



# University of Colorado Anschutz Medical Campus

ANNUAL STUDENT MSA CAPSTONE PRESENTATIONS

April 8, 2024

ANSCHUTZ MEDICAL CAMPUS

Strauss Health Science Library

## **Poster Sessions**

Session 1: 1:00 pm – 2:00 pm

Session 2: 2:00 pm – 3:00 pm

Session 3: 3:00 pm – 4:00 pm

The MSA Directors would like to acknowledge, with gratitude, the support for medical student research provided by:

**The University of Colorado**  
**School of Medicine Dean's Office**  
*And*  
**Undergraduate Medical Education Office**  
**Poster Session Judges**

The organizing committee wishes to acknowledge their appreciation of the following serving as judges for the MSA Capstone Presentations. Without their generous contribution of time and talent the forum would not be possible. Thank you!

Madiha Abdel-Maksoud	Aimee Gardner	Chelsey Patten
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Robert Anderson	Carlos Goncalves	Sara Pope
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David (Tyler) Coyle	Jim Maloney	John Tentler
Caleb Doll	Blake Martin	Jeffrey Wagner
Julie Dunn	Sarah Milla	Blair Weikel
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Jarrod Ellingson	Kristen Nadeau	Sarah Wherry
Brian Erly	Anna Neumeier	Alicia White
Sarah Faubel	Stephen Newton	Joshua Williams
Brandi Freeman	Karen Orjuela	Jun Ying
Steve Fuest	David Orlicky	Shanta Zimmer

Primary Presenter: Sarah Seiwald

Project Title: *Human Breast Milk Enhances Cellular Proliferation in Cornea Wound Healing*

Primary Mentor: Mark Petrash

Thematic Area: Basic Biomedical Science

Abstract: Purpose: Corneal epithelial defects from ulcers, trauma, or surgery heal as new epithelial cells grow centripetally from the limbus and replenish the epithelium. Corneal wound healing requires cell signaling molecules. However, a topical treatment with these components is not available. Human breast milk (HBM) offers a potential, novel treatment as it contains bioactive molecules important in epithelial cell healing. This study seeks to investigate the potential of HBM in cornea wound healing.

Methods: Balb/C mice, 8-12 wks old, were anesthetized prior to creating a 2mm central cornea epithelial defect. Mice were randomly assigned to a treatment group: HBM, ophthalmic ointment containing neomycin, polymyxin B, dexamethasone (RxTx), or saline and treated 4x/day for 2 days. Wound area was quantified by fluorescein and ImageJ at 0, 8, 24, and 48h post wounding and eyes used for histology, RT-qPCR, and ELISA.

Results: Wounded corneas treated with HBM demonstrated increased re-epithelialization at 8h post injury compared to RxTx and saline treatments. ELISA showed significantly higher Ki67 in HBM treated eyes vs. saline control at 8h ( $p=0.0278$ ). Additionally, immunohistology revealed more Ki67 positive cells in the HBM group compared to saline at 8h and 24h ( $p=0.0063$  8h;

p=0.00072 4h). For inflammatory analysis, HBM group IL-1 $\beta$  levels were similar to the saline group, and higher than RxTx treated eyes (p<0.05). Immunohistochemical staining for CD11b (macrophage marker) revealed HBM-treated eyes had significantly more positive cells vs. saline. RT-qPCR of limbal stem cell markers (LESCs) revealed upregulation of Integrin  $\alpha$ V at 8h with HBM vs. saline.

Conclusions: HBM treatment on corneas with debridement of epithelium demonstrated improved healing, cellular proliferation, and upregulation of the LESCC gene transcript, integrin  $\alpha$ V, after wounding. Future studies could investigate LESCC response to different signaling molecules in HBM to better understand the efficacy of this potential therapy.

Primary Presenter: Courtney McDonald

Project Title:

*GlobalSurgBox: A Portable Surgical Simulator for Surgical Trainees Worldwide*

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Primary Mentor: Yihan, Madiha Lin, Abdel-Maksoud

Thematic Area: Global Health

Abstract: Purpose

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Simulator training is increasingly recognized as a critical component to surgical education.

However, successful implementation of these platforms is often limited by affordability, portability, and accessibility. The goal of this study was to evaluate whether a novel, portable surgical simulator would be of value to surgical trainees. Additionally, we aimed to assess whether this simulator would be of value to surgical trainees in multiple countries across the income spectrum.

Methods

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The GlobalSurgBox was designed as a compact, portable, and modular surgical trainer. This trainer was designed to be adaptable for trainees of all skills levels, as well as locally adaptable and replenishable in countries across the income spectrum. Between March and November 2021,

medical students and general surgery residents from three academic medical centers in three countries (USA - high income, Kenya - middle income, and Rwanda - low income) were instructed on how to perform basic surgical technical skills using the GlobalSurgBox.

Participants were sent an anonymized survey evaluating the practicality and helpfulness of the trainer.

## Results

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A total of 69 participants used the GlobalSurgBox and responded to the survey (100% response rate). This included 30 from the USA, 26 from Kenya, and 13 from Rwanda. All respondents agreed that surgical simulation was an important aspect of surgical education. Despite varying levels of access to simulation resources, only 1 of 30 (3.3%) USA trainees, 13 of 26 (50%) of Kenyan trainees, and 10 of 13 (77%) Rwandan trainees stated they used these resources routinely. 29 (96.7%) of USA trainees, 13 (50.0%) of Kenyan trainees, and 9 (69.2%) of Rwandan trainees stated that there were barriers to using simulation resources. The most commonly cited barriers to using these simulators included lack of convenient access and lack of time. After using the GlobalSurgBox, only 3 of 30 (10.0%) residents reported lack of convenient access as a continued barrier to using the trainer. 26 (86.7%) of US trainees, 25 (96.2%) of Kenyan trainees, and 12 (92.3%) of Rwandan trainees stated that the GlobalSurgBox was a good

facsimile of the operating room. 30 (100%) US trainees, 25 (96.2%) Kenyan trainees, and 9 (69.2%) Rwandan trainees stated that the GlobalSurgBox better prepared them for clinical settings.

## Conclusion

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A majority of residents across all three countries reported multiple barriers to surgical simulation in their current surgical training. The GlobalSurgBox eliminated many of these stated barriers by providing a portable, affordable, and realistic way to practice skills needed in the operating room.

Primary Presenter: Lauren Barbera

Project Title: *HIV and COVID-19: Review of Clinical Course and Outcomes*

Primary Mentor: Kristine Erlandson

Thematic Area: Clinical Science

Abstract: Background: Understanding the relationship between HIV and SARS-CoV-2 has important public health implications.

Objective: To summarize current research on COVID-19 among People with HIV (PWH) as published through July 15, 2021.

Methods: We conducted a search of PubMed, Scopus, preprint databases (medRxiv, bioRxiv), and the references of publications found using key terms relevant to COVID-19 (€€COVID-19€€ OR €€SARS-CoV-2€€ OR €€coronavirus€€ ) AND to HIV (€€HIV€€ OR €€Human Immunodeficiency Virus€€ OR €€AIDS€€ OR €€Acquired Immunodeficiency Syndrome€€ ).

We summarized all articles that reported data or opinions on SARS-CoV-2 and HIV coinfection.

Conclusions: Although many initial case series and cohort studies found no increased risk for SARS-CoV-2 infection or severe COVID-19 outcomes among PWH, recent studies have signaled an increased risk for severe COVID-19 disease progression even in the setting of well-controlled HIV. Whether this is due to the increased prevalence of comorbidities in PWH and other social determinants of health is unknown. These conflicting findings highlight the continued need for COVID-19 related research among PWH that addresses COVID-19 disease



course as well as exacerbation of existing comorbidities already disproportionately represented among PWH.

Primary Presenter: Hannah Kylo

Project Title: *Adaptive Responses in Uteroplacental Metabolism and Fetoplacental Nutrient Shuttling and Sensing during Placental Insufficiency*

Primary Mentor: Stephanie Wesolowski

Thematic Area: Basic Biomedical Science

Abstract: Glucose, lactate, and amino acids are major fetal nutrients. During placental insufficiency-induced intrauterine growth restriction (PI-IUGR), uteroplacental weight-specific oxygen consumption rates are maintained, yet fetal glucose and amino acid supply is decreased and fetal lactate concentrations are increased. We hypothesized that uteroplacental metabolism adapts to PI-IUGR by altering nutrient allocation to maintain oxidative metabolism. Here, we measured nutrient flux rates, with a focus on nutrients shuttled between the placenta and fetus (lactate-pyruvate, glutamine-glutamate, and glycine-serine) in a sheep model of PI-IUGR. PI-IUGR fetuses weighed 40% less and had decreased oxygen, glucose, and amino acid concentrations and increased lactate and pyruvate versus control (CON) fetuses. Uteroplacental weight-specific rates of oxygen, glucose, lactate, and pyruvate uptake were similar. In PI-IUGR, fetal glucose uptake was decreased and pyruvate output was increased. In PI-IUGR placental tissue, pyruvate dehydrogenase (PDH) phosphorylation was decreased and PDH activity was increased. Uteroplacental glutamine output to the fetus and expression of genes regulating glutamine-glutamate metabolism were lower in PI-IUGR. Fetal glycine uptake was lower in PI-IUGR, with no differences in uteroplacental glycine or serine flux. These results suggest

increased placental utilization of pyruvate from the fetus, without higher maternal glucose utilization, and lower fetoplacental amino acid shuttling during PI-IUGR. Mechanistically, AMP-activated protein kinase (AMPK) activation was higher and associated with thiobarbituric acid-reactive substances (TBARS) content, a marker of oxidative stress, and PDH activity in the PI-IUGR placenta, supporting a potential link between oxidative stress, AMPK, and pyruvate utilization. These differences in fetoplacental nutrient sensing and shuttling may represent adaptive strategies enabling the placenta to maintain oxidative metabolism.

Primary Presenter: Salman Ashraf

Project Title: *Therapeutic approaches for UCPPS management: research advances, experimental targets and future directions*

Primary Mentor: Anna Malykhina

Thematic Area: Clinical Science

Abstract: Latest Therapeutic Advances in Urologic Chronic Pelvic Pain Syndrome

Salman Ashraf\*, Taylor C. Clarkson, Alison Xiaoqiao Xie, Anna P. Malykhina

Introduction and Objective. Urologic Chronic Pelvic Pain Syndrome (UCPPS) is a painful chronic condition with persistent pelvic pain often originating from the pelvis that can lead to detrimental lifestyle changes in the affected patients. The syndrome affects both, females and males, with an estimated prevalence from 5.7 to 26.6% across the world. In this narrative review, we summarized the latest translational and clinical research advances in the UCPPS field, followed by the currently used approaches to accurate diagnosis, treatment options, and potential improvements for treating UCPPS patients.

Methods. A narrative review of existing literature surrounding chronic pelvic pain and associated co-morbid pain conditions was conducted. The National Library of Medicine was searched for original clinical and translational research data within the past 10-15 years followed by the review of the published findings. The data was corroborated with findings from the

Multidisciplinary Approach to Pelvic Pain Network, and additional original clinical research studies.

Results. UCCPS is a complex chronic condition which could be misdiagnosed due to the broad range of symptoms and significant symptom overlap with other chronic illnesses. UCPPS is typically diagnosed based off patient medical history and physical examination. Additional evaluation techniques center around focal findings such as pelvic masses and mucopurulent cervical discharge. Secondary to physical exam, urinalysis, microbiologic tests, and laparoscopy are often used to rule out other causes prior to diagnosing UCPPS.

Conclusions. Diagnosis of UCPPS should implement a more holistic approach by incorporating specific questions about region, duration, and previous history of pain (both cyclical and non-cyclical) into initial examination. Establishing a clear understanding of the patient's pain description is necessary in order to rule out other causes, and to initiate treatment early on with existing methodologies while creating a more customized treatment plan.

Source of funding: NIH grant support DK116648

Primary Presenter: Thy Nguyen

Project Title: *1) Effects of a Eucaloric High Fat Diet on Anterior Pituitary Hormones and Adipocytokines in Women with Normal Weight*

*2) Analysis of Inflammatory Markers in Response to Induction of Reprometabolic Syndrome by a Eucaloric High Fat Diet in Normal Weight Women.*

Primary Mentor: Nanette Santoro

Thematic Area: Basic Biomedical Science

Abstract: Project 1)

Objective: Obesity in women is associated with decreased fertility, adverse pregnancy outcomes and relative hypogonadotropic hypogonadism, which we termed “Reprometabolic Syndrome.”™ We previously demonstrated that a one-month eucaloric high-fat diet (HFD) recapitulated this phenotype in normal weight women by decreasing GnRH-stimulated LH and FSH secretion. Herein, we investigated the effects of a one-month eucaloric HFD on other anterior pituitary trophic hormones, their targets, and adipocytokines.

Design: This research is a secondary analysis of a parent study.

Subjects: Eighteen normal weight (BMI 18.0-24.9 kg/m<sup>2</sup>) healthy, eumenorrheic women (mean age 29.78 ±5.92) completed the study.

Intervention: Participants underwent frequent blood sampling during the early follicular phase of the menstrual cycle before and after the one-month eucaloric HFD intervention (48% calories from fat).

Main Outcome Measures: Serum thyroid stimulating hormone (TSH), free thyroxine T4 (fT4), total triiodothyronine (tT3), cortisol, growth hormone (GH), prolactin (PRL), Insulin-like Growth Factor 1 (IGF-1), adiponectin, and leptin were measured by immunoassay. One-sample t-tests were used to assess significance of differences in hormone levels before and after the HFD intervention.

Results: Exposure to a eucaloric HFD did not result in weight change. Plasma metabolomics demonstrated elevation of red blood cell fatty acids by the last day of the HFD, validating adherence among participants. There was a small but significant decrease in tT3 ( $p=0.01$ ) and cortisol ( $p=0.02$ ) after the HFD. No changes in TSH, fT4, PRL, GH, IGF-1, leptin, or adiponectin levels were observed in response to the HFD.

Conclusion: A one-month eucaloric HFD, previously shown to induce Reprometabolic Syndrome and suppress gonadotropins, had no significant effect on other anterior pituitary hormones or adipocytokines.

