mediated neurodegeneration in MS.

Ashley Fisher (Dr. Veronica Campanucci)

Modelling the Gut-Neuron Interaction in Cystic Fibrosis Using Intestinal Organoids

Cystic Fibrosis (CF) is a severe and life-threatening disease, with effects most notably seen in the respiratory system. However, patients also experience a number of extrapulmonary complications, the most common of which are gastrointestinal (GI) dysfunction and pain. Given recent research showing the effects of CF on the peripheral nervous system (PNS), as well as the innervation of the gut by the PNS, we developed an in vitro model system of intestinal organoids and sensory neurons to test the possible contributions of the PNS in the GI complications of CF patients. This study consists of two major objectives, which are the development of the organoid-sensory neuron system, and the testing of the neuron's role in GI dysfunctions. The first objective has been accomplished over the course of the summer, with innervation of the intestinal organoids by the sensory neurons being seen, while the second objective will be investigated in the future of this study.

Lorynn Labbie (Dr. Michelle Collins)

Elucidating the Function of Pitx2c in Cardiac Conduction System Patterning

Heartbeat is established by a cellular network known as the cardiac conduction system (CCS). The transcriptional network that patterns the CCS is highly conserved between humans and zebrafish. When CCS development is disturbed, cardiac arrhythmias, such as atrial fibrillation (AF), can occur. Pitx2c is a transcription factor potentially linked to AF pathogenesis and restricts sinoatrial node (SAN) pacemaker cells to the right side of the heart by acting within the CCS transcriptional network. If Pitx2c is a negative regulator of SAN development genes, we hypothesize that zebrafish with pitx2c mutations will display enlarged SAN regions and disorganized conductive tissue marker expression.

In this study, in situ hybridization was performed on 72- and 120-hours post-fertilization zebrafish to examine expression of tbx3a, tbx5a, tbx18, isl1a, shox2, hcn4, and hcn2b. Increased tbx18 expression was observed in pitx2c+/- and pitx2c-/- zebrafish and increased hcn4 expression was observed in pitx2c+/- embryos. Immunohistochemistry was then employed to visualize Cx40 and Cx43 gap junction protein expression in adult zebrafish hearts. Cx40 expression appeared increased in the ventricle and less diffuse in the atrium of pitx2c+/- and pitx2c-/- versus wildtype zebrafish. No obvious Cx43 expression differences were observed between genotypes. Future experiments will focus on quantifying gene expression.

Biochemistry, Microbiology & Immunology

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Rylan Bahrey (Dr. Aaron White)

Characterizing the Interactions Between Bacteria and Human Amyloid Proteins

Neurodegenerative diseases (ND) are a class of disorders that involve the abnormal processing and accumulation of proteins, called amyloids, within the central nervous system. Global prevalence of ND is high, with upwards of one billion people (1 in 6 individuals) currently suffering from some form of neurodegenerative ailment. Salmonella and E. coli bacteria are common causes of human illness worldwide and would seem to have no connection to ND. We and others have shown that Salmonella and E. coli can form biofilms, dense collections of bacteria, within the digestive tract during infections. Salmonella and E. coli both produce curli, a key biofilm protein that happens to be a bacterial amyloid. Curli proteins have a similar 3D structure to amyloid beta, a protein that accumulates as plaques in the brain of Alzheimer's disease patients. Our hypothesis is that curli produced in the human intestine can interact with amyloid beta and other human amyloids and stimulate their misfolding, perhaps triggering ND.

Abdullah Qureshi (Dr. Michael Wu)

High-throughput Identification of Chemicals Associated with Dopaminergic Neurodegeneration

Our environment is a key determinant of human health and recent research has proven chronic exposure to chemicals - even at low concentrations - can lead to chronic diseases. Therefore, my aim was to identify any previously uncharacterized novel environmental chemicals that may induce neurodegeneration and be a risk factor for Parkinson's disease. In the Wu lab, we utilize the genetic organism Caenorhabditis elegans which are perfect for my project as they are model organisms for evaluating developmental neurotoxicology. The transgenic strain of C. elegans used for this study expresses a dual reporter system: red-fluorescent protein (RFP) linked to dop-3 (dopamine receptor-3) gene and green-fluorescent protein (GFP) linked to dat-1 (dopamine transporter-1) gene allowing us to visualize these two dopaminergic markers that are expressed in muscle and neurons respectively to identify chemicals that exhibit dopaminergic neurotoxicity. I screened this strain of worms against the U.S EPA ToxCast library which consists of around 4665 chemicals to identify any that exhibit neurotoxicity and/or induce locomotor defects. As a result, we identified 11 chemicals ranging from herbicides, fungicides, ink toner and glaze for ceramics, additives for condiments, medicine components, dyes and industrial reagents that require further experimentation.

Alina Sami (Dr. Linda Chelico)

The Restriction of Coronavirus by APOBEC3 Enzymes

The APOBEC3 (A3) family of enzymes are 7 host restriction factors that suppress retroviruses like HIV by inducing a type of mutation, called deamination, in viral genomes. Deamination involves modifying the cytosine bases into the uracil base in single-stranded nucleic acids. This base change is a direct mutation in RNA genomes and is promutagenic in DNA genomes and results in improperly folded or non-functional viral proteins that ultimately decrease the replication capacity of the virus. Although A3s have typically been studied for their restriction of the HIV virus, an overwhelmingly high rate of A3-induced uracils have also been detected in SARS CoV2 genomes. However, the A3 responsible and the effect of these mutations on the coronavirus is not clear. A3-induced mutations should decrease viral infectivity or transmissibility, but in some cases have been found to enhance infectivity. We hypothesized that multiple A3 enzymes can restrict coronaviruses by deaminating the viral RNA genome. Through our work so far, we found that the ability of A3 enzymes to inhibit the coronavirus depends on the A3 expressed, with A3F-expressing cells showing greater viral restriction compared to cells not expressing A3F, and A3C expression showing no significant effect. Overall, these data will enable us to understand the molecular host and pathogen interactions, which will lead to identification of vulnerabilities of the virus to the host and therapeutic targets against SARS CoV2.

Enrique Aburto Arreguin (Dr. Jessica Sheldon)

Molecular Mechanisms of histamine sensing and response in food spoilage microorganisms

In humans, histamine serves as an important role as a signaling molecule with many functions, such as a neurotransmitter and an immunomodulator. Recent research has shown that bacteria are capable of producing, sensing, and transporting histamine and histamine metabolites in their environment. Improper storage of fish species with naturally high levels of histidine (e.g. tuna) can lead to the conversion of histidine into histamine by Gram-negative bacteria that inhabit the gills and gastrointestinal tracts of these fish. This conversion is done by the enzyme histidine decarboxylase. Consumption of fish with elevated histamine levels can result in scombroid poisoning, with symptoms similar to those of an allergic reaction such as hives, flushed skin, diarrhea, and vomiting. We hypothesized that the fish spoilage bacterium Morganella morganii can sense, transport, and respond to histamine in various ways in order to facilitate activities such as nutrient acquisition and niche determination. We determined that M. morganii is capable of producing histamine when grown in acidic media, high concentrations of histamine inhibit the growth of M. morganii in rich media, and that the histamine synthesis and transport gene cluster is highly conserved in our tested isolate when compared to a reference genome.

Lois Blas (Dr. Jeffrey Chen)

Examining the effect of inhibiting p-HBAD synthesis by the live Bacillus Calmette Guérin (BCG) vaccine on its protective efficacy against tuberculosis disease

Bacillus Calmette-Guérin (BCG) is the only approved vaccine against tuberculosis. However, the protection provided by BCG diminishes as infants get older and is inefficient in protecting against tuberculosis disease in adults, requiring the need to improve the BCG vaccine. Research has found that the surface structure of M. tuberculosis and M. bovis contains glycolipids and glycans that have roles necessary for the bacteria to cause infection. Previous research has discovered that the glycan para-hydroxybenzoic acid derivatives (p-HBADs) have immunosuppressive effects on immune cells, leading to our hypothesis that BCG deficient of p-HBAD might be more immunogenic and therefore more protective against tuberculosis. Chorismate pyruvate lyase is the gene found responsible for the synthesis of p-HBADs and phenolic glycolipids (PGLs) in BCG. Previous research has shown that para-hydroxybenzoic acid (4HB) inhibits the production of p- HBADs through competitive inhibition, while vanillic acid is a weak inhibitor of cpl. The objective of this project is to grow BCG in media containing 4HB and vanillic acid which is expected to inhibit the production of p-HBADs and PGLs by BCG. Our findings show that 4HB and vanillic acid have inhibitory properties towards the growth of BCG. Results from lipid analysis show an increase in the production of p-HBAD by BCG, while the production of PGL remains the same. Overall, we found that 4HB and vanillic acid did not inhibit the synthesis of p-HBAD by BCG and has increased it instead.

Christine Joyce Francisco (Dr. Jessica Sheldon)

The co-opting of common goods: Mechanisms of xenosiderophore uptake by Acinetobacter baumannii

Acinetobacter baumannii is a multidrug-resistant pathogen that thrives in nutrient-scarce conditions and efficiently acquires essential iron through small iron-binding molecules called siderophores. A. baumannii acquires nutrients using 21 TonB-dependent receptors (TBDRs), nine of which are metal-regulated and thought to be involved in siderophore and potentially fungal xenosiderophore uptake, and three known to be involved in endogenous siderophore uptake. A. baumannii can cause co-infections with fungi, suggesting it may use some of these TBDRs to co-opt xenosiderophores to facilitate its survival in nutrient-scarce environments. This study investigates A. baumannii's use of fungal xenosiderophores under iron limitation via TBDRs. Growth curves were used to evaluate siderophore utilization, conducted in triplicates, and analyzed statistically using GraphPad Prism. We show that A. baumannii can use fungal xenosiderophore, ferrichrome, as an alternative iron source when its own siderophore transporters are lacking, and that an undefined siderophore transporter (16050) influences its iron-dependent growth. Future work involves evaluating ferrichrome's support of A. baumannii growth using siderophore uptake assays, confirming the metal-regulated expression of the nine TBDRs, and creating a deletion mutant of an iron-regulated xenosiderophore TBDR to determine its role in siderophore utilization. Lastly, other fungal chelators' impact on growth under iron limitation will be explored.

Rebecca Iyoha (Dr. Yuliang Wu)

Assessing the Role of DDX41 Helicase in Homologous Recombination Repair, Myelodysplastic Syndrome and Acute Myeloid Leukemia

DEAD-box helicase 41 (DDX41) mutations are associated with hematologic malignancies myelodysplastic syndrome (MDS) and acute myeloid leukemia (AML). Genome instability is one of the causes of MDS and AML. Our preliminary results suggest that DDX41 facilitates homologous recombination (HR) repair by resolving R-loops, but the exact role of DDX41 in HR repair is not known. We hypothesized that DDX41 facilitates HR repair by resolving R-loops, and dysregulation of this pathway may lead to genome instability and MDS/AML. To test this, we performed immunofluorescence at different time-points post-DNA damage treatment (bleomycin) and found that DDX41 did not colocalize with double strand break (DSB) marker γH2AX. Secondly, we did flow cytometry on three GFP report cell lines that represent different DNA repair pathways and found that all three repair pathways were affected when DDX41 was knockdown. Thirdly, we used a dot blot to detect DDX41 and R-loop interactions and found there was increased interaction after bleomycin treatment. In conclusion, DDX41 is required for DSB repair, including HR, SSA (single-strand annealing) and NHEJ (non-homologous end joining) pathways but it is not localized to DSB sites. DDX41 directly interacts with R-loops. Therefore, further studies are required to determine DDX41's exact role in DSB repair.

Matt Ritchie (Dr. Peter Pioli)

Interferon-Mediated Regulation of Thymus Antibody-Secreting Cell Generation

Background. B cells play an important role in the adaptative immune system due to their ability to sense pathogens and differentiate into antibody-secreting cells (ASCs). Upon their differentiation, ASCs continuously produce antibodies which protect from pathogenic infection. Thymic ASCs are of importance as they have the potential to be expanded and autoreactive in autoimmune diseases such as myasthenia gravis. Toll-like receptor 7 (TLR7) is shown to promote the release of the cytokines Interferon (IFN) I, II, and III all of which share considerable functional overlap. In the thymus IFN I, II, and III are constitutively expressed from epithelial cells.

Hypothesis. This leads us to hypothesize that TLR7 stimulation, via an agonist such as imiquimod (IMQ), and subsequent IFN signaling will act to promote ASC generation in the thymus.

Methods. We aim to explore IFN mediated regulation of thymus ASC by stimulating TLR7 with IMQ in low (2ug), and high (20ug) doses at 2 and 7 days. We will quantify the effects of IMQ using flow cytometry to stain cells for ASC specific surface proteins/markers and analyze the population sizes as well as perform quantitative PCR using TaqMan primers specific for mRNA sequences of IFN inducible genes.

Ally Seifert (Dr. Jeff Dong)

Inflammation and Senescence in Chronic Neurodegeneration

Multiple sclerosis (MS) is a debilitating neuroinflammatory disease characterized by demyelination and neurodegeneration in the central nervous system (CNS). Unfortunately, MS patients develop irreversible disability as they age due to chronic neurodegeneration, and effective therapeutics remain lacking. Oxidative phosphatidylcholines (OxPC) are critical biomarkers of oxidative stress in MS. We previously demonstrated that they are highly neurotoxic molecules requiring microglia for clearance. Importantly, we also found aging exacerbated acute OxPC damage in the CNS, partially by impairing microglia function. Since OxPC are elevated in chronic MS lesions where reactive microglia/macrophages accumulate, we hypothesize that OxPC deposition in the CNS can promote chronic neurodegeneration and that aging alters the behaviour of microglia in chronic lesions. To test this hypothesis, we injected purified MS-relevant OxPC into the spinal cord white matter of young and aging mice and analyzed acute (day 7) and chronic (day 42 and day 100) lesions using confocal microscopy. Specifically, we compared microglia/macrophage proliferation (KI67), cellular senescence (H2-AX, P16), and neurodegeneration (βAPP). Our results suggest decreased proliferation, increased microglia/macrophage senescence, and worsened neurodegeneration in chronic OxPC lesions. Collectively, we provide new insights into how microglia/macrophages respond to chronic OxPC injury in the CNS and how aging may modify their response.