Project 2)

Obesity is associated with chronic low-level inflammation and is known to contribute to metabolic dysfunction and hypogonadotropic hypogonadism, which we have previously termed the Reprometabolic Syndrome.™ To investigate potential factors involved in obesity-related

reproductive endocrine dysfunction, we conducted a secondary analysis of inflammatory markers in a sample of normal weight women exposed to a one-month eucaloric high-fat diet (HFD), which, as reported earlier, induced the relative hypogonadotropic hypogonadism characteristic of Reprometabolic Syndrome. Eighteen healthy women with a BMI between 18.0-24.9 kg/m<sup>2</sup> and regular menstrual cycles participated in the study. Frequent blood sampling was performed during the early follicular phase before and after the one-month eucaloric HFD intervention (48% of calories from fat). Serum samples pooled from each participant were analyzed using immunoassay to measure levels of 30 cytokines, interleukins, and chemokines. Differences pre- and post-HFD intervention were examined by one-sample t-tests. Exposure to the eucaloric HFD did not result in changes in body weight. HFD-induction of Reprometabolic Syndrome in normal weight women was associated with a significant elevation only in the anti-inflammatory cytokine IL-10 (p=0.04). Eotaxin, IL-6 and MIP-1 $\beta$  also increased in response to the HFD, but not statistically significantly (p=0.07). Results suggest that the increase in multiple inflammatory markers, typically associated with obesity, are not primary mediators of the relative hypogonadotropic hypogonadism of Reprometabolic Syndrome.



Primary Presenter: Laura Meimari

Project Title: *A Critical Analysis of Community Based Substance Use Interventions in Refugee and Immigrant Populations*

Primary Mentor: Janet Meredith

Thematic Area: Global Health

Abstract: Background: Though substance use disorder and mental health concerns are widely recognized issues within displaced populations, problematic alcohol use within the Burmese refugee population of Denver in particular has been identified as an issue of importance by members of the community itself. Many of these refugees have experienced violence and persecution at the hands of a military junta, resulting in high rates of post-traumatic stress disorder and substance use. The Burmese refugee population faces alcohol-related challenges, including availability in camps on the Thai-Burma border. Through prior partnerships with University of Colorado medical students utilizing a community-based participatory research (CBPR) approach, problematic alcohol use was identified as a theme for health literacy intervention by the community. In the setting of numerous contributing factors, this project instead demonstrated key areas of consideration for conducting CBPR, working in immigrant and refugee communities, and future considerations to best engage communities. In this critical analysis, we will examine the strategies that were employed in conducting this study and highlight current literature support in conducting substance use interventions in diverse communities..

Methods: IRB approval was granted to conduct focus groups within the Burmese refugee population of Denver to develop a health literacy program with administration of standardized pre- and post-course surveys. However, attempts to recruit participants and engage with the community were unsuccessful, and initial aims were not carried out. The researchers identified and discussed the barriers to success experienced within the framework of published literature exploring common obstacles to conducting research within communities similar to the target population (ie. displaced, refugee, Burmese, experiencing substance use disorders).

Results: Literature discussing barriers to engagement of refugee populations with substance use treatment programs and to engagement with CBPR was considered, as well as literature exploring recommendations for more successful community engagement. Many of the barriers experienced by the authors in attempts to engage the target community were aligned with those discussed in literature, with major themes including stigma of the topic, challenges posed by the COVID-19 pandemic, obstacles to forming trusting relationships within the closed community, and difficulty engaging a representative audience.

Conclusions: There are many barriers to conducting CBPR, especially within communities dealing with sensitive and stigmatized issues. Researchers should consider barriers discussed in literature to improve rates of success.

Primary Presenter: Anthony Smyth

Project Title: *How Do Rotator Cuff Repair Study Designs Correlate with Revision Rates? A Systematic Review*

Primary Mentor: Eric McCarty

Thematic Area: Clinical Science

Abstract: Abstract

Purpose: Rotator cuff tears are the most common cause of shoulder disability. Surgical technique advancements and patient risk factor identification have allowed for significant improvements in functional outcomes after rotator cuff repairs. Revision rate is a ubiquitously utilized primary outcome for rotator cuff repair studies. The purpose of this paper is to assess the correlation between study design elements and revision rates following rotator cuff repair because understanding how revision rates correlate to elements of study designs is key to interpreting results.

Methods: A systematic search of the PubMed, Embase, and Cochrane Library databases was conducted. The following search terms were used by two different researchers on 3/20/21 and 4/2/21 - ((Rotator cuff repair[Title/Abstract]) AND (Revision[Title/Abstract]) NOT (Systematic Review[Title/Abstract]) NOT (arthroplasty[Title/Abstract])). All English-language studies published between 2002 and 2021 were manually reviewed for revision rate as a primary outcome to primary rotator cuff repair. Revision rate is defined as the percentage of primary rotator cuff repairs that underwent revision.

Results: 16 studies with 25 total treatment groups were included. 5 level IV studies and 11 level III studies encompassed a total of 95,578 patients. Of these treatment groups, the revision rate was compared by the study style (prospective vs retrospective), sample size, time required to follow up, time to follow up, average age, and post-operative American Shoulder and Elbow Surgeons (ASES) score. No significant difference was found between revision rates of retrospective and prospective studies. A significant correlation was found between time required to follow up and revision rate (.42,  $p < 0.05$ ).

Conclusion: A statistically significant positive correlation between time required to follow-up and revision rate is logically consistent with the idea that more time passing will result in more rotator cuff repair failures. This study provides a useful reference for reviewers when evaluating the validity of rotator cuff repair studies and trends in data.

Level of Evidence:

Level of Evidence of Evidence I

Clinical Relevance:

Previous work has discussed the relevance of the study design and how it effects outcomes for shoulder dislocation rates, but at this point, multiple large rotator cuff repair studies have not been pooled together to look at trends that correlate with outcomes. This systematic review

should serve as a useful reference for reviewers of papers focusing on rotator cuff tears in order to compare revision rates to other papers<sup>€™</sup> interventions and study designs.

Primary Presenter: Adriana (Sofi) Hall

Project Title: *Neurodevelopmental and Mental Health Outcomes in a National Clinical Sample of Youth with Sex Chromosome Trisomies Compared with Matched Controls: A PEDSnet Study*

Primary Mentor: Shanlee Davis

Thematic Area: Clinical Science

Abstract: Neurodevelopmental and Mental Health Outcomes in a National Clinical Sample of Youth with Sex Chromosome Trisomies Compared with Matched Controls: A PEDSnet Study

Objective To compare the prevalence of neurodevelopmental and mental health diagnoses in youth with sex chromosome trisomy (SCT) with matched controls.

Study design Using the PEDSnet database, patients with one or more outpatient encounters and a diagnosis code mapping to 47,XXY/Klinefelter syndrome (n=1,171), 47,XYY/Double Y syndrome (n=243), or 47,XXX/Trisomy X syndrome (n=262) were matched (1:4) with controls using propensity scores incorporating eight variables. Generalized estimating equations were used to compute odds ratios (OR) with 95% confidence intervals (CI) for the prevalence of Neurodevelopmental and Mental Health composite diagnoses, prescriptions for psychiatric medications, and encounters with behavioral health providers.

Results All SCT groups had higher odds of diagnoses within the Neurodevelopmental (OR 4.01, 95% CI 3.52, 4.57, P <0.0001) and Mental Health composites (OR 1.84, 95% CI 1.60, 2.13, P <0.0001), and one or more encounter with a behavioral health specialist (OR 3.86, 95%CI 3.39,

4.39,  $P < 0.0001$ ) than matched controls. Youth with XXY and a mental health diagnosis were more likely to have a prescription for a selective serotonin reuptake inhibitor (OR 1.88, 95% CI 1.38, 2.57,  $P < 0.0001$ ).

Conclusions Compared to matched controls, youth with SCT have greater odds of a Neurodevelopmental and Mental Health diagnoses, emphasizing the need for appropriate screening, evaluation and treatment in these populations.

Keywords: sex chromosome aneuploidies; Klinefelter syndrome; Trisomy X; Jacobs syndrome; 47,XXY; 47,XYY; 47,XXX

Primary Presenter: Sarah Vangi

Project Title: *Utility of the Social Vulnerability Index in Risk Stratification of Critically Ill Neonates with Surgical Conditions*

Primary Mentor: Shannon Acker

Thematic Area: Clinical Science

Abstract: Utility of the Social Vulnerability Index in Risk Stratification of Critically Ill Neonates with Surgical Conditions

Principal Investigator: Ann M Kulungowski

Presenter: Sarah C Vangi

Authors: Sarah C Vangi, Bailey D Lyttle, Emily Cooper, Shannon N Acker, Jenny Stevens, Megan J Turner, and Ann M Kulungowski

Background/Objective/Purpose:

Pediatric surgical conditions in critically ill neonates are associated with significant morbidity and mortality. Factors including minority race, public health insurance, and lower socioeconomic status are individually associated with worse surgical outcomes. Social vulnerability index (SVI) is a composite measure of 16 census variables calculated based on home address, which increases with higher risk of social vulnerability. We hypothesize that SVI may predict critically ill neonates at risk for adverse outcomes following index pediatric surgical intervention.

Methods:



We performed an IRB-approved, multicenter retrospective review including patients who underwent surgical intervention for anorectal malformation, congenital diaphragmatic hernia, congenital pulmonary airway malformation, gastroschisis, Hirschsprung disease, hypertrophic pyloric stenosis, intestinal atresia, malrotation, meconium ileus, omphalocele, or tracheoesophageal fistula and were admitted to the neonatal intensive care unit (NICU) between January 2016-December 2022. Exclusion criteria included less than 35 weeks<sup>€</sup>™ gestation and necrotizing enterocolitis. Patient home address was used to calculate SVI, and patients were divided into quintiles by SVI percentile. Associations between SVI as a continuous variable and clinical outcomes including mortality, 30-day readmission, unplanned reoperation, hospital length of stay (LOS), and transfusion requirements were evaluated. Binary and continuous outcomes were fit using logistic and Poisson regression models respectively, controlling for gestational age, open versus laparoscopic surgery, pressor requirement, prenatally diagnosed congenital anomalies, and maternal antenatal conditions including diabetes and hypertension.

#### Results:

331 patients met inclusion criteria. Mean age at admission was 7 days, and 33% were female.

Patients were overall evenly distributed across SVI quintiles. Patients with higher SVI were more likely to require blood transfusion ( $p=0.020$ ), with every 0.1-unit increase in SVI resulting in 13% increased odds of requiring blood transfusion. Patients with higher SVI also experienced

longer hospital LOS ( $p=0.011$ ) with every 0.1-unit increase in SVI resulting in a 4% increase in hospital LOS.

Conclusion:

Critically ill neonates with surgical diagnoses that are more socially vulnerable as determined by SVI are more likely to experience poor outcomes, including need for blood transfusion and increased hospital LOS.

Significance:

SVI may be a useful metric for identifying and targeting resources for at-risk patients in the peri-operative period.

Table: Adjusted Regression Model Comparing SVI as a Continuous Variable with Clinical

Outcomes

Outcome

N=331

SVI,

Median (Q1, Q3)

Odds Ratio

Confidence

Interval

P-Value

Mortality, N (percent)

23 (6.9%)

0.31

(0.12, 0.77)

0.88

0.76-1.02

0.107

30-day readmission, N (percent)

29 (9.4%)

0.68 (0.40, 0.91)

1.09

0.96-1.25

0.189

Unplanned reoperation, N (percent)

47 (14%)

0.53 (0.26, 0.85)

1.01

0.91-1.12

0.890

Hospital length of stay in days, mean (SD)

40.6 (67.9)

0.54 (0.26, 0.84)

1.04

1.01-1.07

0.011

Need for blood transfusion, N (percent)

111 (33.6%)

0.63 (0.29, 0.91)

1.13

1.02-1.25

0.020

Primary Presenter: Rachel Demby

Project Title: *INCIDENCE OF BONE STRESS INJURIES IN DIVISION I COLLEGIATE ATHLETES*

Primary Mentor: Karin VanBaak

Thematic Area: Public Health and Epidemiology

Abstract: This abstract provides an overview of the incidence of bone stress injuries (BSIs), previously known as “stress fractures”, in Division 1 college athletes, drawing insights from several key articles on the subject. Many articles were reviewed when preparing for data collection for this project. This review delves into the critical role of knowing athlete risk factors for BSIs, early detection of injuries, prevention strategies, and using a multidisciplinary approach in optimizing outcomes for collegiate athletes.

One article reviewed for this paper, authored by Arendt et al, is a retrospective review (2003) that adds valuable retrospective insights into bone stress injuries in college athletes. The study, conducted at a single institution, provides a comprehensive analysis of the prevalence, distribution, and outcomes of stress injuries, offering a unique perspective on the challenges and successes encountered in managing these injuries within a collegiate sports setting.

By synthesizing this article and many others, we aim to contribute to the understanding of the complex nature of BSIs or “stress fractures” in Division 1 college athletes. However, the review underscores the significance of a comprehensive approach to BSIs, encompassing early

diagnosis, advanced imaging, and a well-coordinated management strategy to optimize the health and performance of collegiate athletes while minimizing the long-term impact of these injuries.

Primary Presenter: Jasmine Polkowske

Project Title: *Placental DEPTOR inhibition restores maternal vasodilation in fetal growth restricted mice.*

Primary Mentor: Ramón Lorca

Thematic Area: Basic Biomedical Science

Abstract: Fetal growth restriction (FGR) is a gestational complication characterized by a reduction in expected fetal growth and is a leading factor of fetal and neonatal morbidity and mortality. The mechanistic target of rapamycin (mTOR) kinase is a central regulator of cellular growth, homeostasis, and aging. DEP-domain-containing mTOR-interacting protein (DEPTOR) is an endogenous inhibitor of mTOR signaling that downregulates mTOR complex 1 and 2 activities. Previous studies have shown that silencing DEPTOR in the placenta increases trophoblast amino acid transport and mitochondrial respiration. We hypothesized that placental DEPTOR silencing prevents the effects of maternal nutrient restriction-evoked FGR on the vasodilation of maternal uterine artery (UtA). We assessed vascular function through wire myography and structural characteristics by histology in pregnant maternal UtA at gestational day 18.5. Vasoactive responses were tested for increasing concentrations of phenylephrine, acetylcholine, bradykinin, and sodium nitroprusside (SNP). Placental DEPTOR silencing restores the vasodilatory responses to SNP in maternal UtA in mice with FGR pregnancies. No significant structural differences were observed in vascular structure. These observations



highlight a role for placental mTOR signaling in the regulation of maternal uterine vasculature during pregnancy.

Primary Presenter: Melissa Smith

Project Title: *ETHICAL CONSIDERATIONS FOR CLINICAL CARE ON SHORT TERM MEDICAL MISSIONS IN LOW- AND MIDDLE-INCOME COUNTRIES: A SCOPING REVIEW*

Primary Mentor: David Richards

Thematic Area: Global Health

Abstract: Intro: Despite short term medical missions (STMMs) to low- and middle-income countries (LMIC) becoming increasingly popular, ethical considerations for the provision of clinical care on STMMs are poorly defined. Clinicians are often unprepared to adapt care and ethical precepts to resource limited environments. There may be discord in interpretation of ethical principles between visiting providers and hosts. Clinical care provision has direct impact on the health of patients and communities and there is a need for guidelines regarding ethical clinical care.

Methods: Scoping review of the literature published from 2001-2021 restricted to English language identified 3072 records discussing ethical considerations of provision of clinical care on STMMs. Records were screened by title, abstract and finally full text by independent reviewers resulting in 40 records for inclusion.

Results: Thirteen themes were identified as important considerations for provision of ethical clinical care on STMMs. These themes included: collaboration/longitudinal relationship, education, lack of follow up, cultural barriers, needs assessment/goal setting, capacity building, outcome evaluation, pre-departure preparation, scope of practice, resources allocation, detriment

to local systems, bidirectionality, and formal ethical review. From these themes a list of guidelines is outlined.

Conclusion: While ideally clinical care on STMMs would be regulated by formal ethical review boards this is difficult to develop and enforce. Independent STMMs must evaluate their approach to clinical care in LMICs. Care should be given to focusing on collaboration, education, follow up, cultural barriers, and performing a needs assessment/goal setting. These efforts may be guided by the checklist included within.

Primary Presenter: Jane Song

Project Title: *Advanced Vessel- and Cell-Size MRI to Assess Chemo-Radiation Treatment Response in Pediatric Ependymoma Models”?*

Primary Mentor: Natalie Serkova

Thematic Area: Basic Biomedical Science

Abstract: Introduction: Metabolomics is a Systems Biology approach to study endogenous small molecules (commonly known as metabolites) within cells, biofluids, tissues or organisms.

Metabolites and their concentrations directly reflect the underlying biochemical activity and best represent molecular phenotype. Two main approaches, targeted and untargeted metabolomics, are executed by mass spectrometry (MS) and nuclear magnetic resonance (NMR) spectroscopy.

Area Covered: NMR metabolomics is a quantitative non-destructive technique with high reproducibility and simultaneous non-discriminative detection of hundreds of metabolites making

it a powerful clinical tool for untargeted search and validation of novel metabolic biomarkers.

This review reports on the advanced NMR protocols for quantitative metabolomics, from sample handling to spectral acquisition, metabolite quantification and biomarker identification. Several NMR-discovered metabolic biomarkers are used in clinical diagnostics, especially in oncology

and neuroscience, accompanied by metabolic imaging based on magnetic resonance spectroscopy (MRS) and positron emission tomography (PET).

Expert Opinion: Over the course of the past year, NMR metabolomics has steadily evolved from a mere research tool into a clinical approach that might play an important role in routine diagnostic testing in the future. NMR-based tissue biomarkers have a great potential to be translated into non-invasive imaging protocols using in-vivo MRS and metabolic PET tracers, especially in the area of neuroradiology and neurooncology.

Primary Presenter: Preston Le

Project Title: *Completeness of Common Outcomes from RCTs*

Primary Mentor: Liron Caplan

Thematic Area: Clinical Science

Abstract: Background

Treatment guidelines depend on the conclusions drawn from systematic reviews (SR) that aggregate randomized controlled trial (RCT) data. However, the degree to which common intervention outcomes are employed and report results sufficiently to allow for aggregation remains unknown. We aimed to assess the completeness of reporting of common outcomes in SRs across medical specialties.

Methods

To ensure all specialties were represented, a convenience sample of SRs from the Cochrane Database of Systematic Reviews were drawn from 21 medical topics using PRISMA guidelines. The primary outcome was the proportion of RCTs that reported a common outcome in each SR. We evaluated SR characteristics associated with this proportion, including the number of included RCTs, the number of participants, the duration of the SR period, and the number of outcomes in each SR.

Findings

Only 14.3% of 105 SRs (encompassing 2308 RCTs) included an outcome common to all included studies. The likelihood of reporting a common outcome varied according to the number of included RCTs within SRs (61% [C.I. 52-70%] for reviews with less than 15 trials and 14% [5-27%] for reviews with >50 trials,  $p<0.001$ ) and according to the duration of the SR period ( $p=0.01$ ).

### Interpretations

The prevalence of SRs reporting uniform outcomes across RCTs is small. Our findings likely overstate the occurrence of common outcomes, as data that could not be aggregated were excluded. Efforts to allow comparisons of studies and aggregation of results from trials must be improved.

### Funding

Rocky Mountain Regional Veterans Affairs Medical Center

University of Colorado Department of Medicine Schweppe Endowment.

Primary Presenter: Joy Huang

Project Title: *Successful Extension of Vascularized Composite Allograft Perfusion Cold Storage to 24 Hours in a Rat Hind Limb Transplant Model*

Primary Mentor: Christene Huang

Thematic Area: Basic Biomedical Science

Abstract: **Background:** Vascularized Composite Allograft (VCA) transplantation is a treatment option for complex tissue injuries; however, ischemia reperfusion injury (IRI) and high acute rejection rates remain a challenge. Hypothermic machine perfusion (HMP) using acellular storage perfusate is a potential solution. This study evaluated the University of Wisconsin (UW) Kidney Preservation Solution (KPS-1) compared to normal saline (NS) for preservation of donor rat hind limbs subjected to 24h of ex-vivo perfusion cold storage.

**Methods:** Hind limbs were subjected to 24-hour perfusion cold storage with heparinized KPS-1 (n=6) or heparinized NS (n=6). Flow, resistance, and pH were measured continuously. At the end of the 24h period, tissue was collected for histological analysis of edema and apoptosis.

**Results:** KPS-1 perfused limbs showed significantly less edema than the NS group, as evidenced by lower limb weight gain ( $p < 0.001$ ) and less interfascicular space ( $p < 0.001$ ). KPS-perfused muscle had significantly less cell death than NS-perfused muscle based on terminal deoxynucleotidyl transferase dUTP nick-end labeling (TUNEL) ( $p < 0.001$ ) and Cleaved Caspase-3 (CC3) staining ( $p = 0.045$ ). During HMP, a significant decrease in pH over time was detected in both groups, with a significantly greater decline in pH in the KPS-1 group than in the NS group.



There were no significant differences overall and over time in flow rate or vascular resistance between the KPS and NS groups.

Conclusions: Perfusion with KPS-1 can successfully extend VCA perfusion cold storage for 24h in a rat hind limb model without significant edema or cell death.

Primary Presenter: Nicholas Cleland

Project Title: *Altered Metabolism and DAM-signatures in Female Brains and Microglia with Aging*

Primary Mentor: Kimberley Bruce

Thematic Area: Basic Biomedical Science

Abstract: Despite Alzheimer's disease (AD) disproportionately affecting women, the mechanisms remain elusive. In AD, microglia undergo metabolic reprogramming, which contributes to microglial dysfunction and AD pathology. However, how sex and age contribute to metabolic reprogramming in microglia is understudied. Here, we use metabolic imaging, transcriptomics, and metabolic assays to probe age- and sex-associated changes in brain and microglial metabolism. Glycolytic and oxidative metabolism in the whole brain was determined using Fluorescence Lifetime Imaging Microscopy (FLIM). Young female brains appeared less glycolytic than male brains, but with aging, the female brain became male-like. Transcriptomic analysis revealed increased expression of disease-associated microglia (DAM) genes (e.g., ApoE, Trem2, LPL), and genes involved in glycolysis and oxidative metabolism in microglia from aged females compared to males. To determine whether estrogen can alter the expression of these genes, BV-2 microglia-like cell lines, which abundantly express DAM genes, were supplemented with estradiol (E2). E2 supplementation resulted in reduced expression of DAM genes, reduced lipid and cholesterol transport, and substrate-dependent changes in glycolysis and oxidative metabolism. Consistent with the notion that E2 may suppress DAM-associated factors,

LPL activity was elevated in the brains of aged female mice. Similarly, DAM gene and protein expression was higher in monocyte-derived microglia-like (MDMi) cells derived from middle-aged females compared to age-matched males and was responsive to E2 supplementation. FLIM analysis of MDMi from young and middle-aged females revealed reduced oxidative metabolism and FAD<sup>+</sup> with age. Overall, our findings show that altered metabolism defines age-associated changes in female microglia and suggest that estrogen may inhibit the expression and activity of DAM-associated factors, which may contribute to increased AD risk, especially in post-menopausal women.

Primary Presenter: Jonathan Zakrajsek

Project Title: *Extracorporeal Membrane Oxygenation (ECMO) for Severe Asthma Exacerbations Requiring Mechanical Ventilation*

Primary Mentor: Bill Vandivier

Thematic Area: Clinical Science

Abstract: Extracorporeal Membrane Oxygenation (ECMO) for Severe Asthma Exacerbations

Requiring Mechanical Ventilation

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Campus. Aurora, Colorado.

Rationale: Asthma affects 20 million adults in the United States resulting up to 500,000 hospitalizations each year. Patients admitted to the intensive care unit (ICU) for asthma exacerbations requiring invasive ventilation have a mortality of ~7%. Extracorporeal membrane oxygenation (ECMO) is a salvage technique used in patients with reversible causes of respiratory failure to increase delivery of oxygen, remove CO<sub>2</sub> and allow time for recovery. Case reports, case series and uncontrolled registry studies have examined potential benefits of ECMO for asthma exacerbations with respiratory failure, but no studies have examined outcomes associated with use of ECMO for asthma exacerbations compared to standard care. Objective: To assess outcomes associated with use of ECMO during asthma exacerbations requiring invasive ventilation compared to standard care. Methods: Patients were extracted from the Premier Healthcare Database from 2010-2020 if they had a primary diagnosis of asthma or asthma exacerbation, or a primary diagnosis of respiratory failure with a secondary diagnosis of asthma or asthma exacerbation, and were treated with invasive mechanical ventilation. Patients were excluded for age < 18 years, no ICU admission, chronic lung disease other than asthma, diagnosis of COVID-19, or if they were not treated with corticosteroids. Hospital mortality was the primary study outcome. Key secondary outcomes included ICU length of stay (LOS), hospital LOS, length of invasive ventilation and hospital costs. Differences in outcomes were assessed using propensity score matching at a 1:2 ratio of ECMO versus no ECMO, and by covariate adjustment of the entire study group. Results: A total of 20,494 patients with asthma

exacerbations requiring invasive ventilation were included in the study, of which 130 were treated with ECMO and 20,364 were not. ECMO use increased over the study period ( $p < 0.0001$ ), and patients were treated with ECMO for an average of 4 days. After propensity matching, ECMO (N=103) versus no ECMO (N=206) was associated with reduced mortality (11.4% vs. 23.3%,  $p = 0.017$ ) and increased hospital costs, but no difference in ICU LOS, hospital LOS or length of mechanical ventilation (Table). The covariate-adjusted model replicated these findings (Table). In the propensity-matched analysis, ECMO was also associated with increased renal replacement therapy ( $P = 0.02$ ), shock ( $P = 0.02$ ) and 30-day all-cause readmission ( $P = 0.01$ ).

Conclusion: ECMO was associated with reduced mortality at the cost of increased morbidity in asthmatics requiring invasive ventilation, indicating that ECMO has the potential to save thousands of lives.

Table. Outcomes Associated with ECMO for Asthma Exacerbations

Propensity-Matched Model

N=309

Covariate Adjusted Model

N=20,494

OR

95% CI

P Value

OR

95% CI

P Value

Mortality

0.43

0.22-0.85

0.016

0.38

0.21-0.68

0.001

Ratio

95% CI

P Value

Ratio

95% CI

P Value



Hospital Cost

1.76

1.47-2.12

<0.0001

1.65

1.44-1.89

<0.0001

ICU LOS

1.20

0.96-1.49

0.12

1.14

0.98-1.34

0.09

Hospital LOS

1.15

0.91-1.44

0.24

1.08

0.92-1.26

0.34

Length of Invasive Ventilation

1.13

0.91-1.41

0.26

1.08

0.93-1.26

0.30

Primary Presenter: Ronald Yang

Project Title: *Tzanck Smear in Dermatologic Practice*

Primary Mentor: Cory Dunnick

Thematic Area: Clinical Science

Abstract: The Tzanck smear was introduced in the 1950s and has been used for the diagnosis of erosive, vesiculobullous, tumoral, and granulomatous diseases. The Tzanck smear is rapid, easy to perform, and relatively inexpensive. Results from this diagnostic test can be obtained at the bedside, often within several minutes. Tzanck smears have high diagnostic reliability for erosive/vesiculobullous and granulomatous lesions. For some lesions, the sensitivity of Tzanck smears can exceed 80% up to 90% depending on the expertise of the user. However, for more challenging diagnoses, Tzanck smear should be used in conjunction with more advanced techniques to ensure an accurate clinical diagnosis. This article reviews the background, indications, construct, and applications of the Tzanck smear to highlight this commonly used diagnostic tool in dermatology.

Primary Presenter: Boston Gubler

Project Title: *Characteristics of Electronic and Paper Questionnaire Users in an Academic Memory Clinic*

Primary Mentor: Peter Pressman

Thematic Area: Public Health and Epidemiology

Abstract: Patient-reported outcomes (PROs) provide essential information for clinical care, especially given time constraints in modern medicine. Electronic PRO (ePRO) collection methods like online surveys offer some advantages but also have inherent barriers that might exclude certain groups. This retrospective study analyzed 785 academic memory clinic patients and caregivers who were offered electronic pre-visit questionnaires and then the same questionnaires on paper in the clinic if not completed electronically. We examined demographic, disease, and caregiver factors associated with electronic, paper, or no questionnaire completion using mixed-effects logistic regression models. Advancing patient age was associated with increased electronic questionnaire completion by caregivers. Hispanic ethnicity correlated with decreased use, possibly from a lack of Spanish translation of the questionnaires. Medicaid insurance correlated with less electronic questionnaire use. Worse neurobehavioral symptoms and functional disability were associated with increased electronic use, while increased caregiver burden was associated with less. Electronic questionnaires may be more efficient and empower disclosure of sensitive information but they still risk excluding vulnerable groups. Ensuring all

demographics are accounted for remains vital as medicine continues to adopt more digital data collection methods.