Kyle Vincent (Dr. Aaron White)

Characterizing Bet-Hedging in Salmonella Dual-Reporter Strains

Non-typhoidal Salmonella species are the leading cause of acute gastroenteritis or what is commonly known as “food poisoning” with an estimated prevalence of 94 million cases and approximately 155,000 deaths a year. To transmit and cause disease among humans and animals, Salmonella must cycle between an environmentally protected biofilm state and a virulent planktonic state. Before exiting a host, bet-hedging mechanisms are utilized to differentiate cells into biofilm or planktonic states in stable, strain-specific proportions. It is hypothesized that bet-hedging increases the likelihood of Salmonella transmitting and causing disease by allowing for immediate reinfection of a new host or survival under harsh and unpredictable environmental conditions. Using dual-reporter strains of Salmonella Typhimurium (STm) that allow for the identification of cells either in a biofilm (GFP) or planktonic (mCherry) state through confocal microscopy, I could quantify the proportions at which various Salmonella strains bet-hedge their populations in biofilm flask cultures. Through this research, it was found that each of the dual-reporter strains displays bet-hedging in proportions that are like their wild-type phenotypical presentation. For example, STm D23580, an invasive host-adapted strain displays impaired biofilm expression, while STm 14028 expresses biofilm at higher proportions due to its evolutionary adaption towards environmental survival.

Kaylen Young (Dr. Oleg Dmitriev)

Interactions Between the Metal Binding Domains of the Copper Transporter ATP7B and the Membrane Transport Protein CTR1

ATP7B is a P-type ATPase copper transporter that maintains homeostatic copper levels in human cells. Copper enters the cell through CTR1, a passive transporter in the plasma membrane. As it is released into the cytosol, copper is accepted by the metallochaperone ATOX1, then ATOX1 transfers copper to one of the six metal binding domains (MBDs 1-6) of ATP7B. The MBDs are connected by long flexible loops that allow a wide range of molecular motions and facilitate interactions with ATOX1 and, possibly, other proteins. We know that at high copper levels, ATP7B traffics from the trans-Golgi network to the cytosolic membrane vesicles and the plasma membrane, where it excretes excess copper from the cell. In this state, we propose that ATP7B may accept copper directly from CTR1 without mediation by the metallochaperone ATOX1. In this study, we used isothermal calorimetry (ITC) experiments to see if binding occurred when CTR1 was titrated into the MBDs. Results from the ITC experiments suggested weak binding between CTR1 and MBD2, indicating that ATP7B can accept copper from CTR1 without the metallochaperone ATOX1. These results were followed with NMR experiments showing the chemical shift indicative of this binding event.

Nelson Archer (Drs. George Katselis and Ed Krol)

Synthesis of a Trifluoroacetate Precursor for the Development of a Diazirine Photoaffinity Probe for DPE binding to a-synuclein

Aggregates of the neural protein a-synuclein are present in Lewy Bodies in the brains of Parkinson's Disease patients and compounds that inhibit a-synuclein aggregation are under investigation as possible therapeutics for Parkinson's Disease. Previously we reported that diphenylethanes (DPEs) can inhibit a-synuclein aggregation in vitro but do not know the amino acids on a-synuclein involved in the interactions with DPEs. To identify these interactions and better understand the amino acids that play a role in a-synuclein misfolding, we propose to use diazirine-labelled DPEs as photoaffinity labelling probes. Photoaffinity probes incorporate a stable functional group (diazirine) which allows the probe to interact with its target, the diazirine is then activated with ultraviolet radiation to form a reactive carbene which forms a covalent bond to the protein. Mass spec proteomics are used to determine the binding region on the protein.

We are developing and optimizing methods to synthesize the trifluoroacetate substituted DPE precursors of the diazirine-labelled DPEs. We adapted a Wittig reaction to couple 3-bromo-4,5-dimethoxybenzaldehyde and 3,4-dimethoxybenzyl alcohol followed by Pd-catalyzed hydrogenation to form the bromo-DPE (6). Bromo-DPE was then converted to the trifluoroacetate-DPE (7) using n-BuLi and trifluoroacetyl piperidine. This reaction was low yielding (20%) and will require further optimization.

Oluwaseun Ogunniyi (Drs. Changiz Taghibiglou and Anas El-Aneed)

Development of an Analytical Methods to Identify INDIP, a Novel Peptide for Acne Treatment

Although Acne is a common problem amongst adolescents, it does affect individuals of all ages . INDIP, a novel 22 amino acid peptide, has shown therapeutic efficacy against Acne. The present study was aimed at developing a novel analytical method for the identification of the INDIP peptide in pharmaceutical formulations. Being a novel therapeutic product, the mass spectrometric behavior of INDIP in full scan and in tandem mass spectrometry (MS/MS) modes was first established. Acetonitrile and Water (1:1) were used for the preparation of 0.022M peptide solution. Liquid chromatography (LC)--MS/MS was used to separate the peptide from other contaminants. We are currently working on developing isolation strategies to extract INDIP from commercial pharmaceutical formulations.

RESEARCH QUESTION - there is an urgent need to develop detection method to measure INDIP in pharmaceutical formulations to protect the intellectual property of both the inventors and University due to possible infringement on USASK patent.

Payton Sayers (Dr. Stephen Lee)

Impact of pre-existing comorbidities on adverse outcomes in elderly COVID-19 patients: A Saskatchewan population-based retrospective cohort study

Older patients and patients with multiple and complex comorbidities have poorer outcomes from COVID-19. We aimed to assess COVID-19 inpatient major adverse event (MAE) rates in ≥80 years old COVID-19 patients and younger patients and to determine the pre-existing comorbidities associated with increased risk of MAE in elderly COVID-19 patients. This Saskatchewan-based retrospective cohort study compared 100 elderly patients ≥80 years old to 100 younger adult patients 19-79 years old. Data collected included patient demographics, health information, specific conditions from the Charlson Comorbidity Index, and details of inpatient hospital stay while COVID-19+. The relationship between comorbidities and MAEs was examined using a multivariable logistic regression model. We found patients ≥80 years old experienced a higher rate of all-cause mortality compared with those aged 18-79 years old (35% vs. 17%, P=0.006). In the overall patient cohort, higher odds of all-cause mortality were observed in age ≥80 years old (≈4.4-fold), males (5.3-fold), ICU admission (≈8-fold), and those with pre-existing COPD (≈2.4-fold), cerebrovascular disease (≈3.9-fold) and diabetes without complication (≈4.6-fold). Public health and mitigation efforts need to focus on the very elderly populations with targeted interventions in long term care facilities to prevent spread of COVID-19 or early identification and treatment with antivirals.

Jake Hesselink (Dr. Michael Levin)

Targeting A1 Clustering to Prevent Neurodegeneration in an Optogenetic Model of Multiple Sclerosis

Multiple sclerosis (MS) is an autoimmune disease characterized by demyelination and degeneration of neurons in the central nervous system (CNS). Dysfunction of RNA-binding proteins, like heterogeneous nuclear ribonucleoprotein A1 (A1), has been proposed as a mechanism for neurodegeneration in MS. A1 has been shown to aggregate and mislocalize in MS, and A1 self-association has been shown to cause cell stress. By treating cells with a molecule (Molecule 3) that targets the A1 self-associating domain, we hypothesize that we will reduce A1 clustering, cell stress and neurite loss. We used optogenetics to transfect neuro-2a (N2A) cells with OptoA1mCh linked to Cryptochrome 2 optogene, such that A1 would self-associate under blue light (BL) and could be visualized with fluorescence microscopy. In differentiated N2As, we used live-cell imaging to quantify neurite loss and an anti-peIF2S1 tag to quantify cell stress. Cells treated with Molecule 3 showed significantly less neurite degeneration after 3 hours of BL stimulation, with a trend of reduced A1 clustering. BL caused significant cell stress except in cells treated with Molecule 3, though further studies are needed to demonstrate significant stress reduction. These results suggest disruption of A1 self-association may be a target to prevent neurodegeneration in MS.

Eric Wang (Drs. Pouneh Dokouhaki, Fang Wu, and Ahmed Mostafa)

HLA Eplet Based Risk Stratification in Kidney Transplantation

Patient characteristics, Human Leukocyte Antigen (HLA) mismatch, and laboratory results have been shown to be ineffective in risk assessment and prediction of kidney graft outcomes. However, there remains a need for risk assessment of transplant patients to personalize immunosuppression and thereby minimize side effects including infection and malignancy. There has been prior evidence that the number of HLA eplet-mismatches at the HLA-DR and DQ loci are associated with de novo DSA (dnDSA) formation, graft rejection, and failure. To assess the association of eplet mismatches with dnDSA formation, we collected data from 500 patients transplanted in Saskatchewan from 1990 up to July 2022. We established high-resolution HLA-typing through a blend of high-resolution sequencing and Haplostat prediction, initially relying on low-resolution typing data. Eplet-mismatches were calculated using the HLA Matchmaker tool. Multivariable analysis demonstrated a significant association between eplet-mismatches and the formation of HLA-A ($p=0.0064$), B ($p=0.0318$), C ($p=0.0215$), DR3/4/5 ($p=0.0004$), and DQ ($p=0.0001$) -specific dnDSA. Furthermore, we determined eplet-mismatch thresholds beyond which patients can be classified at high risk of dnDSA formation. Therefore, eplet-mismatch can serve as a valuable clinical resource to assist in the prediction of patient prognosis, guide personalized immunosuppression, and improve transplant outcomes.

Ngoc Minh Tuyen Nguyen (Dr. Yuliang Wu)

DDX41 Helicase in P-bodies Formation

DDX41 is a member of the DEAD-box helicase family, and mutations in this helicase are observed in patients with myeloid malignancies, including myelodysplastic syndrome (MDS) and acute myeloid leukemia (AML). P-bodies are cytoplasmic granules that increase in size and frequency in stressful conditions. Their functions include storing proteins needed for translation repression and mRNA degradation. This project aims to study the impacts of DDX41 helicase on P-bodies formation, to better understand the role of mutated DDX41 in P-bodies dysregulation, due to both being associated with myeloid malignancies. P-bodies proteins DCP1A and EDC4 were examined and compared between wild-type (WT) and DDX41 knockout (KO) cells under the influences of ER stressor NaAsO2 and oxidative stressor glucose-free media. Using Western blot to measure the protein expression levels, we concluded that DDX41 influences EDC4 but not DCP1A's expression levels. Using immunofluorescence, we concluded that DDX41 is required for P-bodies formation under NaAsO2 treatment but not glucose starvation.

Jian Park (Dr. Jeff Dong)

Oxidized Lipids Induce Microglia and Macrophage Cell Death

Multiple sclerosis (MS) is a chronic neuroinflammatory disease characterized by demyelination and neurodegeneration in the central nervous system (CNS). At steady state, axons are myelinated by sheaths of lipids that aid in electrical conduction but during MS the oxidation of myelin associated lipids can lead to the production of cytotoxic molecules such as oxidized phosphatidylcholines (OxPC). Our previous research found OxPC elevation in MS lesions and their injection into the spinal cord white matter of mice induced demyelination and neurodegeneration. These OxPC-induced white matter lesions contains clusters of microglia/macrophages, which are the primary immune cells that respond to OxPC deposition in the CNS. How microglia/macrophages respond to OxPC-induced lesions needs additional investigation. To assess the response of microglia/macrophages to OxPC, we stimulated microglia/macrophages in vitro with oxidized 1-palmitoyl-2-arachidonoyl-sn-glycero-3-phosphocholine (OxPAPC) or 1-palmitoyl-2-(5'-oxo-valeroyl)-sn-glycero-3-phosphocholine (POVPC). In addition, we stimulated monocytes, precursor cells to macrophages, with OxPAPC and POVPC. Over the period of 20 hours, we observed cell death and lipid peroxidation in both the monocyte and microglia/macrophage cultures. We anticipate our results will aid future experiments in understanding how microglia/macrophages respond to OxPC, thereby better informing their function in the context of oxidative stress injury in MS.

Eric Luo (Dr. Jenny Wachter)

Investigating Borrelia burgdorferi outer membrane vesicles and phage

Borrelia burgdorferi is the causative agent of Lyme disease and is the leading cause of tick-borne illness in North America1. B. burgdorferi (Bb) exists in nature in an enzootic cycle where it transitions between a vertebrate host and an Ixodid tick vector2-4. Because of these disparate environments, Bb encodes many surface-exposed proteins that are differentially expressed and are important in tick transmission and mammalian virulence5-11. Additionally, Bb has been shown to slough off its outer membrane to produce outer membrane vesicles (OMVs) both in vitro and in vivo12. During culture of Bb, outer surface proteins associated with the tick vector are detected in BbOMVs12,13. However, artificial induction of the alternative sigma factor, RpoS, results in the presence of immunogenic proteins expressed during vertebrate infection in BbOMVs14. We have recently engineered a strain which induces expression of outer surface proteins involved in vertebrate infection and produces large amounts of BbOMVs in response to the un-modulated over-expression of RpoS15. This strain also induces prophage encoded by the cp32 plasmids. We would like to further characterize the OMVs and prophage produced by this Bb strain through defining the surface-exposed proteins present in BbOMVs produced during un-modulated RpoS expression and phage isolation.

Kirrat Ahmad (Dr. Nazeem Muhajarine)

See us, Hear us: Children, youth and families coping with mental health during the pandemic

COVID-19 and related restrictions resulted in unhealthy behaviours (increased screentime (ST), decreased physical activity (PA), poor sleep quality) and poor mental health (poor mood states) or have exacerbated them. As part of an ongoing study "See us, hear us 2.0" we aimed to address the impact of COVID-19 on mental well-being (measured by the CoRonavIrus Health and Impact Survey (CRISIS) scale) in children and youth and on indirect impacts (school experience, ST, PA, sleep, and social connectedness) two years into the pandemic in Saskatchewan. We hypothesized that youth (8-18 years) who experienced negative indirect impacts will have poor mental health outcomes; and further exacerbation of poor outcomes in equity-seeking groups. A cross-sectional study design was used. Data were analyzed using regression analyses (nominal and binary). The CRISIS scale was used to assess mental health outcomes. Decreased PA, and increased ST persisted two years into the pandemic, but to a lesser magnitude; each indirect impact measured had significant associations with individual CRISIS items (e.g., tiredness, loneliness, happy vs. sad, restlessness, irritability), suggesting an impact on mental well-being. The negative impacts two years in are more subtle than they were in the early months (March-June 2020) but present.

Yara Al-Haroub (Dr. Niels Koehncke)

Blood Lead Levels and Hand Surface Lead in Private Practice Veterinary Workers

A previous study found high surface lead on the inside of lead protective equipment worn by veterinary workers during radiography, resulting in the contamination of hands and raising concern for risk of oral-dermal lead exposure.

This study aims to compare lead blood concentrations in veterinary workers using lead shielding with control population. Measure hand surface lead before and after use of shielding, and to quantify surface lead on reception and radiology keyboards.