Primary Presenter: Madison Kim

Project Title: *CONNECTING OLDER ADULTS WITH STUDENTS THROUGH INTERPROFESSIONAL TELECARE (COAST-IT): A PROGRAM EVALUATION.*

Primary Mentor: Sarah Teitz, Devin Gilhuly Devin Gilhuly

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract: **Background:** Given the growing older adult population, it is critical that future health care professionals are prepared to care for older adults. Student attitudes towards older adults and communication skills benefit from geriatric specific training. COAST-IT (Connecting Older Adults with Students Through Interprofessional Telecare) is a longitudinal program implemented across various health profession schools at an academic hospital system that focuses on providing students the opportunity to improve communication skills and attitudes towards older adults. **Methods:** Older adults from various local community facilities were paired with students from pharmacy, nurse practitioner, dental, and medicine programs. Students made social phone calls every week to two weeks to their older adult partner (OAP). Students were surveyed before and after program participation about their attitudes towards older adult and self-perceived communication skills. The survey also included free text responses to assess knowledge and attitudes towards older adults. A chi-square test was used to evaluate for statistical significance between aggregate pre- and postresponses. In 2022, COAST-IT progressed to the use of the COCOA-24, a validated survey, to comprehensively evaluate the programs impact. **Results:** 186 students responded to the initial survey. The percentage of students who ranked their confidence



level as "every confident" increased from 18.4% to 31.1% and the percentage of students who ranked themselves as "not really confident" decreased from 7% to 0.5%. Data collection is ongoing on a semester basis, now with the COCOA- 24 instrument. Conclusions: Caring for the growing older adult population will require interprofessional teams that have well-developed communication skills and knowledge of the challenges older adults face. Many geriatric focused curriculum interventions are not longitudinal programs. The COAST-IT program provides students a way to practice building longitudinal relationships that improve attitudes toward older adults and build communication skills with real patients in their preclinical years. For future considerations, program evaluation can extend to evaluating the impact that COAST-IT has on the OAP regarding loneliness and perceived social isolation.

Primary Presenter: Andrea Lorenz

Project Title: *Predictive Value of 1-Hour Glucose Elevations during Oral Glucose Tolerance Testing for Cystic Fibrosis-Related Diabetes*

Primary Mentor: Christine Chan

Thematic Area: Clinical Science

Abstract: Background. In cystic fibrosis-related diabetes (CFRD) screening, oral glucose tolerance test (OGTT) thresholds for detecting prediabetes and diabetes are defined by the 2-hour glucose (2 hG). Intermediate OGTT glucoses, between 0 and 2 hours, that are  $\geq 200$  mg/dL are deemed “indeterminate,” although lower 1-hour glucose (1 hG) thresholds identify those at increased risk of type 2 diabetes in other populations, and may also better predict clinical decline in CF. Studies of 1 hG thresholds  $< 200$  mg/dL in people with CF are limited.

Methods. A single center, retrospective chart review was performed of patients with 1 hG available on OGTTs collected between 2010 and 2019. In patients with  $\geq 2$  OGTTs, Kaplan-Meier analysis estimated likelihood of progression to CFRD based on a high vs. low 1 hG. In patients with  $\geq 1$  OGTT, mixed-effects models tested whether baseline 1 hG and 2 hG predicted growth and lung function trajectories.

Results. A total of 243 individuals with CF were identified with at least 1 OGTT including a 1 hG, and  $n = 177$  had  $\geq 2$  OGTTs. Baseline age (mean  $\pm$  SD) was  $12.4 \pm 2.6$  years with  $3.2 \pm 1.4$  years of follow-up. Twenty-eight developed CFRD. All who developed CFRD had a 1 hG  $\geq 155$  mg/dL prior to 2 hG  $> 140$  mg/dL. The average 1 hG was 267 mg/dL when 2 hG  $\geq$

200mg/dL. In a subset with baseline 2 hG < 140mg/dL, 1 hG  $\geq$  140mg/dL conferred an increased 5 years risk of CFRD ( $p = 0.036$ ). Baseline 2 hG predicted decline in FEV1%predicted, but 1 hG did not.

Conclusions. In youth with CF, 1 hG  $\geq$  140 mg/dL is an early indicator of CFRD risk.

However, 2 hG, rather than 1 hG, predicted lung function decline.

Primary Presenter: Emma Lamping

Project Title: *Analysis of Time Between Skin Lesion and Lymph Node Biopsies and Lymph Node Metastasis in Patients With Melanoma*

Primary Mentor: Camille Stewart

Thematic Area: Clinical Science

Abstract: Does Time from Biopsy to Surgery Affect Nodal Status for Patients with Malignant Melanoma?

How Long Can We Wait? An Evaluation of Time to Surgery and Sentinel Lymph Node Status in Malignant Melanoma

Authors: Elliot Le, Emma Lamping, Laura Helmkamp, Nicole Kounalakis, Martin McCarter, Ana Gleisner, Camille Stewart

Introduction: The COVID-19 pandemic has challenged surgical oncologists to examine the clinical significance of time from diagnosis to surgical treatment for clinical N0M0 melanoma. Waiting to perform wide local excision and sentinel lymph node biopsy may increase the likelihood of metastatic spread to lymph nodes, which impacts prognosis and need for adjuvant systemic therapy. We examined the relationship between time from biopsy to definitive surgical treatment to determine its impact on nodal status.

Methods: We performed an IRB approved retrospective review of patients with clinical N0M0 malignant melanoma that underwent wide local excision and sentinel lymph node biopsy treated

at two institutions from 1/2018-6/2021. Student's t-test, Wilcoxon-Mann-Whitney, bivariate and multivariable logistic regression analyses were performed where appropriate.

Results: There were 437 patients identified, 308 (71%) pre-pandemic, and 129 (29%) pandemic, 140 (32%) treated within 30 days, 238 (55%) 31-60 days, and 59 (13%) >60 days post-diagnosis, with 128 (29%) diagnosed with N+ disease. Demographics are presented in Table 1. Time to surgery pre-pandemic was longer (42 days, IQR 30-55) compared to during the pandemic (31 days, IQR 26-41,  $p < 0.001$ ), with a similar number of operations being performed (11/month pre-pandemic, 9 pandemic,  $p = 0.34$ ). Time to surgery was not a significant predictor of N+ disease for 0-30 vs 31-60 days (OR 0.72; 95% CI 0.46-1.13) or 0-30 vs 60+ days (OR 0.65; 95% CI 0.33-1.29). This remained true adjusting for T-stage, mitosis, and ulceration (OR 0.74 95% CI 0.46-1.20, and OR 0.61; 95% CI 0.29-1.25, respectively), and when only examining T3-T4 lesions (OR 0.88; 95% CI 0.44-1.74 and OR 0.82; 95% CI 0.30-2.22, respectively). T-stage expectedly was the greatest predictor of N+ disease (T1 vs T2 OR 3.10; 95% CI 1.45-6.60, vs T3 OR 5.90; 95% CI 2.65-13.12, vs T4 OR 10.70; 95% CI 4.13-27.75).

Conclusions: In this cohort, time from diagnosis to surgery was shorter during the pandemic than pre-pandemic. Time to surgery did not appear to affect the rate of N+ disease identified after sentinel lymph node biopsy for patients presenting with clinical N0M0 disease, suggesting it may

be safe for these patients to wait up to 60 days or longer prior to undergoing surgical treatment for malignant melanoma.

Table 1. Demographics of patients diagnosed with clinical N0M0 malignant melanoma who underwent wide local excision and sentinel lymph node biopsy from 1/2018-6/2021.

Median (IQR) or %(N) n=437

Age at diagnosis 60.0 (49.0-69.0)

Gender

Female 43.0% (188)

Male 57.0% (249)

Race

Asian 0.2% (1)

Micronesian, NOS 0.2% (1)

Other 0.9% (4)

Unknown 1.4% (6)

White 97.3% (425)

Ethnicity

Hispanic/Latino 2.5% (11)

Not Hispanic/Latino 96.6% (422)

Unknown 0.9% (4)

Era

Pre-pandemic (1/2017 €“ 3/2020) 70.5% (308)

Pandemic (4/2020 €“ 6/2021) 29.5% (129)

T stage

1 24.5% (107)

2 36.2% (158)

3 27.1% (118)

4 12.2% (53)

Ulcerated

No 64.9% (283)

Yes 35.1% (153)

Mitoses (per mm<sup>2</sup>) 3.0 (1.0-7.0)

N stage greater than N0

No 70.7% (309)

Yes 29.3% (128)

Time to treatment 38.0 (28.0-51.0)

Time to treatment

0-30 days 32.0% (140)

31-60 days 54.5% (238)

>60 days 13.5% (59)



Primary Presenter: Rachel Anderson

Project Title: *Describing postoperative void patterns following cesarean delivery without the use of urinary catheterization*

Primary Mentor: Stefka Fabbri

Thematic Area: Clinical Science

Abstract:

Primary Presenter: Andrew Mariotti

Project Title: *Operational outcomes of propofol sedation versus fentanyl, midazolam and diphenhydramine sedation for endoscopies and colonoscopies at an academic medical center*

Primary Mentor: Adeel Faruki

Thematic Area: Clinical Science

Abstract: Background

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On July 1st, 2021, the University of Colorado Hospital (UCH) implemented new sedation protocols in the luminal gastrointestinal (GI) suite. GI proceduralist supervised, Nurse Administered Sedation with fentanyl, midazolam, and diphenhydramine (NAS) sedation was transitioned to Monitored Anesthesia Care with propofol under physician anesthesiologist supervision (MAC)

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Objective

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To determine if there are statistically significant reductions in Sedation-Start to Scope-In time (SSSI) when using Monitored Anesthesia Care with propofol (MAC) versus Nurse Administered Sedation with fentanyl, midazolam, and diphenhydramine (NAS). Secondary objectives were to determine if statistically significant improvements to other operational times, quality measures, and satisfaction metrics were present.

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## Method

This study was a retrospective analysis of a natural experiment resultant of a change from NAS to MAC sedation protocols. Outcomes for NAS protocols from 1/1/21€“6/30/21 were compared to outcomes of MAC protocols from the dates 8/1/21€“10/31/21. Results were analyzed using Quasi-Poisson regression analysis and stratified based on upper GI, lower GI, and combined procedures. Patient demographic data including age, biological sex, comorbidities, and BMI, were adjusted for in the analysis. ASA matching was not performed as nursing sedation does not use ASA classifications. Pre-anesthesia co-morbidities were assessed via evaluation of a strict set of comorbidities abstracted from the electronic medical record. Perioperative operational

outcomes include Sedation Start to Scope-In (SSSI), In-Room to Scope-In Time (IRSI), Scope Out to Out of Room (SOOR), Total Case Length (TCL), and Post Anesthesia Care Unit Length of Stay (PACU LOS). Quality outcomes include PACU Administered Medications (PAM), and Clinician Satisfaction Scores (CSS).

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**Results**

A total of 5,582 gastrointestinal (GI) endoscopic cases (upper, lower, and combined endoscopies) were observed. Statistically significant decreases in SSSI of 2.5, 2.1, and 2.2 minutes for upper, lower, and dual GI procedures were observed when using MAC protocols. A

statistically significant increase in satisfaction scores of 47.0 and 19.6 points were observed for nurses and proceduralists, respectively, when using MAC.

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### Conclusion

MAC protocols for endoscopic GI procedures at UCH led to statistically significant decreases in the time required to complete procedures thus increasing operational efficiency

Primary Presenter: Hyun Kim

Project Title: *Impact Of COVID-19 On Adults With Cerebral Palsy Among Cohort Of The Cerebral Palsy Adult Transition Longitudinal Study*

Primary Mentor: Patricia Heyn

Thematic Area: Clinical Science

Abstract: This mixed-method case series reports on the impact of COVID-19 on a cohort subset of adults with cerebral palsy (CP) using patient-reported outcome instruments focusing on access to healthcare, vaccination status, quality-of-life, socialization, and physical and mental health obtained via electronic survey and phone interview. Fifteen subjects from a cohort of 72 adults with CP who previously participated in a longitudinal study at our institution agreed to participate. A medical history questionnaire, the Coronavirus Disability Survey (COV-DIS), the PROMIS-57, and qualitative free-text responses were collected. A summary of the responses from each participant is included, giving a qualitative description of the challenges faced by individuals with a pediatric onset condition during the pandemic. While many reported the same negative feelings of isolation, reduced social interaction, physical decline, and delayed access to healthcare often shared by the general population during the pandemic, some reported positive aspects related to remote work, increased availability of delivery services reducing their reliance on self-mobility, increase availability of telemedicine, and a feeling that the lockdown made their life feel more "normalized." The small sample size limits generalization of these results but can provide some insight of the impact of COVID-19 on this vulnerable population.



Primary Presenter: Jayden Peacock

Project Title: *Forty-Year Update of the Obstetric Anesthesia Workforce Survey*

Primary Mentor: Joy Hawkins

Thematic Area: Clinical Science

Abstract: Abstract

**BACKGROUND:** Nationwide obstetric anesthesia workforce surveys have been conducted every 10 years since 1981 in the United States (US). This new survey is the 10-year follow-up to the latest survey conducted in 2011. Anesthesia providers from US hospitals were surveyed in 2022-2023 and asked to provide data for their hospital from 2021. These surveys provide data on trends in the obstetric anesthesia workforce, methods of practice, and highlight areas of success and areas for improvement in the field. Our primary hypothesis was that the provision of obstetric anesthesia services has changed in the last ten years.