Workers from all clinics in Saskatoon were invited to complete a survey assessing the frequency of radiology shielding use, with the goal of identifying 50 participants. Of all the people surveyed only 19 workers met the control criteria of no history of lead shielding use in the last 6months, and 31 workers were included in the exposed group. Potential lead transfer between workers was assessed by sampling clinic keyboards at reception and in the radiology area. Preliminary data show significantly higher surface lead on hands post-shielding (mean difference 2.4µg, 95% CI 0.27-4.4µg, $p = 0.03$) compared to pre-shielding.

Early data is consistent with previous study demonstrating increased hand surface lead after handling radiology shielding. Blood and hand surface wipe lead measurements will be completed in winter 2024.

Julia Billingsley (Dr. Janet Tootoosis)

Response to TRC Call 24: Implementation of a Mandatory Indigenous Health UGME Course at the University of Saskatchewan

This project delves into the response to Call to Action #24 at the University of Saskatchewan's College of medicine, which introduces the requirement of Canadian medical and nursing schools to ensure their students take a mandatory course on Indigenous health issues. In order to do this, we completed a literature review on the integration of Indigenous Health in a medical school curriculum and an environmental scan on current efforts at medical schools across Canada. Semi-structured interviews were also completed with various faculty, staff, and medical students at Usask's College of Medicine.

Samantha Mannala (Dr. Nazeem Muhajarine)

Documenting the Wider Impacts of COVID-19 on Four Focus Areas through Data and Stories

Simultaneous to the upward trends in transmission and deaths due to COVID-19 in Saskatchewan, social health challenges surged during the pandemic. Our aim is to illuminate the impacts of the pandemic on four focus areas (food insecurity, housing precarity and houselessness, mental health, and substance use), drawing on qualitative methods to describe how the pandemic affected health equity in Saskatchewan.

24 semi-structured interviews were conducted between March and May 2023. Interviewees were in urban, remote/rural, and First Nations communities. Audio files were transcribed into text documents through OtterAI, an artificial intelligence transcription service. The research team verified the transcripts, and the finalized versions were used for data coding and analysis. A coding framework was developed and adapted to be used in Nvivo, a qualitative data analysis software.

Our analysis found key themes regarding increases in food insecurity during the COVID-19 pandemic, along with modified programming, community support, and food shortages. We also noted a deterioration in mental health across communities, an increase in housing precarity along with challenges with housing the un-housed and applying public health guidelines in shelters and ASIS hotels. Lastly, we found an increase in substance use, including more overdoses and an increased toxic illicit drug supply.

Yousef Saber Omar (Dr. Peter Spafford)

Survey of HPV and Oropharyngeal Cancer Awareness Among Immigrants to Canada

Objective: Human papilloma virus (HPV) associated oropharyngeal squamous cell carcinoma (OSCC) rates are on the rise, and vaccine hesitancy continues to be a contributing factor to this rise. Insight into HPV-associated OSCC awareness among the patient population is imperative to informing effective public policy and education campaigns. Although surveys assessing HPV awareness have been previously conducted in Canada, none have focused on the immigrant population who may face additional barriers to accessing vaccinations and public health education due to their immigrant status.

Methods: 115 participants recruited through posters and in-person in collaboration with Saskatoon immigrant welcome centers. Cross-sectional 22-item questionnaire administered through SurveyMonkey software. Responses collected and data extracted. Chi-square testing and descriptive analysis conducted. Methods approved by University of Saskatchewan REB.

Results: 35 immigrant, 85 non-immigrant participants. Immigrants more likely to not have heard of HPV pre-survey ($X2=13.68$, $p<0.01$), less likely to be aware of HPV as a causative factor of OSCC ($X2= 6.83$, $p<0.01$), less likely to be aware of vaccine availability ($X2= 24.1$, $p<0.01$), more likely to believe HPV vaccine is dangerous ($X2= 11.55$, $p<0.01$).

Conclusions: Increased HPV and associated OSCC public health efforts are required to ensure Canada's immigrant population is adequately educated and protected from preventable malignancies.

Erin White (Dr. Rachel Engler-Stringer)

Measuring Good Food: Using Plate Waste Data Collection with Digital Photography to Assess School Food Programs

Nutrition supports learning and health in children. Children consume approximately one-third of their energy intake within school hours, rendering schools a powerful environment for nutritional intervention. Canada is one of the few OECD countries yet to establish a national school food policy, and there is a need for more Canadian data on the implementation of universal school food programs (SFP). The Good Food for Learning project is a population health intervention study of a curriculum-integrated SFP. To compare the nutritional quality of the intervention and control schools, a plate waste data collection method was employed, combining digital photography, measurement of food mass consumed, and written notes on food content. Throughout the data collection process, lessons emerged surrounding the strengths and challenges of the plate weight method and how this methodology might contribute to larger-scale projects surrounding SFPs. A key theme in this project was the strength of the efficient digital photography method in minimizing classroom disruption while also collecting large volumes of data. While the nutrition analysis of the data collected is still ongoing, these reflections show promise in allowing large and geographically-dispersed volumes of food intake data to be collected, serving our overall knowledge of healthy food in schools.

Emergency Medicine

Zoey Bourgeois (Dr. Sachin Trivedi)

A Before and After Assessment of the Impact of an Early Pregnancy Assessment Clinic on Emergency Department Utilization by People Experiencing Complications of Early Pregnancy

Background: Complications of early pregnancy are common and estimated to account for 1.6% of Emergency Department (ED) visits in Canada annually. The Early Pregnancy Assessment Clinic (EPAC) is a new outpatient-based care model in Saskatoon designed to provide timely follow up and essential management to these patients.

Objective: This study aims to assess the impact of the Saskatoon EPAC on ED visits and health care utilization by patients with complications of early pregnancy.

Methods: We performed a retrospective chart review of visits to the ED with complications of early pregnancy in the 6-month period preceding and following the opening of the EPAC. Descriptive statistics were calculated to assess for changes in health care utilization pre- and post- EPAC opening.

Results: Thus far, we have completed early analysis of the EPAC data and have shown that while the number of patients returning to the ED for complications of early pregnancy have remained stable, ED visits for this complaint have been reduced and inpatient gynecology consults have been reduced by 39.9%.

Conclusion: Early analysis of the EPAC clinic shows some reduction to in-patient based services for patients experiencing complications of early pregnancy.

Kate DeVito-Porter (Dr. Paul Olszynski)

Chest Compressions under Transesophageal Echocardiogram Guidance: Analysis of Healthcare Provider Experience

Background

Transesophageal Echocardiography (TEE) during cardiopulmonary resuscitation (TEE-CPR) offers real-time, sonographic guidance during cardiac arrest. TEE-CPR during compressions helps identify an optimal area of compression (AOC), improving hemodynamics. However, it is unknown to what extent performing TEE-CPR compressions vary from standard CPR (S-CPR). The objective of this study is to examine the characteristics of TEE-CPR compressions compared to S-CPR.

Methods

The mixed methods 34-item survey was distributed to healthcare providers (HCPs) at Canadian TEE-CPR sites. Quantitative analysis was used to quantify changes in the AOC and describe differences between TEE-CPR and S-CPR.

Results

Analysis of HCP respondents (n=16) indicates a change to the AOC nearly half (46%) of the time when using TEE-CPR. When moved, the most common new AOC was found to be left of the sternum (31%), followed by a move both leftward and caudally (19%). Most HCPs reported similar logistical and mechanical characteristics in TEE-CPR and S-CPR.

Conclusions

In instances where TEE-CPR led to a new AOC, it was most often a movement leftward or leftward-caudal. There was no additional mechanical detriment when comparing TEE-CPR to S-CPR. Out-of-hospital cardiac arrest patients may benefit from compressions at the above-mentioned sites when S-CPR is unsuccessful. Further study is warranted.

Thomas Lowe (Dr. Jay Shavadia)

Incidence and Predictors of Left Ventricular Systolic Dysfunction in patients with ST-segment elevation Myocardial Infarction

Background: following ST-segment elevation myocardial infarction (STEMI), routine imaging with echocardiogram is recommended to quantify left ventricular ejection fraction (LVEF) because LVEF <40% indicates significant cardiac dysfunction and often correlates to adverse clinical outcomes. However, contemporary rapid reperfusion in STEMI has substantially decreased the rates of clinically significant LV dysfunction and the role of routine echocardiography is unclear. Therefore, the aim of this project was to identify patient-level factors associated with clinically significant left ventricular dysfunction (LVEF <40%).

Methods: 1269 adult patients presenting with confirmed STEMI diagnosis and receiving in-hospital echocardiogram at Royal University Hospital in Saskatoon, SK were included and grouped based on whether they had LVEF <40% or LVEF ≥40%. We analyzed patient demographics, comorbidities, lab results, angiographic information, and all-cause mortality in-hospital and 12 months using univariable and multivariable logistic regression models.

Results: key variables associated with LVEF <40% included: longer time from FMC to primary PCI; anterolateral infarct; LAD/diagonal artery as the culprit vessel; elevated CK, troponin, NT-proBNP, and HbA1C; and a history of MI, CHF, PCI, and IVDU.

Conclusion: overall, this project highlighted key clinical variables that can be used to predict patients at increased risk of LV dysfunction following STEMI.

Lydia Onosanya (Dr. James Stempien)

30 Day Post-Operative Emergency Department Utilization After Gynecological Surgery

Introduction: Following gynecological surgery, some patients utilize the Emergency Department (ED) for post-operative complications before seeing their gynecologist. Previous literature has suggested poor coordination of care as a reason for attending the ED. In Saskatoon, the rate of post-op ED utilization has not been studied, and their results may serve to significantly improve patient care and prevent non-emergent utilization of the ED.

Methods: We performed a retrospective chart review of all patients who underwent gynecological surgery within 2022. All patients who utilized a Saskatoon ED within 30 days of surgery were identified. Patient characteristics, past medical history as well as surgical characteristics were collected. For those who attended ED within 30 days of their surgery: date of return, primary complaint, hospital readmission, and need for repeat surgery were noted.

Results: 6.1% of patients presented to a Saskatoon ED follow gynecological surgery. Of these, 17% were readmitted or surgical takebacks, while 83% were discharged the same day. Primary reasons for ED presentation were pain, infection, and vaginal bleeding.

Conclusion: The rate of post-op ED usage was low; however most post-operative patients presented for minor complaints. Post-surgical counselling about expectations of pain, pain management and bleeding would reduce ED usage.

Key words: gynecological surgery, emergency department, postoperative complications

Liam Zimmermann (Dr. Sunil Pradhan)

Assessing the Ability of Undergraduate Trainees' to Recognize Patients that Require Urgent or Emergent Care During High-Fidelity Simulation

Background: Simulation is used in medical education to foster skills in transitioning from medical school to practice, however, there is a paucity of evidence surrounding the use of simulation for trainee evaluation. We aimed to assess the ability of simulation to assess medical students' progression in training to meet the Entrustable Professional Activity 8 competency, which is to recognize a patient requiring urgent or emergent care, provide initial management and seek help.

Methods: Simulation sessions were recorded using Panopto software for video analysis from undergraduate medical students at the University of Saskatchewan (Years 1-4). Reviewers calculated time-to-events and recorded them in an Excel spreadsheet, from which descriptive statistics were calculated.

Results: We have collected data from 29 first-year medical student simulation sessions and 15 third-year student sessions. First year students frequently missed important vital signs (temperature, glucose), whereas third year students more consistently obtained them. First year medical students were faster at gathering a history, whereas more senior year medical students were quicker at obtaining objective information and reassessing patient characteristics.

Discussion: Recorded simulation sessions provided meaningful insights into student performance. Our data supports our hypothesis that trainee performance improves over the duration of medical training.

Alexandre Belisle (Dr. James Stempien)

Alcohol Use Disorder and Community Paramedicine

Introduction: In Saskatchewan, patients with alcohol use disorders (AUD) represent a disproportionately large fraction of emergency department (ED) admissions. Community paramedicine (CP) aims to improve access to emergency medical care by reducing the number of patients admitted to hospital3. The goal is to train paramedics to provide care to these patients directly while identifying which patients should be taken to, and which should be diverted from, the (ED).

Purpose: This research aims to characterize support provided by CP programs to improve health outcomes for patients with AUD. Furthermore, this research aims to bring forth evidence to help guide policy and funding decisions.

Methods: Our study included patients diagnosed with AUD who were enrolled in the Moose Jaw CP program. Basic demographics, alcohol use data, comorbidities, enrolment/discharge dates from the program, number of CP visits, treatment provided, and time per visit were all collected from the program and analyzed.

Results: Pending.

Conclusion: Many ED users struggle with housing, substance abuse and other medical comorbidities that result in frequent use of the emergency department. By demonstrating that community paramedics can effectively address this gap, we can increase their utilization to provide healthcare for this vulnerable population and reduce the stress on EDs.

Husnaat Bajwa (Dr. Rabia Shahid)

Quantifying Hospital Utilization and Patient Profiles: A Last Year of Life Analysis of Internal Medicine Patients

Background: Advancements in medical care have resulted in greater life expectancies. This unfortunately entails a longer end-of-life stage that is characterized by extended hospital stays.

Objective: This study aims to quantify patients' total days spent, hospital admissions and emergency department visits in their last year of life. This study also aims to identify factors that correlate with increased total days spent in the hospital.

Methods: This is a retrospective cohort study. Patients aged 18 years and older who died while admitted to the internal medicine service at two tertiary care centers in Saskatoon between July to December 2022 were included.

Results: A total of 308 patients died during the study duration. Patients spend 8.2% of their last year of life in the hospital. In the year before death patients visited the hospital an average of 3.03 times, with 1.06 ED visits and 1.97 admissions to the internal medicine unit. The Charleston Co-Morbidity index averaged at 6.40. Most patients (65.26%) lived independently and required the use of a mobility aid (71.5%). Approximately 43.83% of patient's death involved the respiratory system.

Conclusion: This study seeks to shed light on the hospitalization patterns and factors influencing end-of-life care for patients under internal medicine services.

Alice Kong (Dr. Lilian Thorpe)

Expanding eligibility of Medical Assistance in Dying: Impact and viewpoints of assessors and providers

Background: After the June 2016 Bill C-14, Medical Assistance in Dying (MAID) became an alternative end-of-life option. The March 2021 amendment, removing the reasonably foreseeable natural death (RFND) stipulation and the expected 2024 inclusion of sole mental disorders, adds new challenges and ethical dilemmas for MAID assessors and providers.

Method: Using a SurveyMonkey-based survey, we collected insights from Saskatchewan MAID assessors and providers regarding the expanded MAID eligibility.

Results: The data reveals complexities in the roles of MAID professionals, especially after the RFND criterion's removal. While explicit opposition was limited, a distinct unease was discernible among respondents, especially when cases fell outside the RFND parameters. In spite of their extensive experience, many concerned about addressing the nuanced psychological facets of patient suffering.