**METHODS:** A stratified random sample of hospitals was generated based on both geographic strata (using the US Census Bureau's nine regions) and delivery strata (number of births per year). Delivery strata is defined as follows (deliveries per year): >4500 (stratum 1), 3000-4499 (stratum 2), 1500-2999 (stratum 3), 500-1499 (stratum



4), <500 (stratum 5). Questionnaires containing 32 questions were sent via email and physical mail to the primary provider of obstetric anesthesia services at these hospitals.

Data collection was facilitated via the REDCap survey database. Results were analyzed using the R statistical package. All statistical inferences were performed at a significance level of 0.05.

RESULTS: 48.4% of L&D units utilize the care-team model for anesthesia (physician anesthesiologists + non-physician anesthetists). Overall, 69.5% of L&D units have physician anesthesiologists present during L&D weekday hours. Only 29% of L&D units use independently practicing CRNAs. Staffing of labor/delivery units with CRNAs without physician supervision has increased primarily in the smallest hospitals (utilized in 74.7% of Stratum 5 hospitals in 2021). Trials of labor after cesarean (TOLAC) are being offered at a higher rate than 2011, with a coinciding decrease in requiring in-house anesthesia coverage for TOLAC patients. However, the majority of hospitals do require in-house anesthesia coverage (67.9% overall) and OB coverage (68.3% overall) for all TOLAC patients. Epidural anesthesia remains the predominant

method of anesthesia during labor, used in 70% of cases in 2021. High proportions of stratum 1-3 hospitals employ a variety of patient safety measures including the presence of massive transfusion protocols (MTPs) at 99% of these hospitals. 76% of stratum 5 hospitals have an MTP, and have lower rates of implementing other patient safety measures.

**CONCLUSIONS:** Anesthesiologists are present in the majority of L&D units overall. The epidural continues to be the most commonly used method of analgesia for labor. The implementation of patient safety measures is increasing across hospital strata, but smaller hospitals are slower to implement these measures. There remain significant challenges in achieving uniform standards of obstetric anesthesia care. Obstetric anesthesia surveys, updated every ten years, continue to provide information about changes in obstetric anesthesia practice and differences in practice between large and small delivery services.

Primary Presenter: Michael Skaggs

Project Title: *Drive-Through Efficiency: How to Prepare for and Execute a Mass-Vaccination Event*

Primary Mentor: Daniel Resnick-Ault

Thematic Area: Public Health and Epidemiology

Abstract: The 2019 novel coronavirus is on pace to overtake the 1918 influenza as the deadliest pandemic in U.S. history. A highly efficient strategy for vaccination is crucial to curbing the public health crisis. In January 2021, UCHealth €” an innovative nonprofit health system serving Colorado, southern Wyoming, and western Nebraska €” brought together key stakeholders to develop a new drive-through vaccination model with the goal of providing immunizations to 10,000 individuals over a 2-day period, which would be the largest vaccination effort in the United States at that time. Health care innovators, operational leaders, and information technology experts used iterative process improvement and real-time data collection to create the model. Their standards for efficiency in handling high volume events are published in a playbook available to any entity hoping to utilize drive through mass vaccination. From arrival to departure, median time spent in the vaccination clinic was 24 minutes, including 15 minutes of observation.

Primary Presenter: Cole Bortz

Project Title: *Critical Incidents in Colorado’s Opioid Treatment Programs: A Comparison of the COVID-19 Pandemic to Previous Years*

Primary Mentor: Tyler Coyle

Thematic Area: Public Health and Epidemiology

Abstract: Background and Aims:

In response to the COVID-19 pandemic, Substance Abuse and Mental Health Services Administration (SAMHSA) guidance allowed methadone clinics greater flexibility to provide take-home medication doses to patients. This study aims to characterize trends in the rates of critical incident “safety events occurring in opioid treatment programs (OTPs) that are reportable to regulatory entities” across all Colorado OTPs during the COVID-19 pandemic.

Design/Setting:

Retrospective review of critical incidents (CIs) for patients enrolled in Colorado OTPs between the years 2017 to 2022.

Cases:

De-identified CI data for all Colorado OTP agencies as obtained from the Colorado Behavioral Health Administration’s Opioid Treatment Program Critical Incident Repository Dataset.

Measurements:

Primary: CI rates; Secondary: mean number of CIs per month.

#### Findings:

OTP patient enrollment in Colorado increased from 4,377 in 2017 to 7,327 in 2022. Overall, Medication Diversion accounted for 70% of CIs, followed by Death (14%), and Other (5%).

There was a significant increase in the overall rate of CIs from 2017 to 2022 (1.1% to 3.4%). The average post-COVID CI rate was higher than pre-COVID (4.0% vs. 2.4%). There was no difference, however, in the post-COVID rate of CIs when exclusively compared to 2019 (4.0% vs. 4.1%). Post-pandemic years had significantly more CIs per month than pre-pandemic years (27.6±5.6 vs 15.8±3.5). There was no difference in mean monthly CIs between 2019 and post-pandemic (28.5±5.3 vs 27.6±5.6).

#### Conclusions:

There was no increase in the rate of reportable CIs in Colorado OTPs following the SAMHSA COVID-19 guidance increasing take-home doses when comparing 2019 to post-pandemic years.

The notable increase in CI incidence occurred from 2018-2019, predating the pandemic. These data offer a measure of reassurance for the safety of increased take-home methadone doses.

There should be further consideration of how a greater number of take-home doses might benefit both patients and OTPs.

Primary Presenter: Marisa Sobczak

Project Title: *Glycemic Control in Relation to Technology Use in a Single-Center Cohort of Children with Type 1 Diabetes*

Primary Mentor: Todd Alonso

Thematic Area: Clinical Science

Abstract: Background: Technology for patients with type 1 diabetes (T1D), including continuous glucose monitoring (CGM), insulin pumps, and hybrid closed-loop (HCL) systems, is improving, being used more commonly in the pediatric population, and impacts glycemic control.

Materials and Methods: We evaluated the use of these technologies and their impact on glycemic control among patients with T1D who were seen at the Barbara Davis Center (n= 4003) between January 2018 and December 2020, <22 years old, with diabetes duration >3 months. Data were analyzed by age group and technology-use group defined as multiple daily injection with blood glucose meter (MDI/BGM), pump with BGM (pump/BGM), MDI with CGM (MDI/CGM), and pump with CGM (pump/CGM). Glycemic control was compared using analysis of covariance (ANCOVA) and controlling for diabetes duration, race, and insurance.

Results: Among 4003 patients, 20% used MDI/BGM (mean hemoglobin A1c [HbA1c] = 10.0%); 14.4% used pump/BGM (mean HbA1c = 10.0%); 15.4% used MDI/CGM (mean HbA1c = 8.6%); and 49.8% used pump/CGM (mean HbA1c = 8.1%). Compared with MDI/BGM patients, MDI/CGM and pump/CGM users had a lower HbA1c and were more likely to reach an HbA1c <7.0% (all P < 0.0001). Among pump/CGM users, 35% used HCL technology (mean HbA1c =

7.6%) and had a lower HbA1c and were more likely to reach an HbA1c <7% than non-HCL users (P< 0.001).

Conclusions:CGM use was associated with a lower HbA1c in both MDI and pump users. Pump use was only associated with a lower HbA1c if used with CGM. HCL was associated with the lowest HbA1c. Spanish language and minority race/ethnicity were associated with lower rates of pump and CGM use, highlighting the need to reduce disparities.

Primary Presenter: Ethan Coit

Project Title: *Recombinant SARS-CoV-2 spike protein is not sufficient to initiate an inflammatory response in human alveolar epithelial cells in vitro*

Primary Mentor: Eva Nozik

Thematic Area: Basic Biomedical Science

Abstract: Despite an overwhelming body of research already produced in the wake of the COVID-19 pandemic, there is still much more required to understand the acute respiratory failure and hyperinflammatory state that can result from infection with SARS-CoV-2. One significant barrier to further elucidating these mechanisms is the requirement for biosafety level-3 (BSL-3) facilities to perform experiments with the complete SARS-CoV-2 virus. The aim of this research was to create an in vitro, non-infectious model of COVID-19, using recombinant SARS-CoV-2 spike protein (SP) to initiate an inflammatory response in human alveolar epithelial cells. Such a model would allow for the investigation of various pathways involved in the pulmonary inflammatory response that occurs in COVID-19. We hypothesized that treating A549 cells (a human alveolar adenocarcinoma cell line) engineered to express human angiotensin converting enzyme-2 (ACE2) with recombinant SP would be sufficient to initiate an inflammatory response.

To this end, full-length, recombinant SP was added to ACE2 expressing A549 cells at a dosage range of 100 ng/mL to 2 ug/mL. Cells were allowed to incubate with SP for 24 hrs., at which



point mRNA was isolated from the samples. To observe the response induced by SP, qPCR was used to measure the relative expression of inflammatory cytokines IL-1 $\beta$ , IL-6, and TNF- $\alpha$ .

Our results show that recombinant SP does not cause a significant change in the expression of the selected inflammatory markers at a 24-hour time point. This suggests that, in alveolar epithelial cells engineered to express the ACE2 receptor, the full-length SARS-CoV-2 SP alone may not be sufficient to trigger an innate immune response.

While we did not achieve the initial purpose of our investigation, to create a non-infectious model of COVID-19 that could be efficiently replicated by other groups, these results uncover important insights into the SARS-CoV-2 virus and will help guide future research into COVID-19.

Primary Presenter: Ernie Arnouts

Project Title: *Examination of Diffuse Myocardial Fibrosis in Pediatric and Young Adult Fontan Circulations: A Retrospective Cohort Study*

Primary Mentor: Alex Barker

Thematic Area: Clinical Science

Abstract: Abstract

Background: Diffuse fibrosis, as measured by T1 mapping and extracellular volume, may be associated with ventricular dysfunction in the Fontan circulation.

Methods: A retrospective cohort study at a moderate-altitude academic center of pediatric and young adult Fontan patients vs healthy controls exploring demographic differences, markers of fibrosis on cardiovascular magnetic resonance imaging, and associated clinical correlates.

Results: The Fontan cohort of 93 patients was stratified by field strength (n=65 at 1.5T, n=28 at 3T) and again by dominant left (n=47), dominant right (n=45) or combined (n=1) ventricles.

Comparison was made to a control cohort of 49 patients (n=26 at 1.5T, n=23 at 3T). The Fontan cohort demonstrated increased native T1 values across varying field strengths of 1.5T (981.4 vs 1031.6 ms p<.001) and 3T (1253.4 vs 1287.5 ms p=.031). Extracellular volume was also increased (23.2 vs 26.0% p<.001). There was no significant difference between dominant right and left ventricles among 1.5T native T1 (1040.9 vs 1023.1 ms p=.166), 3T native T1 (1275.5 vs 1299.4 ms p=.289) or extracellular volumes (26.3 vs 25.4% p=.321). VO2 max was significantly

reduced among the Fontan cohort (2.4 vs 1.3 LPM  $p < .001$ ), and negatively correlated with extracellular volume ( $R = -.26$   $p = .018$ ). Negative correlation with extracellular volume was also observed with age ( $R = -.35$ ,  $p < .001$ ), hematocrit ( $R = -.51$   $p < .001$ ), and diastolic blood pressure ( $R = -.38$   $p < .001$ ). Positive correlation was observed for Fick cardiac index ( $R = .36$   $p = .007$ ).

Conclusions: Markers of myocardial fibrosis were elevated among the Fontan cohort compared to healthy controls. There was a trend towards increased fibrosis among dominant right ventricles compared to dominant left. Fontan patients were shown to have a reduced exercise tolerance as measured by VO<sub>2</sub> max. A negative correlation between ECV and VO<sub>2</sub> max was observed across the Fontan group, suggesting a possible relationship between myocardial fibrosis and impaired exercise tolerance.

Primary Presenter: Haya Kaliounji

Project Title: *The consequences of on-going conflict in Syria on quality of life and health, and the role of NGOs.*

Primary Mentor: Madiha Abdel Maksoud

Thematic Area: Public Health and Epidemiology

Abstract: The 13-year ongoing Syrian conflict has caused one of the worst humanitarian crises in recent years. Syria's pre-conflict population was 22 million, and as of July 2021, there are approximately 5.4 million people who fled the country as refugees/asylees, and approximately 6.9 million people who were internally displaced. The violence that took place inevitably caused the fall of the healthcare system, leaving millions of Syrians without proper access to healthcare. The conflict also created a movement of humanitarian aid from all over the world, although limited research has been conducted on the role that this humanitarian aid is playing in Syria's and its population's recovery. The goal of this study was to assess the effects of the war on people's health and healthcare access, evaluate the most significant needs of the Syrian population post-conflict, and determine the role of non-governmental organizations (NGOs) in providing aid. To do so, we carried out an epidemiologic case series. We surveyed people who have received prosthetic devices from Rise Again, a non-profit organization that provides prostheses for people who have lost their limbs during the Syrian war. The goal of the survey was to gauge the impact that Rise Again has had on its prosthetic recipients. Results showed that despite the aid that Syria has received during the most active years of the war, there is a lack of

sustainable aid, preventing Syria and its people from fully recovering from the devastating 13-year-old conflict.

Primary Presenter: Reed Campbell

Project Title: *SOCIOECONOMIC STATUS AND ANTIDIABETIC DRUG PRESCRIPTION IN COMORBID COPD PATIENTS*

Primary Mentor: Greg Kinney

Thematic Area: Public Health and Epidemiology

Abstract:

ABSTRACT:

Antidiabetic drugs commonly used for Type 2 Diabetes Mellitus (T2DM) are associated with decreased risk for Chronic Obstructive Pulmonary Disease (COPD) exacerbations in patients with comorbidity. Degree of risk reduction is influenced by medication class. Treatment algorithms for T2DM suggest cost should be a factor in determining which medication to prescribe and there is a large range in costs between medications. Socioeconomic status (SES) has been shown to affect the burden of disease in patients with T2DM. SES likely influences the specific medication class that patients are prescribed and thus might affect COPD outcomes in comorbid patients.

To test the hypothesis that SES is associated with medication prescription, Phase 1 and 2 participant data from the COPDgene cohort was examined. 854 participants that were identified to have received antidiabetic medications were divided into groups based on surveyed ranked variables that estimated SES. The variables that were examined were School Completed, Drug

Cost Covered and Income. Insurance coverage was not examined, as approximately 97% of participants were insured. These groups were then matched to the medication that they were prescribed. Medication classes included Biguanides (metformin), Incretinmimetics, Thiazolidinediones, Alpha-Glucosidase Inhibitors, Ishophloroglucin A, Sulfonylureas, Meglitinides, Amylin Analogues, and Insulin. After statistical examination using chi square tests, there were no significant differences ( $p < 0.05$ ) between SES groups and medication prescription based on our data. These results were not attenuated by additional adjustment for gender, age, or race.