Interpretation: The increased concern among MAID assessors and providers, particularly regarding RFND and MD SUMD cases, highlights the need for enhanced training and access to effective treatments before MAID assessment. The strong call for holistic treatments and psychiatric expertise during MAID assessments is clear.

Future Study: The evolving landscape of MAID, with its expanded eligibility, emphasizes the need for ongoing research. Future studies should prioritize patient demographics, explore the psychological drivers of MAID requests, and ensure adequate resources for both patients and professionals.

Mackenzie Heidel (Drs. Megan Dash and Danielle Cutts)

The True Complexities of "Standard" Family Medical Practice Unmasked: An Observational Cross-Sectional Study in Regina

Objectives. We sought to examine whether family physicians routinely address multiple different concerns for their patients during a single visit and if this is influenced by patient demographics.

Methods. This study was conducted at a multi-physician family medicine clinic in Regina, Saskatchewan. Five physicians contributed their 500 most recent charts, extending retrospectively from June 1, 2023, from in-person visits by patients over 18 years of age and billed as regular appointments without billed procedures. Each chart was reviewed for the number of concerns addressed in the visit.

Results. Fifty percent of visits addressed more than 1 concerns (range = 1 to 8). Multiple logistic regression showed certain physicians (OR 2.036, 95% CI: 1.573 - 2.637, p<.001) and older patients (OR 1.01, 95% CI:1.005-1.014, p<0.001) were more likely to presenting with multiple concerns, but patient sex was not a significant predictor.

Conclusion. Family physicians routinely address more than one concern per visit. Patients value the ability to have all their health concerns addressed in a single visit, which is associated with lower use of health care resources and improved clinical quality. Standard visit length and billing practices should be adapted to reflect this complexity.

Jadyn Lennea (Drs. Cara Spence and Kali Gartner)

Syphilis and Pregnancy Outcomes for Mother-Infant Dyads at Westside Clinic

If someone is infected with syphilis during pregnancy, there is a risk of vertical transmission to the fetus through either the placenta or birth canal, having potentially devastating effects. According to the Public Health Agency of Canada, between 2017 and 2021, Saskatchewan saw an increase in infectious syphilis cases of 1346%. In this study, we reviewed the charts of motherinfant dyads at Westside Clinic treated for prenatal syphilis. We looked at several identified risk factors including maternal age, coinfection, gestation at the time of syphilis diagnosis, number of prenatal visits, and substance use, as well as the time from date of diagnosis to date of infection resolution (four-fold drop in RPR titre from initial reactive test) following treatment. Of the 53 dyads reviewed, 4 infants were at high risk for congenital syphilis (infant RPR greater than maternal at delivery), 3 had the same titre as their mother at delivery, 17 had a lower titre, and 16 were non-reactive. There are many barriers to patients receiving adequate prenatal syphilis treatment, placing infants at high risk for congenital syphilis. In conclusion, the incidence of prenatal syphilis at Westside Clinic and in Saskatchewan is increasing and should be of great concern.

Samantha Morandin (Dr. Jon Witt)

Tracking Internationally Trained Family Physician Flows

Saskatchewan relies on International Medical Graduates (IMGs) to address physician shortages in underserved areas. The Saskatchewan International Physician Practice Assessment (SIPPA) program is a practice readiness assessment (PRA), competency evaluation program and alternative licensure pathway for IMGs. Physicians are assigned to an underserved community and upon successful completion of the SIPPA program must complete a return of service (RoS). This study investigates the migration patterns of IMGs who had participated in the SIPPA program from 2011 to 2021. Additionally, a comprehensive literature review was conducted exploring physician migration patterns in Canada and the factors that influence migration. The literature revealed that family and community influences were the most common themes influencing physician migration. Analysis of SIPPA's database revealed that 69.55% (313 SIPPA participants) migrated from their area of placement following completion of RoS with the most prevalent form of migration being rural to urban migration outside of Saskatchewan, accounting for 52.88% (238 participants). Conversely, 29.77% (134 participants) remained in their area of placement upon completion of RoS. Our study findings underscore the need for comprehensive strategies aimed at enhancing physician retention for SIPPA participant post RoS completion.

Mah Rukh (Dr. Sabira Valiani)

Interventions to Support Families through Bereavement in the ICU: A Scoping Review

Background: While the loss of a loved one is a common phenomenon, the loss of a loved one in the ICU is uncommon and carries a high risk of complicated grief symptoms. For family members who have lost loved ones in the ICU, there is no organized, routine bereavement support offered in Saskatchewan. Objectives include identifying interventions for supporting ICU bereaved families reported in the literature and the outcomes that are relevant to bereaved family members, map findings to a Core Outcome Set by Harrop et al. (2020) and recognize existing gaps in knowledge.

Methods: Our scoping review will utilize Web of Science, CINAHL, EMBASE, APAPsycInfo, and MEDLINE for the literature search. Primary research articles will be included which describe bereavement programs/supports for bereaved loved ones in an adult ICU/CCU. Descriptive statistics will be used to synthesize data.

Discussion: Findings from this scoping review will highlight interventions that have been reported in the literature to support ICU bereaved families and their relevant outcomes. In Saskatchewan, ICU bereavement supports are sporadic, and do not include long-term follow-up. Therefore, this scoping review will serve as a first step in the development of an ICU bereavement program that is evidence-based, longitudinal, and sustainable.

Medical Education

Iris Geldenhuys (Dr. Eric Sy)

Patient and Patient-Family Engagement in Intensive Care Unit Disposition: Mixed Methods Study

Introduction: Transfer of ICU patients to lower acuity settings is a major transition in care. We evaluated how patient and patient-family engagement in ICU transfer/discharge can be improved.

Methods: Mixed-methods study in Regina General Hospital ICUs from May-June 2023. We recruited ICU survivors (and their family members) listed for transfer/discharge. Semi-structured interviews were conducted. Thematic analysis of audio transcripts was performed with NVivo.

Results: Thirty-six patients were screened over six weeks with 13 participants interviewed. Seven were patients and six were substitute-decision makers. Participants mean age was 49.4 years (SD 16.6). Patients had a median SOFA score of 10 (IQR 6-11). Concerning engagement, 46% felt engaged with ICU transfer, 85% felt engaged with ICU care overall. Those who felt engaged reported feeling informed and consulted. Communication with nurses and conduct of daily rounds were the largest factors in engagement. Lack of discussion regarding transfer led to feeling less engaged. Other factors included a lack of expectation to be informed/consulted, as well as patient condition.

Conclusion: Patient and patient-family engagement in ICU transfer/discharge was driven by feeling informed and consulted about transfer/discharge decisions. Barriers include poor communication with staff and discussion surrounding transfer/transfer process. Addressing these processes may improve patient and patient-family engagement.

Chase Ellingson (Dr. Payam Dehghani)

Alcohol use and cardiovascular disease: Knowledge translation and public health messaging

Recently, the Canadian Centre on Substance Use and Addiction (CCSA) released "Canada's Guidance on Alcohol and Health". Most notably, the drinking-risk thresholds were reduced, with low-risk drinking being defined as two or less standard drinks per week. These changes garnered significant media attention and highlighted a knowledge gap between public understanding and the evidence used to create these guidelines. Additionally, there is a commonly held belief amongst the public that alcohol may be "cardio-protective." As such, we aimed to create knowledge translation material addressing the cardiovascular risks associated with alcohol consumption. After reviewing the literature, we found that greater than 1-2 drinks per day increases the risk of developing atrial fibrillation and hypertension. Considering other cardiovascular conditions, research was either insufficient to draw conclusions or conflicting. Nonetheless, it appears that alcohol does not provide a "cardio-protective" effect. As such, we aimed to create knowledge translation material for dissemination through various social media platforms to communicate this information. Also, in partnership with the "Alcohol Change Course," delivered by the University of Regina Online Therapy Unit, we provided individuals with actionable steps to decrease their alcohol consumption.

Romaisa Ismaeel (Dr. Brent Thoma)

Assessment Burden by Design: Exploring Variability in Competence By Design Assessment Forms

The implementation of Competence by Design (CBD) has been criticized for increasing assessment burden on faculty and residents, with the frequency of required assessments being considered as the primary cause. However, poor usability of the assessment interface may also be a contributor. We investigated variability in emergency medicine's 'Core 1' entrustable professional activity. Forms from all Canadian specialty emergency medicine residency programs were compared with that proposed by the Royal College of Physicians and Surgeons of Canada. Program directors, faculty members, and residents were interviewed to understand their user experience. Our analysis demonstrated variability in presentation of the entrustment scale; prompts for narrative feedback; number of milestones, criterion, and option for pre-selection; prompts and number of fields for narrative feedback; which questions were mandatory; and ability of residents to fill out parts of the assessment form before sending it to their supervisor. Our qualitative analysis of interview transcripts demonstrated that granular selection criterion, redundant form elements, and a visually overwhelming presentation caused increased cognitive load. Conversely, minimalism, clear prompts, and facilitated selection allowed for completion of assessment forms to be more time efficient. Our complete analysis will inform the design of a refined CBD assessment form.

Kevin Entwistle and Retaj Ramadan (Dr. Helen Chang)

Primary Care, Second Language Podcast

"Primary Care, Second Language" is a pilot project based in Saskatchewan, providing healthcare professionals with a podcast resource for improving the care of marginalized patient populations. A significant portion of the Saskatchewan population speaks a language other than English. Lack of familiarity with medical terminology and phrases often presents a barrier to effective communication in healthcare settings. For example, interactions between healthcare providers and newcomers to Canada. Healthcare professionals who know even a few words or phrases in their patient's language can help bridge this gap in communication, as well as reaffirm a dedication to creating a safe, welcoming, and inclusive space for patients. We interviewed community members who speak a language other than English and produced several short, educational, and interactive podcasts covering terms and phrases that may be used during a number of common medical encounters. We uploaded these free and accessible episodes on multiple audio streaming services and shared our podcast with medical learners and healthcare professionals. Our pilot podcast project seeks to address key social determinants of health, including education, literacy, and equitable access to health services by creating a free resource for both patients and healthcare providers.

Keywords: Medical education, language, primary care, education, literacy, learning tool, healthcare resource

Sarah-Marie Durr (Dr. Susan Petryk)

Ask the Parent/Patient: Developing a Client Feedback Form to Improve the Clinical Skills of Medical Learners

Patient-centered medicine requires patients to be active decisions makers who help guide their care. This approach to medicine must be reflected in medical education curriculums. While there are existing validated patient feedback forms for medical learners, they are designed for adult patient populations, and are thus not suited for the unique needs of pediatric patients.

REDCap surveys on giving feedback to medical learners were sent to parents/guardians whose child has been seen at the Child and Youth Clinic in Regina, from 2020 to June 2023, and USask simulated patients. USask medical students and family medicine and pediatric residents were sent a REDCap survey asking for their opinions on receiving parent/patient feedback.

Across all three populations, the following statements were within the top 5 most important areas of feedback: “explains things clearly,” “involves me in the decisions about the medical plans (for my child),” and “addresses my concerns and takes them seriously.” Additionally, “listens and gives their full attention” and “did or said anything that made me (or my child) uncomfortable” were within the top five statements for SPs and learners. Developing a pediatric patient feedback form should thus include these listed areas to meet the needs of patients and learners.

Noor Rehman (Dr. Anurag Saxena)

Evaluation and Enhancement of Learning Environment at Postgraduate Training Sites

Background: The learning environment (LE) contributes to the success and satisfaction of learners. In this study the overall perceptions, along with individual differences, of the postgraduate medical education (PGME) LE were explored.

Methods: 205 faculty and residents completed an on-line survey. Questions pertaining to the overall work/LE, strengths and challenges, participant demographics, and, for residents only, evaluation of their LE (SPEED survey) were included. Quantitative data was analyzed using SPSS (t-tests, one-way ANOVAs) and qualitative data (strengths/challenges) were coded thematically in NVivo.

Results: Overall, participants gave above average/excellent ratings for welcoming environment (72%), culture of respect (65%), overall work/LE (61%), fair and equitable access to services (58%), and physical environment (55%). Significant differences (ps<.05) were found between training sites (urban vs distributed), role (faculty vs resident) and those with disability, in terms of how they rated various aspects of the learning environment. The main strengths of the LE included collegiality, education (learning opportunities, teaching quality), environment, and support. Challenges included workload, burnout, service demands, and resources.

Conclusion: These results demonstrate both strengths and weaknesses of PGME LE as well as show how various demographics perceive the LE differently. Efforts to improve identified areas would have immediate benefits to resident learning.

Aafia Maqsood (Dr. Greg Malin)

UGME Policy Review Using an EDI Lens

Background: The undergraduate medical education (UGME) policies were developed within Canada's colonial university system that has inherent systemic biases which do not fully represent all students. Structural racism is entrenched within the medical system which may hinder medical students' success and negatively impact experiences. This study's aim was to begin reviewing UGME policies focusing on EDI to address inherent biases and ensure equitable policies for UGME learners.

Methods: Students, staff, and faculty were invited to online and in-person focus groups, with a sample size of 21. Interviews were transcribed and a thematic analysis of the transcripts was conducted.

Results: In the interviews, students shared the inequities they have experienced ranging from racism, religious discrimination, and harassment to issues like cultural insensitivity, sexism, and barriers rooted in age and socio-economic standing. Participants advocated for more professionalism, transparency, and clarity of UGME policies and their implementation. They suggested providing better reporting systems, including annual EDI summaries. Most importantly, students called for collaborative policy drafting and diverse representation on UGME committees.

Conclusion: The feedback collected from focus groups will serve as a valuable foundation for re-evaluating UGME policies and practices to make them more equitable, diverse, and inclusive.

Oncology

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Rowen Greene (Dr. Dean Chamberlain)

Tumoroid Micro-Tissues as a Representative Model of the Tumor Microenvironment in Triple Negative Breast Cancer

The tumor microenvironment (TME) plays a critical role in dictating the response of a tumor to treatment. Traditional cancer research that focuses on two-dimensional tissue culture methods largely neglects the role of the TME in predicting the treatment response. Tumoroid microtissues are 2mm long, three-dimensional models that mimic the TME of tumors in vivo and can be easily fabricated in the lab. In this project, baseline cell viability and tumoroid growth characteristics were analyzed over a 21-day time course. Analysis of hypoxia within the tumoroids revealed a lack of oxygen in the core due to rapid cell division during the growth period. Thus, the model may provide a foundation for research into the signature hypoxia-induced changes that occur within the TME of triple negative breast cancer.