Primary Presenter: Fei Daly

Project Title: *Health Screening for Internationally Adopted Children: A Systematic Review*

Primary Mentor: Gretchen Domek

Thematic Area: Global Health

Abstract: HEALTH SCREENING FOR INTERNATIONALLY ADOPTED CHILDREN: A SYSTEMATIC LITERATURE REVIEW.

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International adoptees pose unique medical, behavioral, and developmental challenges.

However, there is no consolidated, evidence-based guidelines to help direct physicians to choose necessary health screenings and appropriately evaluate the health and disease status of these children. This review consolidates the scientific evidence presented on disease prevalence in internationally adopted children with a focus on environmental, nutritional, genetic, and infectious disease risks. Electronic databases (n=11) were searched based on the concepts of "international", "child adoption", and "health screenings" with each concept involving multiple subject headings and textwords. Non-English articles were excluded, but no year limits were applied. Two independent reviewers followed PRISMA guidelines to determine



75 eligible pieces of literature, which were read with each article's results being documented.

The most common infections assessed in descending order were stool studies, tuberculosis (TB), hepatitis B, hepatitis C, syphilis, HIV, hepatitis A, and malaria. Results highlight the importance of obtaining immunization titers regardless of prior vaccination records and repeating vaccinations as necessary. Parasitic prevalence has also been noted to be high, so stool testing and subsequent appropriate treatment appears to be warranted. Screening for iron deficiency and vitamin D deficiency were shown to be clinically important while testing blood lead, thyroid stimulating hormone, and insulin-like growth factor did not seem as clinically relevant. Early health screening is essential to identify and treat problems before they become more serious. This systematic review should help guide providers in the health screenings necessary to keep internationally adopted children, adoptive families, and adoptive communities safe and healthy.

Primary Presenter: Setareh Ekhteraei

Project Title: *RESEED - the perceived impact of an enhanced usual care model of a novel, teacher-led, task-shifting initiative for child mental health*

Primary Mentor: Michael Matergia

Thematic Area: Global Health

Abstract: Background: Task-shifted, teacher-led care may begin to bridge the child mental health care gap in low- and middle-income countries by improving mental health literacy. We explore the perceived impact of RESEED (Responding to Students' Emotions through Education), an abbreviated version of Tealeaf (Teachers Leading the Frontlines).

Methods: After classroom implementation of tools from a 3-day training on child mental health and cognitive behavioral techniques in Darjeeling, India, 29 teachers participated in focus group discussions (FGDs).

Results: Inductive content analyses of FGDs demonstrated RESEED's acceptability, positive overall impact, and barriers.

Conclusions: Stepped levels of teacher-led care may support child mental health in resource-limited settings through mental reframing.

Primary Presenter: Victoria Cates

Project Title: *Circulating CD8+ mucosal-associated invariant T cells correlate with improved treatment responses and overall survival in anti-PD-1-treated melanoma patients.*

Primary Mentor: Richard Tobin

Thematic Area: Clinical Science

Abstract: **Objectives:** While much of the research concerning factors associated with responses to immune checkpoint inhibitors (ICIs) has focussed on the contributions of conventional peptide-specific T cells, the role of unconventional T cells, such as mucosal-associated invariant T (MAIT) cells, in human melanoma remains largely unknown. MAIT cells are an abundant population of innate-like T cells expressing a semi-invariant T-cell receptor restricted to the MHC class I-like molecule, MR1, presenting vitamin B metabolites derived from bacteria. We sought to characterise MAIT cells in melanoma patients and determined their association with treatment responses and clinical outcomes.

**Methods:** In this prospective clinical study, we analysed the frequency and functional profile of circulating and tumor-infiltrating MAIT cells in human melanoma patients. Using flow cytometry, we compared these across metastatic sites and between ICI responders vs. non-responders as well as healthy donors.

**Results:** We identified tumor-infiltrating MAIT cells in melanomas across metastatic sites and found that the number of circulating MAIT cells is reduced in melanoma patients compared to

healthy donors. However, circulating MAIT cell frequencies are restored by ICI treatment in responding patients, correlating with treatment responses, in which patients with high frequencies of MAIT cells exhibited significantly improved overall survival.

Conclusion: Our results suggest that MAIT cells may be a potential predictive marker of responses to immunotherapies and provide rationale for testing MAIT cell-directed therapies in combination with current and next-generation ICIs.

Primary Presenter: Jacob Fang

Project Title: *White blood cell nadir to zero following intensive chemotherapy as a predictive factor for patients with acute myeloid leukemia*

Primary Mentor: Daniel Pollyea

Thematic Area: Clinical Science

Abstract: Introduction: The standard of care for patients with acute myeloid leukemia (AML) is intensive chemotherapy or allogenic hemopoietic stem cell transplant (HSCT). However, outcomes following intensive chemotherapy remain poor. Kinetics of white blood cell (WBC) elimination and nadir value may serve as a predictive factor for response to therapy. Methods: We conducted a retrospective analysis of 162 patients with AML treated with at least one round of intensive chemotherapy at University of Colorado Health. The WBC count was monitored for nadir for 28 days following initial treatment. A WBC count less than  $0.1 \times 10^9/L$  was defined as a WBC nadir=0. We performed a multivariate analysis examining the relationship between WBC nadir, age, percent blasts in marrow, secondary AML, treatment-related AML, and ELN group and response. Response to therapy was examined via two definitions: complete response (CR) and CR or complete response with incomplete hematopoietic recovery (CRi). Results: Multivariate analysis showed that a WBC nadir=0 was an independent factor significantly associated with reduced odds of response by both definitions (1st definition: OR: 0.295, 95% CI: 0.110-0.762,  $p=0.013$ , 2nd definition: OR: 0.298, 95% CI: 0.110-0.781,  $p=0.015$ ). Conclusion: In

patients with AML treated with an initial round of intensive therapy a WBC nadir=0 is an independent negative predictive factor for response to therapy.

Primary Presenter: Weston Durland

Project Title: *Diversity Documentary: A Cohort of Resilience*

Primary Mentor: Shanta Zimmer

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract: Abstract.

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Background.

The percentages of matriculating underrepresented minority (URM) students are not meeting the demand for a diverse physician workforce {Lett, 2019 #29}. Several solutions have been proposed, including "pipeline programs" to inspire the next generation early in their schooling {Smith, 2009 #11}. Few have created documentaries following the journeys of URM students from start to finish of medical school, and we hypothesize there are significant benefits to creating a documentary for both medical student cohorts and URM premed students.

Description.

This is a four-person team of medical students: one technology expert and three interviewers.

The subjects for the documentary consisted of nine students from the University of Colorado

School of Medicine (CUSOM) class of 2024. Our subjects for the documentary include the only

two Black men in the class, a Colorado native Latinx woman, a student with cerebral palsy, a

Black mother, a Korean American veteran of the U.S. Army, a daughter of Vietnamese refugees supporting a sister with a schizophrenia diagnosis, a gay Muslim man, and a student of color from rural America. Most documentary subjects are first-generation college and graduate school students. Subjects and interviewers were chosen from the CUSOM class of 2024 and paired together for four years throughout their medical school training. Due to the pandemic, interviews were conducted either in-person or over Zoom depending on various safety and travel limitations throughout the four years of medical school.

Goals:

- 1.) To Foster a sense of community amongst the cohort.
- 2.) Document the emotions and experiences of URM medical students throughout their training.
- 3.) Collect feedback from URM students for the CUSOM in video form.
- 4.) Showcase the completed film to aspiring medical students from URM backgrounds with hopes of informing and increasing their desire to pursue a career in medicine or healthcare.

Conclusions.

Emerging themes from our project include imposter syndrome, trauma (as a result of immigration status, veteran status, race, poverty, medical training), classism, frustration with systemic healthcare issues, and implicit bias in patient care. In addition, over time, we have



noticed that the process of creating our documentary has offered many opportunities to foster a sense of community among subjects and interviewers. We believe it has ameliorated some feelings of isolation given the setting of online medical school courses during a global pandemic.

Primary Presenter: Brandon Wolfe

Project Title: *Intramedullary Fixation for Metacarpal Fractures: A Multi-Institutional Prospective Outcomes Study*

Primary Mentor: Christodoulos Kaoutzanis

Thematic Area: Clinical Science

Abstract: Purpose: Intramedullary fixation (IMF) has emerged as an effective treatment for metacarpal fractures. Benefits include stable fixation that allows early postoperative rehabilitation and high fracture union rates, without increased complications. Both headless compression screws and intramedullary threaded non-compressive nails have been described for this purpose; however, prospective outcomes reporting are lacking. This study assessed the outcomes of metacarpal fractures treated with IMF including patient-reported outcomes (PROs), grip strength, total active digit motion (TAM), and complications.

Methods: A prospective multicenter trial enrolled consecutive patients with closed, extra-articular metacarpal fractures treated with IMF. Radiographic healing was assessed at each postoperative visit and PROs included pain scores, QuickDASH and Short Form Survey (SF-12) scores. Grip strength, goniometric motion measurements, and complications were also obtained.

Results: One-hundred-one fractures were treated in 82 patients with an average age of 33 years and mean follow-up of 69 days. Most patients were male (70%) laborers (28%) who smoke tobacco (26%). QuickDASH scores improved by 40 points, with a final mean of 17 following metacarpal IMF. SF-12 components of PCS and MCS at final follow-up were 55.95 and 48.74,

respectively. Final average grip strength was 15 kg and TAM was 228o. Four complications (3.9%) occurred, including 1 hardware failure, 2 proximal screw migrations, and 1 metacarpophalangeal joint contracture, with 3 of these patients requiring revision surgery.

Conclusions: IMF is a reliable technique for treatment of most metacarpal fractures with satisfactory PROs, excellent strength and motion, and a low complication rate. IMF should be considered for closed, extra-articular metacarpal fractures.

Primary Presenter: Melody Jan

Project Title: *Model of Disability Healthcare Disparities*

Primary Mentor: Alicia Wong

Thematic Area: Public Health and Epidemiology

Abstract: Introduction

According to the CDC, approximately one in four adults (25.7%) in the United States, or 61 million people, reports living with at least one disability. Patients with disabilities are an unrecognized health disparity: they are twice as likely to find health care providers' skills and facilities inadequate, three times as likely to be denied healthcare, and four times more likely to be treated poorly in the healthcare system.

Hypothesis

The purpose of this study is to create a model of disability healthcare disparities based on an existing model of healthcare disparities, which accounts for complexity and multifactorial causes, described in the research article "Advancing Health Disparities Research within the Health Care System: A Conceptual Framework" published by AM Killbourne in 2006. We hypothesize that cumulative knowledge will reveal that patients with disabilities will experience poorer outcomes in the United States healthcare system, attributable to multifactorial reasons at the patient, provider-and-staff, and healthcare organization levels.

Methods

To accomplish this goal, we are conducting an extensive literature review of over 90 disability health equity papers. We applied the findings of these papers to Killbourne's model to create a model of the major healthcare system, patient, provider, clinical encounter, and mediating factors that contribute to disability disparities in the healthcare system. This model can be used to better understand the complex factors that contribute to healthcare outcomes for patients with different types of disabilities, whether women with physical disabilities, deaf patients, or patients with ASD.

#### Findings/Conclusions

Major results of the study include an Excel sheet which lists papers, major findings, and what factors they endorse as contributing to disparities for patients with disabilities in the healthcare system. A model representing these findings has been created. Major causes of disparities identified include attitudes and bias from provider and staff, inaccessible building/environment, inaccessible equipment, provider education (lack of understanding or awareness, disability cultural awareness, continuing education), patient-provider communication, patient factors, and lack of accommodations.

Primary Presenter: Rachael Branscomb

Project Title: *Understanding Pancreatic Development Using a Ferret Model*

Primary Mentor: Lori Sussel

Thematic Area: Basic Biomedical Science

Abstract: Cystic fibrosis-related diabetes (CFRD) is the most significant co-morbidity of CF, impacting >50% of adult patients. Studies in young children with CF indicate that perinatal defects in islet function is an early clinical feature of CF, but the cause of this dysfunction remains controversial. To begin to understand the potential origins of CFRD, it would be optimal to model CFRD in an animal model; however, CFRD is not well-modeled in mice. Alternatively, CFRD occurs spontaneously in the ferret model of CF, suggesting this would be a useful model to characterize whether there is a developmental origin of pancreas dysfunction in patients with CF. Because the development of the fetal ferret pancreas has not yet been characterized, the purpose of this project is to characterize wild type ferret pancreas development as a baseline for future comparison with a CF ferret model. Immunofluorescent staining was employed to characterize key markers of development and islet hormone expression patterns in fetal ferret tissues. In this study, we demonstrate that WT ferret and human islet formation appear similar, and both species diverge from mouse pancreatic morphology as development progresses. Future studies are underway to determine whether CF ferrets display altered pancreatic islet development and hormone expression.



Primary Presenter: Kaitlyn Johnson

Project Title: *Standardizing Elder Abuse Data Collection: Development of Multi-Institution Database for Hospital-Based Consultation Teams*

Primary Mentor: Elizabeth Bloemen

Thematic Area: Public Health and Epidemiology

Abstract: Background

Attempts to improve elder abuse (EA) identification, intervention, and prevention in health care settings have been limited by a lack of comprehensive, longitudinal data available on victims who interact with the health care system. We have designed and launched emergency department / hospital-based EA consultation services in New York and Colorado to improve the care for these vulnerable patients. Our goal was to develop a standardized database that may be used by both and by other similar programs to track EA consults and provide more robust data that can be utilized for research.

Methods/Results

To develop this database, we used models of other interpersonal violence databases, including: the National Electronic Injury Surveillance System-All Injury Program (NEISS-AIP), National Trauma Databank (NTDB), and Child Abuse Pediatrics Network (CAPNET). We included relevant information from the older adult's history that could be obtained from Electronic Medical Records (provider notes, laboratory data, imaging results, photographs and



documentation of injuries). We also included information about the EA consult service interventions during the hospitalization and pertinent discharge information (where the patient went, additional services provided, etc). Relevant post-discharge outcome information was included, as the programs conduct phone calls at regular intervals to follow-up on patients. Given that these programs serve a wide range of older adults from urban and rural environments, relevant data for different populations has been included including veterans, immigrants, LGBT older adults, and non-English speaking patients. The database currently includes 521 fields in 12 forms which are completed over a course of a year of follow up.

## Conclusions

The development and use of this database will facilitate analysis that will improve understanding of EA and the impact of health care-based programs to address it. By having a strong collaboration between one of the largest urban centers and one of the more rural centers of the country we hope that this database will be readily applicable to centers across the country as they develop.

Primary Presenter: Olivia Starich

Project Title: *Composition of the CD27+ Memory-B-Cell Compartment Delineates Immunoglobulin Deficiency Endotypes*

Primary Mentor: Jordan Abbott

Thematic Area: Clinical Science

Abstract: **Purpose:** The finding of reduced numbers of class-switched memory B cells (CSM) in peripheral blood is widely used to assist the diagnosis and subclassification of CVID. Limited data exists on this finding in relation to the entire class of PADs. In this study, consecutive 8-marker comprehensive B-cell panel results were analyzed to determine how reduced CSM quantities might inform the pathophysiology of CVID and other humoral immunodeficiencies.

**Methods:** Subpopulations of CD27+ memory B cells from 64 consecutive subjects with or without humoral immunodeficiency were examined to identify associations with diagnosis and serum immunoglobulin level.

**Results:** CD27+IgM-IgD- percentage (CSM%) was correlated with IgG level in a discontinuous manner with an estimated change point of 9.7% (95% CI: 4.7, 12.4). All subjects with a CSM% below 9.7% had substantially lower serum IgG and IgA levels compared with those above 9.7.

CSM% below 9.7% is not associated with serum IgM level. Rather, the proportion of

CD27+IgMonly B cells (IgMonly or IgMonly%) is correlated with serum IgM.

Conclusion: Low CSM% may mark an endotype of humoral immune dysfunction defined by either loss of class switching or critical failure of the coordinated production of both memory cells and long-lived plasma cells responsible for adequate immunoglobulin levels in humans. In patients with low CSM%, maintenance or expansion of IgMonly cells and IgM production suggests the former explanation, while concomitant loss of IgMonly cells suggests the latter. These findings provide a simple endotypic stratification method for future studies on the failed coordinated B cell response in humans with PAD.

Primary Presenter: Michael Persinger

Project Title: *The Response of Hinsdale County, Colorado to the COVID-19 Pandemic: A Qualitative Case Study*

Primary Mentor: Mark Deutchman

Thematic Area: Public Health and Epidemiology

Abstract: THE RESPONSE OF HINSDALE COUNTY, COLORADO TO THE COVID-19

PANDEMIC: A QUALITATIVE CASE STUDY

Michael Persinger<sup>1</sup>, Meredith McKanna MD<sup>2</sup>, Mark Deutchman MD<sup>1</sup>

<sup>1</sup> Department of Family Medicine, University of Colorado Anschutz Medical Campus,

<sup>2</sup>Department of Internal Medicine, University of New Mexico

Abstract

Background: Historically, it has been recognized that urban solutions to public health issues have yet to be easily translated to rural areas and often lose their effectiveness in the rural setting.

With the progression of the COVID-19 pandemic, there is an increased need to examine rural areas directly and highlight strategies and challenges unique to those areas.

Objective: To identify strategies utilized by key stakeholders within Hinsdale County, one of the most rural and remote counties in the contiguous United States, and their effectiveness in combating the pandemic. The secondary aim is to identify areas of weakness exacerbated by the pandemic and caused strain on the community.

Methods: 7 community members, who were felt to represent various aspects of the county, including medical, public health, government, education, emergency, and the general public, were interviewed using a standardized questionnaire to understand their level of preparation for the pandemic, challenges encountered, and strategies and solutions used. The interviews were dissected qualitatively using a framework analysis approach, and subsequently, a thematic matrix was created.

Results: Numerous underlying themes were appreciated, but the most common across all interviews were the following: the importance of partnerships, the concern of limited resources, the fears of the economic impact on the town, and the overall lack of public health information applicable to rural areas.

Conclusions: Compared to other qualitative studies, rural areas were heavily affected by the lack of resources, specifically with staffing, and the overall difficulty with adapting public health guidelines to rural areas. The study demonstrated the importance of the rural regions creating an interlinked network between their public health, medical, and civilian agencies in preparation for public health emergencies.

Primary Presenter: Vijay Shimoga

Project Title: *Ultrasound OSCE: Standardized Assessment of Ultrasound Proficiency in Undergraduate Medical Education*

Primary Mentor: Juliana Wilson

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract: In recent years, point-of-care ultrasound (POCUS) has become an increasingly popular tool used by physicians at the bedside. This has prompted the creation of ultrasound training courses, now a widely popular and fast-growing facet of preclinical medical education designed to train medical students to effectively utilize ultrasound in the care for their future patients. Although a number of undergraduate medical institutions now teach their students how to practice POCUS through various curricula, standardized methods of assessing students' proficiency in using ultrasound have yet to be developed. To address this unmet need, an "Ultrasound OSCE" was developed to give medical students the opportunity to utilize POCUS in the care of simulated patients in order to evaluate their proficiency. Students performed POCUS maneuvers to assess standardized patients with pleural effusion and abdominal free fluid, and in each case, were evaluated on a number of parameters including probe selection, ability to obtain a diagnostic-quality imaging window, and utilize their findings to determine the most appropriate next step in clinical decision making. A pilot of this assessment showed a roughly normal distribution of scores among students with a mean score of 4.94 out of 11 for the pleural effusion assessment and 7.59 out of 11 for the abdominal free fluid

assessment, suggesting success in some areas and room for improvement in others. A majority of students (79% and 90% in each of the two assessments respectively) received partial or full credit on the technical portions of the assessment, but many also missed points simply for failure to perform basic draping and positioning techniques. These results highlight a successful method of assessing medical students' proficiency in performing POCUS maneuvers, highlighting specific areas of improvement for students and offering curriculum efficacy insight for educators. Development of this assessment protocol provides an example for how other institutions may consider adopting similar approaches to better evaluate students, identify areas for improvement, and strengthen the caliber of ultrasound education at the medical student level.

Primary Presenter: Amira Otmane

Project Title: *LCME Re-Accreditation: Independent Student Analysis 2024*

Primary Mentor: Nancy Asdigian

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract: The Liaison Committee on Medical Education (LCME) is the accreditation body for medical schools in the U.S. and Canada. Once a school is initially accredited, it needs to undergo re-accreditation every eight years to allow students to sit for licensing exams and receive federal funding. A key part of the re-accreditation process is the Independent Student Analysis Survey (ISA), a student-created survey that runs parallel to the self-analysis conducted by school officials and aims to address perceptions of medical students regarding their school.\*

\*Abstract will be complete once complete results of the ISA survey are analyzed.



Primary Presenter: Jacob Edwards

Project Title: *Progression of Small Intraductal Papillary Mucinous Neoplasms and Undefined Cysts of the Pancreas: A Systematic Review*

Primary Mentor: Marco Del Chiaro

Thematic Area: Clinical Science

Abstract: As imaging techniques have improved, cystic lesions of the pancreas have been detected at smaller sizes and earlier stages. However, the clinical significance and optimal management of small cysts (<1 cm in diameter) remains a topic of debate. We performed a systematic review and meta-analysis to evaluate the growth and progression characteristics of small (<1 cm in diameter) cystic lesions of the pancreas.

We followed Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. The review question was, “In patients with small (<1 cm) IPMN and undefined cysts of the pancreas, what is the risk of progression to invasive disease?” Literature searches were performed on November 14, 2022 by a health sciences librarian. Two independent reviewers used a two-stage sifting approach to identify relevant citations. In the initial stage, the titles and abstracts were independently screened for relevance. Following the first stage, the full text of the citation was retrieved and thoroughly screened to assess for inclusion in this study. Non-English citations, published abstracts, and conference proceedings were excluded at the title and abstract review stage. Studies describing small IPMNs and other cystic lesions of the pancreas measuring < 1 cm were included in the study.

22 studies met inclusion criteria for this systematic review (Figure 1). The study period ranged from 1988 to 2019 and included a total of 10,270 patients. Cystic lesions < 1 cm were reported in 2,790 patients. No studies reported initial mean size of lesions <1 cm. Seven studies reported data regarding change in size. 22 of 118 cysts (18.6%) increased in size during surveillance. 78 of 118 cysts (66.1%) exhibited no change in size. 40 cysts shrank or disappeared during follow-up. One study reported 222 of 388 (57.2%) cysts <1 cm remained <1 cm in diameter after 5 years of follow up. Five studies reported data regarding the development of worrisome features. 68 of 1197 lesions (5.7%) developed worrisome features or high-risk stigmata during follow-up.

While a significant minority of lesions exhibit growth and development of worrisome features (5.7%), the majority of these small cysts remain small throughout surveillance. These data provide support for current regimens of surveillance as advocated by major society guidelines.

Primary Presenter: Sarah Ellsworth

Project Title: *AVAILABILITY AND DELIVERY CAPACITY OF MEDICAL OXYGEN IN EMERGENCY CARE SETTINGS IN 14 AFRICAN COUNTRIES PER SARA AND SPA REPORTS*

Primary Mentor: Corey Bills

Thematic Area: Global Health

Abstract: ABSTRACT:

**OBJECTIVE:** This study uses World Health Organization (WHO) and Demographic and Health Surveys (DHS) facilitated country-wide Service Availability and Readiness Assessment (SARA) and Service Provision Assessment (SPA) reports to determine the availability and capacity of healthcare facilities in African countries to provide medically therapeutic oxygen in an emergency care setting.

**METHOD:** Review and data extraction of currently publicly available SARA reports and SPA reports published by 14 African countries, including Kenya, Tanzania, Sierra Leone, Zambia, Somalia, Mozambique, Libya, Democratic Republic of the Congo, Benin, Mauritania, Burkina Faso, Niger, Senegal, and Malawi was performed.

**RESULTS:** Among the countries that were surveyed, oxygen availability was consistently found to be insufficient across healthcare facilities. No countries reported adequate supply of oxygen-delivery equipment, including oxygen cylinders, ventilators, concentrators, cardiac monitors, or ambu bags, with most countries reporting only scant availability of these products. Many African

countries did not collect or publish any data regarding oxygen availability within an emergency care setting.

**CONCLUSIONS:** Across the African countries reporting data, oxygen availability and delivery capacity is inadequate to meet the demands of a large and growing populace. This has been highlighted by the evolving COVID pandemic, which has illuminated the dire outcomes of oxygen shortages in low-and-middle-income countries. Furthermore, given the paucity of available data and published literature on oxygen availability specific to an emergency care setting, it is the authors'™ strong recommendation to the WHO that measures of emergency-specific service and readiness, including oxygen and oxygen delivery equipment, be included in service availability and readiness data collection tools in a standardized format in the future.

Primary Presenter: Courtney Wham

Project Title: *Prehospital ETCO<sub>2</sub> is Predictive of Mortality in Intubated and Non-Intubated Patients*

Primary Mentor: Eric Campion

Thematic Area: Clinical Science

Abstract: Abstract:

Background: Prehospital identification of shock in trauma patients lacks accurate markers. Low end tidal carbon dioxide (ETCO<sub>2</sub>) correlates with mortality in intubated patients. The predictive value of ETCO<sub>2</sub> obtained by nasal capnography cannula (NCC) is unknown. We hypothesized that prehospital ETCO<sub>2</sub> values obtained by NCC and in-line ventilator circuit (ILVC) would be predictive of mortality.

Methods: This was a prospective, observational, multicenter study. ETCO<sub>2</sub> values were collected by a NCC or through ILVC. AUROCs were compared with prehospital systolic blood pressure (SBP) and shock index (SI). The Youden index defined optimal cutoffs.

Results: Of 550 enrolled patients, 487 (88.5%) had ETCO<sub>2</sub> measured through an NCC. Median age was 37 (27-52) years; 76.5% were male; median ISS was 13 (5-22). Mortality was 10.4%.

Minimum prehospital ETCO<sub>2</sub> significantly predicted mortality with an AUROC of 0.76 (CI 0.69-0.84; Youden index=22mmHg), outperforming SBP with an AUROC of 0.68; (CI 0.62-0.74, p=0.04) and shock index with an AUROC of 0.67 (CI 0.59-0.74, p=0.03).

Conclusion: Prehospital ETCO<sub>2</sub> measured by non-invasive NCC or ILVC may be predictive of mortality in injured patients.

Primary Presenter: Megan Aguilera

Project Title: *Representation of Racially Minoritized Patients on Dermatology Private Practice Websites*

Primary Mentor: Lucinda Kohn

Thematic Area: Public Health and Epidemiology

Abstract: This study explored if patient imagery on private practice dermatology websites accurately reflects the racial and ethnic population of the metropolitan area where each practice is located. Homepages from the top ten websites from each metropolitan area were analyzed for images of patients and providers, use of non-English language, and mention of the terms “Skin of Color” or “Ethnic Skin.” Ninety-seven websites were included. A significantly lower percentage of non-White patients ( $p < 0.001$ ) and providers ( $p = 0.022$ ) were pictured on the selected dermatology websites than reported in the Census (Table 1 and Figure 1). Our findings suggest that the images on the homepages of private practice dermatology websites do not reflect the racial diversity of the metropolitan area in which each practice is located.

Primary Presenter: Lukas Sloan

Project Title: *Ambulatory Blood Pressure, Sleep Quality, and Acute Mountain Sickness in the Setting of Acute High Altitude Exposure: The Colorado High Altitude Monitoring Pressure Study (CHAMPS)*

Primary Mentor: Linda Keyes

Thematic Area: Clinical Science

Abstract: Objective

Acute high altitude exposure may increase 24-hour ambulatory blood pressure (ABP), but change in blood pressure with acclimatization is poorly understood. Additionally, high altitude may negatively affect sleep quality, but the association between poor sleep and acute mountain sickness (AMS) is controversial. BP measured at the time of altitude-related symptoms has no association with AMS, but nocturnal BP might. Thus, we compared 24-hour ABP at low altitude versus the first 24 hours at high altitude and after 72 hours as well as sleep quality and 24-hour ABP in high altitude travelers with and without AMS.