Dani Hamm (Dr. Deborah Anderson)

Identifying and Verifying New Targets for Breast Cancer

Triple negative breast cancer differs from other breast cancers as it lacks the three receptors (ER, PR, HER2) used as therapeutic targets. As a result, TNBCs are more difficult to treat and have higher mortality rates than other subtypes. CREB3L1 is a transcription factor found in normal breast cells which has been shown to function as a metastasis suppressor. CREB3L1 has been found to be upregulated in low-grade breast cancers and downregulated in high-grade breast cancers, contributing to the higher mortality and relapse rates of TNBC. Several genes have been identified to be synthetically lethal in the survival of CREB3L1-deficient high grade breast cancer cells in a high-throughput screen. Gene knockouts of these identified genes have been carried out to validate the data from the screen. Knockdowns have been performed and verified via Western blot, quantitative real time PCR, and a CellInsight CX7 high content cell imaging system to determine cell viability. Two genes, RPP21 and SMC3, showed a small but significant difference in the viability of CREB3L1-deficient cells compared to the CREB3L1 expressing cells at 72 hours. These are validated potential therapeutic targets but further studies are required to further validate these targets in additional CREB3L1-deficient TNBC cell lines.

Faizaan Khan (Dr. Franco Vizeacoumar)

Combination Treatment for PLK-1 over-expressing Cancers

Polo-like kinase 1(PLK1) is overexpressed in multiple cancers suggesting that inhibition of this kinase can serve as a powerful antitumor strategy. Previous research has shown PLK1 over expression to be a major cause of chromosomal instabilities, a known driving force of tumour heterogeneity and cancer progression. Some PLK1 inhibitors that have previously entered clinical trials have not provided fruitful results, which might be due to the off-target effects on other members of the polo- like kinase family. Therefore, considering the diverse functions of PLK1 and its family members in cell cycle regulation, there are still major challenges in using PLK1 inhibitors as an anticancer drug. To circumvent these concerns, Dr. Vizeacoumar's lab applied the SDL approach, where overexpression of a gene like PLK1 is lethal only when another, normally non-lethal, mutation/deletion is present. Using this approach, they have identified an SDL target of PLK1. The objective of this project was to test the effect of the SDL hit inhibitor in combination with an FDA-approved library of small molecule inhibitors (SMI) on PLK1 overexpressing cancer cell viability. As monotherapy is often met with drug resistance, it is important to develop combination therapies for effective elimination of cancer cells. The results of this study demonstrate that knockdown of the SDL hit combined with specific SMI's synergistically maximize suppression of PLKhigh cells compared to DMSO control or SDL hit KD, or drug treatment alone.

Mary Lazell-Wright (Dr. Franco Vizeacoumar)

Understanding the Role of an RNA Methyltransferase in Telomere Maintenance

TERT, the gene that encodes for telomerase, is overexpressed in 85-90% of all cancers. These cancers can continuously regenerate their telomeres, leading to cell immortality. Synthetic dosage lethality (SDL) is a concept in which the simultaneous over expression of one gene, and the inhibition of another gene, leads to cell death. However, if just one of these conditions is met, then the cell remains viable. While cancer therapies have aimed to target TERT before, doing so on its own results in a slow and ineffective treatment. However, due to its upregulation, it presents itself as a potential target for SDL therapy. Through previous screens done in the Vizeacoumar lab, RMT (an RNA methyltransferase) has been implicated as a potential SDL partner for TERT. RMT has also been shown to interact with nucleolin (a protein that acts as an indicator of nucleolar function). In this experiment, we showed that knockdown of RMT in high TERT cancer cell lines results in altered heterochromatin behaviour, while not affecting nucleolar function. We also inhibited high TERT and low TERT cancer lines using novel drugs, expecting to see selective lethality in the high TERT lines. The data for this objective is still under analysis.

Josh Anderson (Dr. Anand Krishnan)

Aberrant Cholinergic Signaling May Modulate Metastatic Progression of Breast Cancer

The nervous system has been shown to have a significant influence on cancer growth, progression, and behavior. A positive correlation has been shown between tumor nerve density and cancer growth and progression, with negative outcomes more specifically tied to the autonomic innervation of tumors. Sympathetic innervation has been tied to early cancer initiation and growth, while parasympathetic innervation influences cancer progression to more invasive phenotypes and metastasis. The parasympathetic nerve signaling effects are elusive and seem to be tissue-dependent. Given these trends, we hypothesized that increased parasympathetic (cholinergic) signaling in breast cancer will promote progression to metastatic breast cancer. This was evaluated by quantifying the expression of cholinergic receptors M1 (CHRM1) and M3 (CHRM3) in primary breast tumors, where patients did not develop any metastatic recurrence, and in metastatic breast tumors collected from the brain metastatic site. Results revealed a potential prometastatic role for CHRM3 and an anti-metastatic role for CHRM1. For example, CHRM1 showed higher expression in primary breast tumor samples from non-metastatic patients, while CHRM3 showed higher expression in brain metastatic breast tumor samples. These results suggest that targeting cholinergic signaling may be therapeutic in tackling metastatic recurrence of breast cancer.

Samuel Boctor (Dr. Scott Adams)

Personalizing screening intervals for lung cancer screening using multi modal artificial intelligence

Lung cancer in Canada is diagnosed at Stage IV in 50% of cases, and has a five-year survival rate of 19%. Low dose computed tomography (LDCT) screening has been shown to significantly reduce mortality according to the NELSON study, and the National Lung Screening Trial (NLST). However, screening is also associated with risks of overdiagnosis, invasive follow-up, and downstream harms. Thus, personalized screening where the frequency of screening is tailored to the individual's risk has the potential to reduce false positives, prevent delayed diagnosis, and improve the effectiveness and costs of Lung Cancer Screening (LCS) in Canada. The key to this level of individualization would be accurate prediction of lung cancer risk. There exists various validated multivariate demographic risk models such as PLCO and LLP models and their variants. More recently, however, machine learning has been utilized to increase predictive power. Sybil, is a state-of-the-art 3D convolutional neural network that boasts impressive lung cancer risk prediction using CT scan images only. In this study, we will explore ensembling a demographic-based machine learning model with Sybil and assess performance when stratifying individuals for annual vs. biannual screening based on the number of lung cancers detected and the number of delayed diagnoses.

Samuel Girgis (Dr. Ibraheem Othman)

Western Canadian Province Experience on Outcomes of Acute Myeloid Leukemia Therapy in Elderly: A Retrospective Chart Review Pilot Study

Acute myeloid leukemia is a fatal malignancy that is challenging to treat in the elderly population given their increased chemotherapy resistance, medical comorbidities, and poor functional status. The current literature states a survival rate of 5-10 months on average in the elderly population. Younger populations can receive more intensive chemotherapy regimens and have longer survival rates. The elderly population of Saskatchewan may have fewer comorbidities than would be expected given their age, and thus there may be a role for intensive chemotherapies in the elderly population of Saskatchewan. This retrospective chart review studied 179 individuals over the age of 60 who underwent treatment for acute myeloid leukemia at the University of Saskatchewan and who had physician follow-ups at least 12 months from the date of diagnosis. 26.8% of these individuals lived in rural towns, while 19.0% lived in urban cities. 33.5% of the patients received intensive chemotherapy in the form of cytarabine, and 44.7% of patients received low-dose chemotherapy in the form of azacytidine. Further data analysis is underway to determine whether a correlation exists between a rural address and fewer patient comorbidities, as well as the potential for improved survival rates in the elderly who receive intensive chemotherapy.

Devin Laubscher (Dr. Shahid Ahmed)

Outcomes of Very Young Women and Adolescent with Breast Cancer in Rural and Urban Saskatchewan: A Retrospective Cohort Study

Breast cancer (BC) in young women is uncommon, accounting for about 1.8% of all BC diagnoses. Despite the low incidence, BC in young women tends to have a more aggressive course compared to their older counterparts. Additionally, since BC screening is recommended in women aged 50-69 years there is a risk of delayed diagnosis in younger women, especially those with rural residence. This population-based retrospective cohort study aims to assess the outcomes of young women with BC in Saskatchewan over a period of 20 years in relation to their place of residence. Using descriptive statistics, the prognostic importance of clinicopathological and contextual variables were examined for overall survival (OS) in all stages of BC. Baseline patient characteristics demonstrated significantly elevated rates of smoking history, HER2+BC and mean platelet count in rural populations. The results indicate that young women with BC have high incidence of node positive, HER2+ and triple negative disease subtypes. Rural residence, stage of disease and triple negative BC were correlated with inferior OS. Interestingly, pregnancy and elevated BMI were not correlated with inferior outcomes. These findings indicate the need for future studies aimed at improving the outcomes of younger women with BC, especially those with rural residence.

Carl Pinter (Dr. Shahid Ahmed)

Outcomes of Elderly Patients with Node-Positive Colon Cancer. A Multi-Center Population-Based Cohort Study

Background: This population-based cohort study examined prognostic significance of adjuvant chemotherapy (AC) and other variables associated with inferior outcomes in elderly patients with stage III colon cancer.

Methods: Patients ≥70yrs with stage III CRC diagnosed in Saskatchewan and underwent primary tumor resection during 2012-2018 were evaluated. Cox-proportional-multivariate survival analysis was performed to determine factors correlated with overall survival (OS) and disease-free survival (DFS).

Results: 404 patients, median age 79yrs & M:F of 1:1, were identified. 43% received AC. Patients with AC had median OS of 106 vs. 30 months ($p<0.001$) with 5&10-yr OS of 64% and 49% vs. 31% and 19% ($p<0.001$). Patients with AC had median DFS of 56 vs. 22 months ($p<0.001$) with 5&10-yr DFS of 49% and 30% vs. 24% and 13% ($p<0.001$). Cox-multivariate analysis revealed previous cancer, ostomy, nodes positive: nodes harvested (NPNH) ratio >0.1, grade III tumor, WHO performance status >1, no AC, high-risk stage III disease, and baseline CEA >5 were independently correlated with OS and DFS.

Conclusions: In elderly patients with stage III CRC lack of AC, poor performance status, T4 or N2 disease, grade III tumor, elevated baseline CEA, previous cancer, elevated NPNH ratio >0.1 and ostomy formation correlate with inferior outcomes.

Huzaifa Saeed (Dr. Scott Adams)

PLCOm2012 Lung Cancer Risk Model to Allocate Individuals for Annual vs. Biannual Lung Cancer Screening

The pivotal NLST and NELSON trials have robustly underscored the utility of low-dose CT in the early detection of lung cancer, especially within high-risk cohorts. Nevertheless, employing a blanket annual screening for everyone ushers in a multitude of challenges. These range from the clinical concerns of false positives and overdiagnosis to broader implications like spiraling healthcare costs, radiation exposure, and the psychological impact of patient anxiety. Addressing this complex landscape, our study delves deeply into assessing the PLCOm2012 lung cancer risk model's capability. The aim? To discerningly allocate individuals into more tailored annual or biannual screening intervals. By meticulously analyzing data from the NLST trial and integrating insights from the PLCOm2012 model, we successfully demarcated a subgroup presenting a lower associated risk. Subsequent steps involved the methodical assignment of these individuals to screening frequencies, ensuring they align with their risk profiles. This nuanced, individualized approach was then juxtaposed against the prevailing one-size-fits-all annual screening. Preliminary findings, although still undergoing rigorous review, point towards a promising direction. Should the PLCOm2012 model validate these findings, we stand at the cusp of a paradigm shift in lung cancer screenings: one that harmoniously merges early detection with a holistic, patient-centric approach.

Nima Toussi (Dr. Shahid Ahmed)

Outcomes of Patients with Gallbladder Cancer (GBC) Diagnosed Over a Period of 20 Years: A Canadian Province Experience

Background: GBC is an uncommon but often fatal gastrointestinal cancer. The poor prognosis of GBC may in part be due to lack of effective screening tools and a delay in diagnosis that leads to presentation in the latter stages of the disease. The current study aims to determine outcomes of patients with GBC in relation to contextual, demographic and clinical factors in a Canadian province over a span of 20 years.

Methods: In this population-based retrospective cohort study patients with GBC diagnosed in Saskatchewan, Canada from 2000-2019 were evaluated. Cox proportional multivariate regression analyses was performed to determine factor correlated with inferior outcomes.

Results: 331 patients with median age of 74 yrs and M:F of 1:2 were identified. 149 (45%) patients were referred to a cancer center. Median overall survival (OS) of patients with stage I-III GBC was 20 months (95% CI:10.9-29.1) vs. 4.0 months (3.0-5.0) with stage IV GBC (< 0.001). No significant differences were noted in OS in relation to residence and time-period of diagnosis. Patients who were not referred for a cancer center had a median OS of 3 months (1.98-4.0) vs. 13 months (9.9-16.1), $p < 0.001$. Median disease-free survival (DFS) of patients with stage I-III GBC was 20 months (95%CI: 10-30.1) with 5-year DFS of 36%. For all patients, stage IV disease, HR, 3.02 (1.85-4.94); no referral to cancer center, HR, 2.64 (1.51-4.62); lack of surgery, HR, 1.63 (1.03-2.57); neutrophil:lymphocyte of > 3.2, HR, 1.57 (1.05-2.36); and age ≥70, HR, 1.51 (1.04-2.19) were correlated with inferior OS.

Conclusions: In a real-world setting, most patients with GBC are diagnosed with late-stage disease and were not referred to cancer center. For early-stage GBC, urban residence and stage III disease were correlated with inferior outcome, whereas for all stage GBC, stage IV disease, old age, lack of surgery, lack of referral to cancer center, and high neutrophil to lymphocyte ratio were correlated with inferior survival.

Abby Jia (Dr. Mary Kinloch)

Homologous Recombinant Deficiency Does Not Share the Morphologic Surrogates of BRCA-mutated Ovarian Cancer Patients

High-grade serous carcinoma (HGSC) patients that test positive for homologous recombinant deficiency (HRD) receive targeted first-line PARP-I (poly-ADP ribose polymerase inhibitor) therapy and have longer average progression-free survival (PFS). Under the current Canadian standard of care, identification of HRD is only done through genomic testing for BRCA (BReast CAncer genes) mutations, which only identifies a portion of the etiologies for homologous recombinant deficiency. In this project, we use two next generation sequencing platforms, Illumina MyChoice CDx Assay and ThermoFisher Oncomine Comprehensive Assay Plus (OCA) to obtain patient genetic instability scores using HGSC tissue samples. The two sequencing assays detected homologous recombinant deficiency in 15% and 24% of BRCA-wildtype samples, respectively, which shows that complete genomic profiling can augment the identification of HRD in ovarian cancer patients. In addition, initial attempts to identify a morphologic correlation between HRD and BRCA-mutated HGSC did not result in statistical significance, suggesting the (Set, pEudoendometrioid, and Transitional) morphologic surrogates are specific to BRCA-mutated HGSC and not inclusive in an overall HRD pattern.

Abdi Absher (Dr. Tristan Kerr)

Pediatric Uveitis in Saskatchewan from a Rheumatology Perspective: Epidemiology, Treatment, and Prognosis

Uveitis is the inflammation of intraocular tissue of the middle layer of the eye. Uveitis can be an isolated disease, or a manifestation of both systemic and infectious diseases. Although more prevalent in adult populations, early identification in the pediatric population is crucial for preventing various ocular complications.

Treating pediatric uveitis involves a collaborative approach between Rheumatologists and Ophthalmologists. Despite known etiologies, reported incidences vary widely across studies. Additionally, although there are guidelines for screening and initial treatment for JIA associated uveitis, there is no consensus on the effective screening, management, and monitoring of non-JIA associated uveitis. The study's intent was to assess the prevalence of chronic uveitis in Saskatchewan in a retrospective study of patients with uveitis attending a pediatric rheumatology clinic in the last five years. 48 patients were included in the study. Our study found 37% of patients were positive for ANA, relapses occur more often in anterior and panuveitis, and complications of uveitis were seen more frequently in non-JIA associated uveitis. This study demonstrates the current state of treatment of pediatric uveitis in Saskatchewan and highlights the need for further evaluation of risk factors and current treatment practices to improve outcomes for patients with uveitis.

Indiana Best (Dr. Asma Nosherwan)

UTI Diagnostic Criteria and Antimicrobial Use in Neonates in NICU

Introduction: In preterm infants Urinary Tract Infection (UTI) should be routinely ruled out when suspecting late onset sepsis in the Neonatal Intensive Care Unit (NICU). Reported prevalence of UTI is up to 13%. There is a noticeable paucity of guidance in the management at this age. This causes misdiagnosis and inappropriate antimicrobial use.

Objectives: We aimed to analyze our clinical practice surrounding the management of UTI in our NICU with infants born at < 32 weeks gestational age (GA).

Material and Methods: The chart review was conducted on preterm infants born at < 32 weeks (GA) in our level III NICU between January 2020 and December 2022. The UTI diagnostic criteria was created for accurate diagnosis.

Results: There were a total 43 episodes of UTI in 31 patients (prevalence 11%). 27 episodes were falsely positive with alternate diagnosis. Enterococcus Faecalis was the most common organism. Total 550 doses of the antibiotics were used in infants with falsely diagnosed UTI.

Conclusion: The UTI diagnostic criteria can be used for correct diagnosis of UTI in preterm infants for judicious antimicrobial use in this high-risk population.

Monica Ouellet (Dr. Krista Baerg)

Best Practice for Transition from Pediatric Complex Pain Care: A Scoping Review

Many adolescent and young adults (AYA) experiencing chronic pain often continue to have pain in adulthood and must make the transition from pediatric care to adult care. However, only few studies have described the specific transition protocol from pediatric to adult care that AYA with chronic pain must make. To improve understanding of transitional care needs, this scoping review will determine known barriers and factors associated with successful transition from pediatric chronic pain care to adult care. This scoping review used previously published Arksey and O'Malley framework and followed the PRISMA guidelines. A literature search was carried on Ovid Medline and 12 studies (11 research articles & 1 dissertation) published from 2015 to 2022 were included in the review. In this scoping review most frequently identified barriers to successful transition include lack of self-efficacy, communication, coordination of care between pediatric and adult care. A need of early transition, fluid and dynamic transition process, age-appropriate resources were identified as primary patient care needs during transition. 4 frameworks supporting transitional care for AYA with chronic health conditions were identified, two theoretical frameworks were applied to AYA with CP. Limited evidence suggests that there is lack of standardized transition protocol for clinical use.

Lyuba Pastushenko (Dr. Tim Bradley)

A Retrospective Review of Children with Genetically Acquired Aortopathy in Saskatchewan

Background: Heritable thoracic aortic disease (HTAD) is often undiagnosed and may present with life-threatening aortic dissection. Long-term survival depends on early diagnosis, expert medical management, and elective aortic surgery. The aim of this study was to identify and describe the genotype and clinical phenotype of all children with HTAD followed in Saskatchewan.

Methods: We conducted a retrospective chart review of all children with HTAD followed in Saskatchewan collecting data on genotype, clinical presentation, medical and surgical management, and rate of aortic growth.

Results: Of 18 children included (mean age 12.6±5.6 years, 13 males), 17 have Marfan syndrome and 1 has Loeys-Dietz syndrome. Medical management included angiotensin receptor blockers, beta-blockers, or a combination of both in 13 children and elective valve sparing aortic root replacement was required in 3 children. Annual growth of aortic root dimension and initial aortic root z-score for body surface area were higher in the children who have required surgery or are approaching surgical indication.

Conclusions: To date, this is a descriptive study pending further analysis. This data will be submitted to the Canadian Aortopathy and Connective Tissues Disorder (Can-ACT) Registry which aims to develop national management guidelines and improve care for all children with HTAD across Canada.

John Perverseff (Dr. Jonathan Gamble)

Is an abdominal compression test useful to predict fluid responsiveness in children undergoing general anesthesia?

Background: Hypovolemic patients with improved cardiac output after intravascular volume resuscitation are called “fluid responsive”. The abdominal compression test is often used in pediatric intensive care to determine if a patient is fluid responsive. Despite its common use, the test is poorly studied in children, especially during the intraoperative period.

Methods: We conducted a prospective, self-controlled, crossover, observational, diagnostic study following local Research Ethics Board approval. Two abdominal compression tests were performed on each patient – one before (Time 1) and one after the procedure once fluid had been administered (Time 2). Ultrasound assessment LVOT-VTI was used to measure cardiac output before and after each abdominal compression test.

Results: 38 patients were enrolled. There was a significant change in VTI from pre-abdominal compression to post-abdominal compression at time 1 ($p<0.001$), pre-abdominal compression to post-abdominal compression at time 2 ($p<0.001$), and pre-abdominal compression at time 1 to pre-abdominal compression at time 2 ($p<0.001$). There was a greater percent change in VTI from pre- to post-abdominal compression at Time 1 compared to Time 2 ($p<0.001$).

Discussion: The abdominal compression test is a simple, useful clinical bedside tool in identifying fluid responsive patients.

Orhan Yilmaz (Dr. Mehul Jariwala)

Assessment of cutaneous and extracutaneous factors involved in Morphea (Localized Scleroderma) among pediatric patients in Saskatchewan

Localized scleroderma (LS) is a rare, debilitating skin disorder characterized by progressive sclerosis, leading to long-term physical and emotional consequences. The Canadian Morphea Registry (C-MORE) was established to address the scarcity of Canadian LS data to capture clinical insights, treatments, and quality of life. A retrospective chart review and a prospective analysis of 14 patients diagnosed in the last six years analyzed demographic information, family history, triggers, clinical and laboratory findings, and treatment approaches. Linear scleroderma emerged as the predominant subtype, affecting over half of patients, often involving the scalp and presenting with Parry-Romberg syndrome in nearly 30% of cases. Extracutaneous manifestations were observed in over 30%. Methotrexate emerged as the most frequently prescribed therapeutic agent. Encouragingly, dermatological quality of life scores in pediatric patients were comparable to those reported for more common skin ailments, demonstrating the resilience of affected individuals. Notably, remission rates exceeded 80%, with only a minority experiencing active disease at the last follow-up. This study represents the most comprehensive collection of pediatric LS patients in Saskatchewan, and C-MORE's ongoing efforts promise to shed light on the disease's trajectory within this population.

Mikayla Rudniski (Dr. Bindu Nair)

Factors of care in a virtual world: A scoping review of virtual care in osteoarthritis treatment with a focus on digital determinants of health

Virtual care has become a valuable tool in the delivery of osteoarthritis (OA) care. However, the use of technology and digital care may create potential for health differences through digital determinants of health (DDoH) or exacerbate existing health disparities. The purpose of this scoping review was to explore current perceptions of the use of virtual care in OA management, with a focus on DDoH. We conducted a search across multiple databases, including MEDLINE, Embase, and Scopus. Our search targeted studies relevant to OA, use of virtual care, and DDoH. Studies focused on surgical management of OA were excluded. Relevant articles were screened by two independent reviewers, twenty-three studies were included in this review. Efficacy of virtual care was found to be comparable to conventional care, additionally, providers and patients reported positive experiences using virtual care. Barriers to virtual care included digital literacy, digital self-efficacy, and access to technology. However, no studies examined specifically the DDoH in virtual care of OA. Virtual care presents a viable option for OA management. Future research direction should investigate the impacts of DDoH on access to virtual care in the treatment of OA.

Vivian Heinrichs (Dr. Angelica Lang)

Acute Effects of Lower Trapezius Activation Exercises on Shoulder Musculature during Functional Tasks

Shoulder musculoskeletal disorders are associated with atypical scapular kinematics and muscle activity. Exercises to rehabilitate the scapular kinematics and activate the weakened muscles may be effective at reducing pain and disability. The objectives of this study were to examine the effectiveness of lower trapezius (LT) activation exercises and to compare shoulder muscle activity during a functional task protocol before and after the activation exercises. Muscle activity was measured for four bilateral muscles during four LT activating exercises and the functional task protocol (performed twice). One-way analyses of variance (ANOVAs) were used to compare muscle activations for the exercises, and paired t-tests were used to determine any changes in muscle activity after completing the activation exercises. Two of the exercises preferentially recruited the LT over the upper trapezius (UT), but the overall protocol may not be most effective at recruiting the LT. Despite this, a small, but significant, increase in LT activity (2.9 ± 3.2%, $p<0.001$) was noted in the Right Overhead Reach task. Previous research has noted biomechanical compensations in pathological groups during overhead reaching tasks, indicating the potential therapeutic importance of this change in LT activity. This may be an avenue of research that warrants further investigation.

Annaka Chorneyko (Dr. Angelica Lang)

Sex-related changes in muscle activation during upper limb focused functional tasks

Shoulder pain, caused by various musculoskeletal disorders (MSDs), is a prevalent problem. Biological sex (female) is a risk factor for these MSDs, and shoulder biomechanics may be contributing to the increased risk. The objectives of this study were 1) to compare muscle activation between females and males during an overhead lifting task and 2) to assess if differences were related to shoulder kinematics. Muscle activity was measured for six bilateral shoulder muscles, and upper limb motion was tracked using reflective markers during an overhead lifting task. Statistical parametric mapping was used to assess for sex-related differences. Females had higher muscle activation for all of the muscle groups except the lower trapezius. The largest differences existed in the upper trapezius (right = 14.6%, $p = 0.019$, left = 17.1%, $p = 0.011$) and serratus anterior (right = 22.2%, $p = 0.05$, left = 24.3%, $p < 0.001$). Females tended to have decreased humeral external rotation compared to males, as was noted by previous research, but these results did not reach significance. The increased shoulder muscle activation seen in females may help to explain increased injury risk; however, to inform future interventions to reduce this risk, further investigation is needed.

Maya Berscheid (Dr. Sarah Donkers)

Help! No Comprehensive Guideline for Multiple Sclerosis Rehab: Appraisal of Existing International Guidelines in Multiple Sclerosis

Background: There is no comprehensive clinical practice guideline (CPG) for MS rehabilitation and/or symptom management. The MSBEST team, in partnership with MS Canada and the Canadian Network of MS Clinics, aims to create the first comprehensive MS Rehab Best Practice Guideline. As an initial step, this study identified and critically appraised the quality of existing CPGs with recommendations pertaining to rehab and symptom management in MS.

Methods: Multiple databases were searched to identify existing CPGs. Identified guidelines were screened by 3 researchers based on inclusion criteria. Included guidelines were appraised by 4 reviewers using the Appraisal of Guidelines for Research and Evaluation (AGREE) tool.

Results: 15 guidelines, published from 1998-2020, were included. Standardized mean scores per quality domain are as follows: 1) scope and purpose 83.2%; 2) stakeholder involvement 64.2%; 3) rigour of development 55.7%; 4) clarity of presentation 79.6%; 5) applicability 34.9%; and 6) editorial independence 60%. The highest scoring domains were #1 and #4. Applicability was the lowest scoring domain.

Conclusion: Although strong in reporting objectives, target population, and recommendations, guidelines were poor at presenting information related to clinical applicability. Comprehensive up-to-date guidelines emphasizing clinical application are needed.

Quality Improvement

1

Sonya Mannala (Dr. Emmett Harrison)

Improving Patient's Type II Diabetes Glycemic Control at the Associate Family Physicians Clinic through Interdisciplinary Collaboration

The Associate Family Physicians Clinic Quality Improvement Team aimed to increase the number of patients with type II diabetes at their glycemic target (Hemoglobin A1C <7.0% or 7.0-8.5%) from 58% to 68% from October 2022 to October 2023. These patients had to attend at least one Chronic Disease Management – Quality Improvement Program review (317/547). Quality improvement interventions focus on increasing Nursing Educator and Registered Dietician collaboration in the care of patients with type II diabetes at the Associate Family Physicians Clinic, as this may be associated with improved glycemic control.

The frequency of Nurse Educator and Registered Dietician referrals and appointments were documented from April to September 2023 to measure the impact of quality improvement interventions: an in person collaborative care lecture to physicians, lecture summary provided via email, and collaborative care infographics delivered to patients at routine diabetes visits. The results demonstrate the frequency of Nurse Educator and Registered Dietician referral offers went from 6.2% to 29.6% from April to September 2023, but attended referrals remained low. The goal was not met as only 61% of patients with type II diabetes met their glycemic target by October 2023. A focus group could identify patient factors that impede interdisciplinary collaboration.

1

Hasan Jamil (Drs. Fang Wu, Pouneh Dokouhaki, and Ahmed Mostafa)

When Less is More: Analyzing Out-of-Control Vitamin Testing in Saskatchewan

Testing for vitamins D and B12 is commonly ordered by physicians globally despite their narrow ranges of testing indications. Over-testing is a catalyst for further unnecessary investigations, increased cost, patient anxiety, overtreatment, and burdening of an already at-capacity laboratory. This project described and analyzed testing patterns in the Saskatoon area. Deidentified data from the Saskatoon Hospital Laboratory Information System from Jan. 1st, 2018, to Dec. 31st, 2022, was analyzed and visualized with Excel. The results showed severe and worsening inappropriate testing in the region for both vitamins D and B12. Statistical analysis of testing patterns revealed increasing volumes, inappropriate repeat testing, high proportions of normal results, and a small number of family physicians accounting for a high percentage of ordering. The estimated cost of vitamin D and B12 testing in the past 5 years is over $4.8 million and increasing, with $1.3 million of that in 2022 alone. Interventions are currently being designed and implemented, including laboratory requisition form changes, physician education materials, and laboratory audit reports to be sent out to physicians ordering the most tests.

1

Kayla Joyce (Drs. Ninad Mehta and Camille Hamula)

The Laboratory Diagnosis of Bacterial Vaginosis (BV): Method Comparison

Diagnosis of bacterial vaginosis (BV) is complicated by ambiguous clinical presentation and suboptimal laboratory methods. Microscopic analysis of vaginal smears via the Nugent scoring system with quantitation of normal vaginal flora is considered the current gold-standard. This method is labor intensive with suboptimal performance due to subjective technician interpretation. Indeterminate designations via Nugent score complicate assessment for treatment. Nucleic acid amplification tests (NAATs) with varying diagnostic algorithms incorporating bacterial identity and quantity may be an improved approach to BV diagnostics. This study aims to evaluate performance of a molecular NAAT approach to BV diagnosis in comparison to the Nugent scoring system. We collected 198 residual vaginal samples tested via Nugent score and analyzed them with two NAAT assays: i) the BD MAXTM Vaginal Panel (BD Diagnostics, MD, USA) and ii) the AptimaR BV Assay on the Panther system (Hologic, CA, USA). Percent agreement between Nugent scores and PCR results was calculated. Overall percent agreement ranged from 82.8-88.9% (Cohen's kappa 0.45-0.72). A total of 27.3% of samples designated indeterminate by Nugent score were positive by one or both NAATs. Our findings suggest NAATs may have improved sensitivity over Nugent score for detection of BV.

1

Ryan Chan (Dr. Katelyn Halpape)

Potential Risk Factors Among Patients Developing Venous Thromboembolism While Admitted to the Dubé Centre for Mental Health (DCMH)

Background: Venous thromboembolism (VTE) is a preventable hospital-acquired complication. Although psychiatric inpatients are at risk for VTEs, risk stratification tools for this population do not exist. This study aimed to identify risk factors associated with VTE development in psychiatric inpatients.

Methods: A retrospective case-control chart review of patients admitted to DCMH from 2007 to 2021. Cases were identified through pharmacy software by screening for individuals aged 18 and older who received anticoagulation for VTE treatment. Controls were randomly selected from patients with a non-VTE discharge diagnosis. The selected case-to-control ratio was 1:4. Data were extracted, coded, and analyzed using descriptive analysis and univariate/multivariable logistic regression analysis.

Results: A total of 32 cases and 159 controls were included. Case mean age was 52 years, 65.6% were female, and 65.6% had no previous VTE. Comorbidities including cancer, cardiovascular conditions, insomnia, psychiatric-specific interventions such as electroconvulsive therapy and mechanical restraints, and acute medical diagnoses were independently associated with developing VTE (AORs>1.00, $p<0.05$). Substance use was significantly associated with decreased odds of VTE diagnosis (AORs=0.14, $p<0.001$).

Conclusion: Psychiatric inpatients have unique risk factors that increase the likelihood of developing VTE. Point-of-care resources targeting VTE prophylaxis for at-risk psychiatric inpatients could reduce patient associated complications.

1

Travis Black (Dr. Sachin Trivedi)

Assessing the Use of Diagnostic Imaging for Pulmonary Embolisms in Saskatoon Emergency Departments

Pulmonary embolism (PE) is on the differential diagnosis for several common ED presentations and is a potentially fatal diagnosis. PEs are diagnosed with medical imaging, usually a CT pulmonary angiogram (CTPE) or a ventilation-perfusion scan (V/Q scan). Widespread imaging to rule out PE carries high costs and potential patient harms, such as radiation and contrast nephropathy. Clinicians use the D-Dimer to rule out PE without imaging. Several decision rules surrounding acceptable cut-offs have been developed to reduce imaging without increasing harms. This project retrospectively applied and compared the unadjusted D-dimer cut-off, age-adjusted D-dimer cut-off, YEARS D-dimer cut-off, and PEG-ED D-dimer cut-off to cohort of patients who received CTPE or V/Q imaging in Saskatoon emergency departments in 2022 to assess for a PE.

Ashton Heidt (Drs. Ninad Mehta, Pouneh Dokouhaki, and Fang Wu)

A Retrospective Analysis of Procalcitonin Utilization in Saskatoon Hospitals

Procalcitonin (PCT) is a prohormone that is by the parafollicular cells of the thyroid gland. Researchers have determined that during certain critical illnesses, particularly bacterial sepsis, PCT consistently elevates to readily detectable levels of over 100 µg/L as transcription shifts to a tissue non-specific pattern. PCT has been identified as a biomarker to be used in the screening of suspected septic patients, with definite importance in the emergency department. The purpose of this research project is to evaluate trends in PCT testing in Saskatoon hospitals between 2020-2022. Our results indicate a steady increase in test utilization at Jim Pattison Children's Hospital (JPCH), Royal University Hospital (RUH), Saskatoon City Hospital, and St. Paul's Hospital. JPCH was responsible for 86.1% of Saskatoon test orders in 2022, while RUH was responsible for 11.0%. In 2022 JPCH had 57.0% of it's tests ordered for NICU patients, and 16.8% for emergency patients. RUH had 77.3% of it's tests ordered for stem cell/oncology inpatients, and 0 orders in the emergency department. Increased education will need to be provided to Saskatoon clinicians to ensure more appropriate utilization of PCT testing with increased utilization in the emergency department and more sparing use with inpatients and critically ill patients.

1

Maddy Owens (Dr. Oksana Prokopchuk-Gauk)

Albumin Utilization and Appropriateness in Saskatoon Patients: A Healthcare Quality Improvement Project

Background: Albumin is a human plasma-derived protein available from transfusion medicine laboratories for therapeutic use in 25% and 5% concentrations. There are a limited number of evidence-based indications supporting albumin use in clinical care. A recent Ontario audit identified at least 50% of albumin prescriptions were for inappropriate indications. In the 2021/2022 fiscal year, Saskatchewan had the highest rate of albumin use per capita in Canada. Therefore, the purpose of this quality improvement project was to determine local albumin utilization and appropriateness.

Methods: A retrospective chart audit was conducted on all patients who received albumin between January 1-February 28, 2023 across 3 hospitals in Saskatoon.

Results: A total of 661 albumin infusion orders were prescribed to 250 patients during our study period. Overall, 93.4% of 25% albumin orders and 78.7% of 5% albumin orders were identified to have been administered for inappropriate indications. Albumin was most commonly prescribed by General Internal Medicine, including 40% and 24% of albumin 25% and 5% concentrations, respectively.

Conclusion: Our study confirms that the vast majority of albumin transfused in Saskatoon hospitals is for inappropriate indications. These results highlight an opportunity for resource utilization improvement within the health system.

2

Noaah Reaume (Dr. Peter Hedlin)

The incidence of spinal anesthesia failures during elective Caesarean sections; a comparison of two different suppliers

Caesarean sections are commonly performed under regional anesthesia, using the local anesthetic bupivacaine to achieve a subarachnoid block (SAB). A failed SAB may be defined as pain/discomfort requiring intravenous/inhalational supplementation or conversion to general anesthesia. A previous chart review found that the Caesarean section SAB failure rate at Jim Pattison Children's Hospital (JPCH) in 2020 was 2.5%, with other literature citing failure rates of 0.5-6.4%. We seek to determine the rate of Caesarean section SAB failures at JPCH in 2017, in comparison to 2020, along with patient, provider, and product factors associated with SAB failure.

Chart review (n=1519) was performed to collect patient factors (e.g., BMI, gestational age, GHTN, GDM) and anesthesia factors (e.g., bupivacaine baricity/volume, fentanyl and epimorph doses).

The SAB failure rate at JPCH in 2017 was 4.3%, approximately double the failure rate observed in 2020 (2.5%). In 2020, failures were most likely to be re-attempted (48%), whereas in 2017, intraoperative supplementation was most common (47%). Conversion to general anesthesia was also less common in 2017 vs. 2020 (21% vs. 35%). In 2020, SAB failures were observed to occur in batches, possibly due to the integrity of certain bupivacaine lot numbers. This grouping effect was not observed in 2017 with bupivacaine from a different supplier.

2

Sam Seshadri (Dr. Beverly Wudel)

Factor Associated with Syphilis Treatment Success in Patients Meeting HIV-Syphilis Coinfection Lumbar Puncture Criteria: Saskatoon, SK, Canada

The rates of HIV and syphilis in Saskatchewan have been rising rapidly over the past twenty years. The primary concern of HIV positive patients who have a positive syphilis RPR titre is the progression to neurosyphilis. Therefore, there are criteria published by Canadian Public Health Laboratory Network who suggest a lumbar puncture for patients with a RPR titre ≥ 1:32 or a CD4+ count ≤ 350. We compare rates of lumbar puncture and corresponding syphilis treatment success at an outpatient HIV community-care model clinic and an in-hospital traditional HIV care clinic in Saskatoon, SK. Of 190 patients at both clinics, 122 met lumbar puncture criteria. Through logistic regression analysis, we find that lumbar puncture rates were relatively higher at the in-hospital clinic while treatment success rates were relatively lower when patient factors are considered. The results suggest an importance of immediate access to syphilis treatment in HIV patients and question the utility of lumbar puncture as opposed to syphilis opportunistic treatment.

Rachel Silverberg (Dr. Shuaa Basalom)

Saskatchewan Physicians' Wellbeing

Physician burnout leads to increased medical error, rates of early retirement, reduced clinic hours, unprofessional behavior, and decreased work efforts. The recently published National Physician Health (NPHS) Survey found a dramatic increase in burnout among Canadian physicians compared to pre-pandemic data.

Our study aimed to quantify the wellbeing of Saskatchewan physicians, to establish a baseline for comparison. By better understanding the climate of burnout in our province, targeted interventions can be developed at a personal and institutional level.

We invited Saskatchewan physicians to respond to a virtual questionnaire comprising of demographic items and the 9-item Physician Well-Being Index-Expanded (ePWBI). The ePWBI measures burnout, depression, suicidal ideation, fatigue, overall quality of life, and career-related outcomes (intent to reduce work hours, intent to leave medical practice). ePWBI is scored from -2 to 9, where ≥3 is considered "at risk".

Upon analysis, an alarming 62% (N=77) of participants were categorized as "at risk", with General Practitioners being the most at risk (80%, N=57%), followed by 57% (N=52) of Medical specialists. There were no significant relationships between risk score and other demographics attributes. Saskatchewan physicians are highly at risk for the negative consequences of burnout, especially General Practitioners.

2

Mark Wang (Dr. David Leswick)

Incidence of Surgery After Shoulder MRI According to Physician Type, Patient Age, and Patient Sex

Objective: To compare surgical incidence after shoulder MRI referrals by orthopedic surgeons, family physicians (GPs), and sports medicine physicians. Secondary objectives were to assess the impact of patient age, sex, and MRI findings on the incidence of surgery.

Material, Methods, and Procedures: Ethics approval was obtained. Shoulder MRIs performed over 2 years-time were assessed. Subsequent surgical intervention following MRI was compared among referral groups. Associations of surgery with age, sex and MRI findings were also assessed. Chi-square test, analysis of variance, and univariate/multivariable logistic regression were used for statistical analysis.

Results: Overall, 301 MRIs were evaluated (GP=81, Orthopaedic=204, Sports medicine=16). The mean age was 49.9 years; 37% female versus 63% male. Surgical incidence was 15% for GPs, 36 % for orthopaedics, and 44% for sports medicine. Surgery was 65% less likely for GP than orthopaedic patients (p=0.004). There were no age-related differences. Post-MRI surgical incidence by gender was similar (25.23% female, 34.21% male, p=0.104). Patients with full thickness rotator cuff (RC) tears and labral tears were more likely to have surgery.

Significance: Surgical incidence following shoulder MRI was lower for GP patients. Although more males received MRIs, there was no significant sex-based difference in surgical incidence following MRI.

2

Lindsey Zimmermann (Drs. Ryan Lett and Oksana Prokopchuk-Gauk)

Albumin Utilization and Appropriateness in Regina Patients: A Healthcare Quality Improvement Project

Background: Human albumin (5% and 25%) is a fractionated blood product that is used as an intravenous volume expander. Unfortunately, there is a lack of data in many scenarios so this product is often ordered and administered without appropriate indication. Currently, Saskatchewan has the highest per capita use in Canada. This project aims to examine albumin utilization and appropriateness in Regina.

Methods: A retrospective chart review was completed to provide a current status of albumin use. Variables including albumin recipient demographics (age, sex, admission status, medical conditions), indications for albumin use, completeness and components of the physician order, specialty of the prescriber, dose of albumin administered and ordered, and safety outcomes of albumin infusion over the study period of January through February 2023 were recorded.

Results: Albumin 5% was used inappropriately in 29.3% of orders (n=22/75), while albumin 25% was used inappropriately in 88.2% of orders (n=374/424). Though albumin use was not suggestive of adverse outcomes in this study given that there was no adverse transfusion reactions reported, risk of potential harm and unnecessary medical intervention should prompt review.

Conclusion: This audit reaffirms the importance of evidence-based medicine; analysis of current inappropriate albumin use may guide future optimization strategies.

Kacie Kushniruk (Dr. Susan Petryk)

Optimizing a Model of Support in Child Psychiatry Utilizing Community Mental Health Nurses

Introduction: Child and Youth Services (CYS) incorporates a unique nursing service where Clinical Mental Health Nurses (CMHNs) relay important clinical feedback to physicians and serve as a vital link between families and psychiatrists. Caregivers may also reach out to CMHNs if they feel they require additional support or immediate care. This project aimed to explore how valuable caregivers perceive the current care provided by CMHNs and how services could be improved.

Methods: Mixed-methodology included a 6-point Likert-style agreeability survey via REDCap (n = 88) and a semi-structured interview (n = 10). Statistical analysis was performed utilizing R-Software (4.3.1). Descriptive statistics were computed, and Kruskal Wallis tests were used to explore group differences. Qualitative data were coded via NVivo 12 to identify recurring themes.

Results: No significant differences were observed among caregiver groups. Feedback was overwhelmingly positive regarding call-back times, addressing medication concerns, and reducing stress. Qualitative themes indicated CMHNs are perceived as a significant source of emotional support who help caregivers navigate the healthcare system. CMHNs also create a connecting bridge that fills apparent care gaps between physician appointments.

Conclusion: CMHNs are essential for ensuring an adequate continuum of care, whose services are overwhelmingly perceived as valuable for CYS families.

2

Rachel Cey (Dr. Gary Hunter)

Local Diagnostic Performance of the Hyperdense Basilar Artery Sign

INTRODUCTION: Acute ischemic stroke secondary to basilar artery occlusion is a devastating syndrome, with highly variable clinical presentations. The hyperdense basilar artery (HDBA) sign is a well-recognized finding in basilar thrombosis on non-contrast CT. However, it is challenging to identify without appropriate clinical suspicion. Our objective was to determine a positive HBDA cut-off value from local data for use in standardized CT scan reporting of potential strokes. METHODS: Acute stroke CT, CTA, and conventional angiographic cases of basilar artery occlusion performed at RUH and JPCH were evaluated for variables including HBDA density measured in Hounsfield units (HBDA-HU) with reference values taken from areas of non-occluded basilar artery in the same individual (REF-HU). Indications for CT scans were also evaluated. RESULTS: In this study, a paired t-test analysis revealed a significant difference ($p<0.05$) between HBDA-HU (74.69±44.03) and REF-HU (42±7.15). Of the 13 cases identified, indications for CT included stroke alert (9), seizure (2), septic workup (1), and decreased LOC (1). CONCLUSIONS: HDBA is likely a reliable predictor of acute basilar thrombus in appropriate clinical settings. Future directions include calculation of a receiver operating characteristics curve to determine a threshold HU value for standardized reporting of the HDBA sign.

Surgery

Zahin Rahman (Dr. Michael Kelly)

Investing the Effects of Membrane-Targeting Drugs on Post-Stroke Damage

Stroke is a top-five leading cause of death and disability in Canada. Ion dysregulation is a key component of metabolic dysregulation in stroke and a primary driver of post-stroke edema. This project aimed to gather preliminary data on the effectiveness of Acetazolamide (ACZ) and TGN-020 as potential treatments for post-stroke edema. The middle cerebral artery occlusion (MCAO) model of ischemic stroke was performed in mice, and one of the drugs, or a control substance, was injected into the mice 5mins before re-perfusion. Mice were euthanized at 2hr, 48hr, and 72hr time points. Coronal brain tissue cryosections were obtained for visualization using Hemotoxin & Eosin (H&E) staining, as well as X-Ray Fluorescence Imaging (XFI) and Fourier Transform Infrared (FTIR) imaging. Preliminary results showed that XFI is an effective tool at displaying the elemental maps of stroke vs sham brains, which will be useful in comparing relative amounts of ion dysregulation after the administration of each treatment. Next steps include analyzing all pilot data to determine which drug(s) to further study, adapting the protocol as necessary, and developing a method of mass compression quantification as an additional method of measuring post-stroke damage.

1

Mohammed Armanazi (Dr. Moness Masri)

Visual Recovery in the Emergency Management of Rhegmatogenous Retinal Detachment

Background: Delays in eye care impact visual outcomes, especially in Rhegmatogenous Retinal Detachment (RRD). Improving symptom awareness, timely referrals, and local ophthalmologist access can expedite critical early surgeries. The impact of RRD and macular involvement duration on postoperative visual acuity is not well-defined.

Methods: Retrospective chart review of 1,000+ urgent eye care cases (January 2012-July 2023), identifying 96 RRD patients. We studied primary variables (pre/post-operative BCVA and macular status) and secondary factors (age, gender, residency, symptoms, surgery type) with appropriate statistical tests.

Results: Delays from symptom onset (average 8.8 days), First Healthcare Visit (1.5 days), and First Retina Specialist Visit (0.7 days) negatively impacted Final BCVA. Each extra day between First Retina Specialist Visit and Surgery increased odds of post-VA>=0.5 by 78% ($p = 0.005$) and doubled Macula-OFF risk ($p = 0.036$). Every added day from the First visit to Surgery raised odds of post-VA>=0.5 by 20% ($p = 0.042$).

Conclusion: Timely intervention is crucial in RRD. Delays in symptom recognition, referrals, and surgery harm visual outcomes. Extended specialist visit-surgery intervals decrease BCVA and heighten macular detachment risk. Patient awareness and access to care affect RRD management and vision preservation, highlighting the need for assessing geographical disparities.

1

Whitney Curtis (Dr. Sarah Smith)

Examining the relationship between birth weight and cesarean section rate in a tertiary care center

Introduction: Cesarean sections have a higher risk of maternal morbidity and mortality. With the rates of cesarean section in Canada increasing, there is a push to identify the reasons leading to this increase.1 It has been hypothesized in the current retrospective study that the increased cesarean section rate at Regina General Hospital over the past five years is due to higher infant birth weight.

Methods: A retroactive chart review study was completed, collecting data for 8179 deliveries at Regina General Hospital in 2018 and 2022. The primary outcome of this study was to determine the relationship between infant birth weight and delivery method. The secondary outcome was to determine the trends in infant birth rate and caesarean section rate over time.

Results: Cesarean sections increased by 7.30% from 2018 (n = 1204) to 2022 (n = 1292). Infant birth weight and sex (male) and gestational diabetes all had statistically significant effects on the probability of the patient having a cesarean section.

Conclusion: The results showed that gestational diabetes and infant male sex increased the likelihood of a cesarean section, while increased infant birth weight decreased the likelihood of having a cesarean section.

1

Maya Gabruch (Dr. Michelle Clunie)

Pragmatic Observational Study of the Safety and Efficacy of Prothrombin Complex Concentrate for Excessive Bleeding During Adult Cardiac Surgery

Purpose: Cardiovascular surgery (CVS) with cardiopulmonary bypass (CPB) carries a high risk of bleeding and blood product utilization. Recent evidence suggests that Prothrombin complex concentrate (PCC) is an alternative to plasma (FFP) for the management of bleeding in CVS.

Hypothesis: PCC is a safe option that will decrease allogenic blood transfusions in CVS.

Methods: We conducted an observational study of a 6-month period before (Sept-Feb 2019-20) and after (Sept-Feb 2022-23) PCC availability for CVS. Primary outcomes included 30-day mortality, duration of mechanical ventilation, ICU and hospital length of stay, thromboembolic complications, acute kidney injury and bleeding complications. Secondary outcomes included chest tube bleeding and blood product utilization.

Results: 312 CVS patient-charts were reviewed (n=158 2019/20 group; n=154 from 2022/23 group). There was no difference in demographics, CPB duration, mortality or complications between groups. The 2022/23 group had a statistically significant increase in PCC and fibrinogen concentrate use, less chest bleeding, and decreased cell-saver volume. There was no difference in blood product utilization.

Conclusions: The use of PCC to treat excessive bleeding after CPB appears to be safe and may decrease chest tube bleeding in adult cardiac surgical patients. However, a reduction in allogenic blood utilization was not observed.

1

Wardah Mahmood (Dr. Almereau Prollius)

The effect of body mass index (BMI) on surgical and anesthetic outcomes in total laparoscopic hysterectomy (TLH)

The objective of this study is to evaluate the effect of body mass index (BMI) on surgical and anesthetic outcomes for elective total laparoscopic hysterectomy (TLH). We predict a direct relationship between increasing BMI and operative time, anesthetic time, and blood loss. This retrospective, cohort study included 603 patients who had an elective TLH in Saskatoon, SK, Canada between January 1, 2018 and December 31, 2019.

Hospital medical records of all TLHs during the time period were reviewed. The independent variable was BMI and the dependent variables include primary outcomes of operative time, anesthetic time, and estimated blood loss and secondary outcomes of intraoperative complications, conversion to an open procedure, and blood or iron transfusion.

We will use bivariate analysis for associations, Chi-squared tests for categorical outcomes and ANOVA or Krukal-Wallis tests for continuous variables. Linear regression analyses, significance tests and odds ratios will be included. We will do subgroup analyses to control for confounding factors such as age and comorbidities.

Based on the literature and projected data, there appears to be a correlation between increasing BMI and our preliminary values. This data will guide counselling and surgical planning to improve outcomes for patients undergoing TLH at our surgical centre.

1

Sydney Murray (Dr. Michael Moser)

Were the 2016 recommendations for percutaneous kidney biopsies followed and did they lead to safer and more accurate results?

Background: Based on our prior research, provincial guidelines for the performance of percutaneous renal biopsies were implemented in 2017. The current study aimed to assess whether the recommendations led to the goal of fewer non-diagnostic specimens and decreased complications.

Methods: Percutaneous ultrasound-guided renal biopsies performed on adult patients (n=337) from June 2017 to May 2021 in Saskatoon were analyzed. Technical factors were measured on ultrasound images taken during biopsies. Specimen metrics were obtained from pathology reports. Information on complications was collected from medical records.

Results: Compared to our previous study, non-diagnostic specimens decreased from 10% to 4% (p=0.0005), and complications decreased from 36% to 14% (p=0.0001). Biopsies done utilizing the checklist recorded an average angle of attack closer to the recommendation of 50-70° compared to the non-adherent group (63.7° vs 72.2°, P=0.0188). Compliance to recommendations did not change year-by-year from 2017 to 2021. Biopsies following recommendations completely (only 29% of biopsies) had fewer complications than biopsies that did not (8% vs 17%, P=0.032).

Discussion: The recommendations implemented in 2017 resulted in a reduced number of non-diagnosistic biopsies and fewer complications. Work still needs to be done to further improve compliance with the provincial guidelines.

2

Carolyn James (Dr. Michael Kelly)

Neurobehavioural Testing in Mice: Studying the Aftermath of MCAO Stroke

Stroke is ranked the fifth leading cause of death in Canada in 2020, resulting in ~13500 deaths each year [1]. Stroke is a major public health concern with significant economic and societal repercussions. Most stroke survivors require extensive rehabilitation to restore the quality of their lives and in many cases people never fully recover. Due to changing population demographics, particularly in developing nations, the public health burden of stroke will continue to increase over the coming decades [2], with current estimates of the morbidity and cost burden understating these impacts [3].

Ischemic stroke accounts for ~80% of stroke cases and hemorrhagic stroke for nearly 20%, although the proportions of stroke types depend on population [4]. Middle cerebral artery occlusion (MCAO) strokes are the most common, caused by obstructed blood flow and subsequent brain infraction in the MCA territory. Using published methods for testing behaviour and function in post-stroke mice will give a clear quantitative metric for post-stroke deficits relative to sham controls. Having a better-established baseline for post-stroke outcomes will provide us with a benchmark reference for untreated MCAO animals and controls in future drug treatment studies.

2

Sameer Rathnayaka (Dr. Rahul Mainra)

Kidney Transplant Outcomes and Practice Patterns following Antibody Mediated Rejection in Saskatchewan: A Retrospective Study

Acute rejection is an important cause of allograft loss in kidney transplantation. Antibody-mediated rejection (AMR) is difficult to treat, exacerbated by specific immunologic profiles including HLA mismatches and de novo donor-specific anti-HLA antibodies (dnDSA), and pose a higher allograft loss risk. Despite advances, ambiguity persists in AMR prevention and treatment. Clinical trials have not shown superiority of modern immunosuppression therapies over conventional treatments like plasmapheresis and IVIG, yet are widely used without conclusive evidence. This retrospective study conducted at the Saskatchewan Transplant Program aims to identify factors associated with graft failure or a 30% eGFR decline 12 months post-AMR diagnosis. The goal is to establish a foundational dataset for future clinical trials addressing AMR. The study observed that AMR treatment consists predominantly of conventional regimens (IVIG, Plasmapheresis, prednisone, and antibody therapy). There were no statistically significant associations between AMR prognosis, current treatment practices, and patient demographics. However, the presence of anti-HLA DSA was correlated with AMR occurrence, albeit with sample size limitations precluding association of specific antibodies with AMR risk. Future directions involve extended follow-up intervals, analysis of additional variables relevant to AMR management, and collaboration with Canadian and international sites to provide a comprehensive perspective on AMR in kidney transplant recipients.

2

Kalea Rempel (Dr. Jagadish Rao)

Retrospective Review of TEG and Transfusion Practices in Cardiac Surgery in an Urban Tertiary Care Centre

Hemorrhage occurs commonly in cardiac surgery and is a significant cause of morbidity and mortality. Standard laboratory testing has not predicted the need for blood products in the surgical setting. This study examines if the implementation of thromboelastography (TEG) after 2011 in cardiac operating rooms affects transfusion practices. A retrospective analysis of patients who underwent cardiac surgery in 2010 and 2014, patient characteristics will be analyzed to determine similarities. Transfusion algorithms using TEG were compared with transfusion algorithms based in clinician decision. Blood and blood components will be analyzed using T test and Chi Square Testing. Linear models will be used to determine the impact of TEG on transfusion practices. The analysis includes 371 patients (2010), and 343 patients (2014), totaling 709. Data collection for this project is still underway. Preliminary data indicates that there were less transfusions in 2014, after the implementation of TEG in the cardiac OR. The findings from this project will aid in determining the usefulness of TEG during surgery and expand its use to other departments. Due to how quickly TEG gives results and dictates blood product administration it has the potential to greatly reduce morbidity and mortality and save significantly on blood product use.

2

Natisha Thakkar (Dr. Geethan Chandran)

An Analysis of Operating Room Efficiency in a Single Surgeon's Practice

Background: Operating room (OR) efficiency is a high priority for many hospitals. An efficient OR can improve patient safety and satisfaction, reduce complications and increase patient turnover. There is opportunity for pre-, post-, and intraoperative efficiency to be improved through various interventions. The aim of this study is to examine measures of OR efficiency in a single surgeon's practice, in order to assess progress from previous years and further identify areas where improvements can be made to maximize efficiency.

Methods: This study included a retrospective analysis of operative records over the first six months of 2023. A comparison of OR efficiency measures from 2023 and 2016 was performed using a Mann-Whitney test, following the implementation of a streamlined pick list. 2023 OR efficiency measures from St. Paul's Hospital (SPH) and Saskatoon City Hospital (SCH) were also compared through a Mann-Whitney test.

Results: The difference between OR efficiency measurements in 2016 and the first six months of 2023, and between SPH and SCH in 2023, were not statistically significant.

Conclusion: Based on these results, the implementation of a streamline pick list did not significantly impact non-operative OR time and there is no disparity in OR efficiency measures between SPH and SCH.

2

Alexander Waslen (Dr. Angelica Lang)

Wrist fusion surgery alters shoulder kinematics during functional tasks compared to non-fusion side

Wrist fusion surgery is a commonly used treatment for late-stage rheumatoid arthritis that decreases pain but eliminates mobility at the wrist. Total wrist fusion patients report having difficulties with several tasks of daily living including reaching high shelves and perineal care. The purpose of this investigation was to determine whether total wrist fusion surgery causes kinematic changes in the upper limb compared to the non-wrist fusion arm during functional tasks. Seven participants who had undergone unilateral total wrist fusion surgery more than six months ago were recruited. All participants completed a series of eight functional tasks while their upper limb kinematic data was recorded with the Vicon motion capture system. Scapular and humeral angles were calculated, and compared between wrist fusion and non-wrist fusion arms in each participant. Wrist fusion resulted in increased scapular upward rotation during the forward transfer and wash axilla tasks, as well as increased humeral rotation and scapular protraction during the hair comb task when compared to the non-wrist fusion arm. Knowing that total wrist fusion may contribute to these kinematic changes could allow for rehabilitation strategies to prevent long term injury at the shoulder as a result of this procedure.

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