Methods

This is a prospective observational cohort study of 28 lowlanders visiting 2500-2800m during their first 24 hours at high altitude, and at 72 hours. BP was monitored every 30 minutes while awake and every hour overnight using Welch-Allyn6100 ABP monitors. Sleep quality with the Groningen Sleep Quality Scale (GSQ), AMS by the 2019 Lake Louise Score Questionnaire



(LLS). High altitude data was collected during the first and third days at high altitude. Data collection for these participants was done between 2019-2022.

## Results

We enrolled 28 participants (mean age 58, range 32-77, m=18, f= 10). In preliminary data for 8 of these participants (f=5, m=3), we found an increase in average 24-hour SBP between low and high altitude (121 [91-150] mmHg vs 132 [96-169] mmHg, respectively), with a mean SBP increase of 12 [-16-40] mmHg,  $p=0.049$ . Diurnal SBP was greater at high altitude (123 [94-151] vs 136 [100-172],  $p=0.02$ ), but nocturnal SBP did not differ (112 [72-151] vs 121[79-163],  $p=NS$ ). Results were similar for DBP. Comparing the first 24 hours versus 72 hours at high altitude, we found no differences in average 24-hour SBP (132 [96-169] mmHg vs 132 [92-172] mmHg,  $p=NS$ ), diurnal SBP (136 [100-172]) mmHg vs 136 [95-177] mmHg,  $p=NS$ ) or nocturnal SBP (121 [79-163] mmHg vs 113 [84-142] mmHg,  $p=NS$ ). For the entire cohort, there were 3 participants with AMS and 23 without AMS (missing data,  $n=2$ ). Baseline GSQ did not differ in AMS+ vs AMS- ( $p=NS$ ), however, AMS+ had higher 24-hour GSQ scores, (ie, worse sleep quality) vs AMS- (mean GSQ AMS+= 10.7 [95%CI:8.88-12.4] vs AMS-= 5.5 [95%CI:3.89-7.16],  $p=0.04$ ). In a subset ( $n=8$ ), baseline GSQ did not differ versus 24-hour GSQs or 72-hour scores ( $p=NS$ ); however, sleep quality was worse on the first night vs the third (GSQ 6.9 vs 1.9,  $p=0.02$ ). Mean 24-hour SBP (129 mmHg vs 140 mmHg) and mean daytime SBP (136 mmHg vs

150 mmHg) did not differ by AMS status ( $p=NS$ ), however, AMS+ had lower mean nocturnal SBP versus AMS- (96 mmHg vs 127 mmHg,  $p=0.01$ ).

## Conclusion

In our cohort, BP was elevated at high altitude compared to low altitude due to increases in diurnal BP and remained so after 72-hours of acclimatization. The clinical importance and the long-term effects of elevated BP during high altitude sojourns remain to be determined. Those with AMS had worse sleep quality, supporting the inclusion of a sleep quality question in the LLS. Sleep quality improved after time at high altitude. Surprisingly, mean nocturnal SBP was lower in those who develop AMS. We need more participants to validate this finding.

Primary Presenter: Gregory Dyba

Project Title: *Does 25-OH vitamin D Insufficiency Predispose Young Children to Multiple Fractures from Minimal Trauma? A Preliminary Analysis*

Primary Mentor: Daniel Lindberg

Thematic Area: Clinical Science

Abstract: Abstract

**Background & Significance:** In the absence of significant accidental trauma, the identification of multiple fractures in a young child raises concern for physical abuse. One group has suggested that there is an unrecognized "epidemic" of 25-OH vitamin D insufficiency that produces findings frequently mistaken for child abuse. Our objective was to test this hypothesis.

**Methods:** We prospectively identified children <5 years old with blood obtained during their care for acute trauma at a single pediatric center. We determined 25-OH vitamin D levels and the number of identified fractures.

**Results:** Among 281 eligible participants, 25-OH vitamin D levels were obtained in 83 (29%). Using a threshold of 20ng/mL, 13 (16%) participants were found to have 25-OH vitamin D insufficiency. The proportion of children with at least one fracture was 62% for children with insufficiency, and 57% for those with sufficient 25-OH vitamin D levels ( $p=0.768$ ). The mean number of fractures was 1.8 for 25-OH vitamin D sufficient children and 1.1 for 25-OH vitamin D insufficient children ( $p=0.675$ ). Seven children had five or more fractures identified, including

5 who were diagnosed with physical abuse, and 2 with severe accidental trauma. Of the children with >5 fractures who were diagnosed with non-accidental trauma, all had 25-OH vitamin D levels >20 ng/mL. The proportion of children diagnosed with physical abuse was not statistically different for children with 25-OH vitamin D insufficiency vs. those without ( $p=0.474$ ).

Conclusion: 25-OH vitamin D insufficiency in the absence of significant trauma is not a plausible explanation for multiple fractures.

Primary Presenter: Lukas Ommen

Project Title: *Assessing Physiologic Measures Using the Empatica E4 Wristband in ICU Nurses*

Primary Mentor: Marc Moss

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract: Burnout, PTSD, anxiety, and depression have been well known and studied previously in healthcare workers including critical care/acute care nurses. However, data in these studies is the result of self-report scales and diagnostic interviews and there is limited information on the biologic and physiologic mechanisms of stress in this population of nurses. With the emergence of COVID-19 and the ensuing pandemic, the healthcare system was put under increased stress which resulted in increased rates of burnout, PTSD, and staffing shortages. The goal of this study is to monitor heart rate variability, motion-based activity and sympathetic nervous system arousal using Empatica E4 wristbands to derive features associated with stress, engagement and excitement in critical care nurses/acute care nurses and to determine daily activities conducted by critical care/acute care nurses, frequency of physiologic responses to psychological distress, and the association of preexisting psychological distress and changes in physiological responses to new stress. Preexisting psychological distress and mental health was evaluated using five different surveys. We hypothesize that critical care/acute care nurses who perform more tasks that cause increased sympathetic arousal and other markers of stress will have a corresponding increase in their scores of psychological stress. We further hypothesize that MICU nurses will see an increase in their scores on their surveys with increasing time spent doing non-nursing

related tasks. Additionally, it is also hypothesized that nurses will show higher risk-taking behavior than the general population. After analyzing the results, it was shown that MICU nurses during the study spent 23% of their time on average charting. This was the most out of any activity. Further analysis showed some surprising correlations between nursing activities and results of the surveys. The correlations that were found did not support the hypothesis mentioned above. Further analysis needs to be completed to draw conclusions from the Empatica wristband data. Hopefully, by gaining a better understanding of the activities that increase physiologic signs of stress there can be interventions around those activities to better protect healthcare workers from burnout.

Primary Presenter: Alan Makedon

Project Title: *Indocyanine Green Angiography for Use in Robotic Spermatic Cord Denervation*

Primary Mentor: Granville Lloyd

Thematic Area: Clinical Science

Abstract: Introduction: Chronic orchialgia continues to be a challenge for urologists to treat and for patients to live with. Currently, conservative treatment (rest, anti-inflammatory drugs, physical therapy, and antidepressants) is the first-line therapy for men struggling with chronic orchialgia. However, when these approaches fail, alternative therapies are required. Before resorting to orchiectomy, microsurgical spermatic cord denervation (MSCD) has been shown to significantly decrease pain with few side effects for the correctly selected patient. Accurate microsurgical technique and especially avoidance of arterial injury is critical, especially for novice surgeons as well as in cases with aberrant anatomy. In this video presentation, we describe the novel use of indocyanine green (ICG) angiography in correlation with Doppler during robotic MSCD for the purpose of arterial localization and verification of preservation.

Methods: Robotic MSCD was performed in 10 cases of chronic orchialgia after failed conservative treatment and after an effective anesthetic cord block in the office. The procedure consists of a few distinct steps: division of the cremasteric muscle, isolation of the vas deferens and division of the central adipose tissue. ICG was injected twice in each procedure: to identify

the testicular artery during central dissection and to confirm preservation of the artery at conclusion. Micro-Doppler was used adjunctly to confirm findings.

Results: In all 10 patients, ICG angiography identified the location and course of the testicular artery, including in cases of aberrant and reoperative anatomy. Doppler assessment confirmed this.

Conclusion: ICG angiography during robotic MSCD is a novel technique to clarify spermatic cord arterial anatomy and is especially useful in the setting of prior surgery and developmental abnormality. This technique is a valuable adjunct to this procedure for novice surgeons, as well as producing visual documentation of arterial preservation, without adding significant time or complication.



Primary Presenter: Zachary Trottier

Project Title: *Lewy body dementia*

Primary Mentor: Samantha Holden

Thematic Area: Clinical Science

Abstract: Lewy body dementia encompasses a spectrum of neurodegenerative disease causing progressive cognitive impairment. The disease entities included under a Lewy body dementia umbrella are dementia with Lewy bodies and Parkinson<sup>€™</sup>s disease dementia. These two conditions are currently best distinguished by the timing of onset and relative prominence of motor versus cognitive symptoms yet share many clinical and pathological characteristics. Criteria have also been developed or proposed to identify their respective prodromal stages, including mild cognitive impairment in Parkinson<sup>€™</sup>s disease and prodromal dementia with Lewy bodies. This chapter will overview the spectrum, clinical features, pathophysiologic mechanisms, diagnostic criteria, and management of LBD.

Primary Presenter: Shreyaas Aravindan

Project Title: *Open Fixation of Posterior Malleolus Fractures Increases Morbidity: An Important Consideration For Fractures Involving Less than 25% of the Articular Surface*

Primary Mentor: Joshua Parry

Thematic Area: Clinical Science

Abstract: Purpose: To assess the morbidity of open reduction internal fixation (ORIF) of posterior malleolus fractures (PMFs) in the setting of trimalleolar ankle fractures

Methods: A retrospective review of 79 trimalleolar ankle fractures was performed to identify need for syndesmotic fixation, blood loss, operative/tourniquet time, complications, and reoperations. Patients with PMF ORIF (n=38) were compared to those with no fixation (n=41).

A subanalysis of patients with small PMFs (<25%) was performed.

Results: The PMF ORIF group required less syndesmosis fixation (Proportional difference (PD) -44.6%, 95% confidence interval (CI) -61.8 to -23.0%), had more blood loss (MD 20 ml, CI 0 to 40), longer operative times (MD 53.0 min, CI 35.9 to 70.1), longer tourniquet times (MD 26 min, CI 4 to 33), and had no difference in radiographic joint step-off or concentrically reduced joints.

The PMF ORIF group had more postoperative complications (PD 26.9%, 6.3 to 44.8%) and a trend for more reoperations (PD 13.6%, -3.4 to 29.6%). Wound complications were more common in the PMF ORIF group (PD 26.5%, CI 6.9 to 43.6%), resulting in 5 (16.1%) irrigation and debridement procedures. On analysis of patients with small PMFs (n=42), PMF ORIF (n=15) resulted in longer operative times and tourniquet times but had no observed difference in

joint step-off, concentrically reduced joints, need for syndesmotic fixation, blood loss, or complications/reoperations.

Conclusion: PMF ORIF in the setting of trimalleolar ankle fractures was associated with increased operative/tourniquet times, blood loss, wound complications, and did not eliminate the need for syndesmosis fixation.

Primary Presenter: Madison Pelton

Project Title: *Exploring the Use of Visual Learning Tools in Neonatal Resuscitation Education: A Scoping Review*

Primary Mentor: Susan Niermeyer

Thematic Area: Global Health

Abstract: Neonatal deaths account for a majority of deaths in children under the age of 5 globally and improving healthcare workers' (HCWs) access to quality neonatal resuscitation education and training has been a strategic goal of stakeholders in HIC and LMIC. The introduction of visual learning tools (VLTs) as an adjunct to traditional, text-based educational materials has become increasingly popular, but there is very little comprehensive information regarding the types of visual tools used, the stages of education in which these tools are implemented, and the impact of these tools on HCWs knowledge and skills or the clinical environment and neonatal outcomes. This scoping review explores VLTs from the simplest illustrations to complex virtual reality games and highlights pertinent data collected regarding the impact of VLTs on educational and clinical outcomes. Across global contexts, HCWs welcomed the use of VLTs in their education and clinical practice. There is promising evidence that VLTs could lead to increased long-term retention of resuscitation knowledge and skills, though these results were not consistent across every clinical scenario. Improving transparency in the design process and data collection when implementing VLTs is essential to determine which tools will be the most

effective and beneficial for HCW and patient outcomes and how these tools can be incorporated in a sustainable manner.

Primary Presenter: Zoe Lee-Chiong

Project Title: *Pelvic Exam Experiences Among Spanish-Speaking-Only Patients*

Primary Mentor: Claire Schultz

Thematic Area: Public Health and Epidemiology

Abstract: **Background:** The pelvic examination is a critical part of a woman's preventative and reproductive healthcare by screening for early cervical cancer and other gynecological conditions. Hispanic/Latina patients are less likely to have received a pelvic exam in the past year, particularly if they have low-English proficiency, despite having the highest incidence of cervical cancer compared to other races and ethnicities in the United States.

**Methods:** This mixed methods study aimed to identify factors that influence the experience of Spanish-speaking-only female-identifying patients during routine pelvic examinations. Data were collected via online surveys and semi-structured interviews with nulliparous Spanish-speaking-only patients aged 18-35 who had recently undergone a pelvic exam. Qualitative content analysis using the Health Belief Model as a theoretical framework was conducted to generate themes on participant's experiences.

**Results:** Twelve individuals completed interviews, and 10 completed the survey. All participants reported a positive experience and would consider receiving a pelvic exam in the future. Patients perceived many health benefits to receiving a pelvic exam but tended to over-attribute the exam's ability to screen for all gynecologic conditions. Clinical factors that contributed to a

more positive pelvic exam included level of communication during the exam, provider effort to speak Spanish, having a female provider, sense of control during the exam, and use of clean technique.

Discussion: Interventions to improve patient knowledge of the pelvic exam and its limitations in screening for gynecologic conditions are needed for Spanish-speaking-only patients to prevent a false sense of security that could hinder patients' trust in the healthcare system. Clinicians may improve patient experience by explaining the indications for receiving the pelvic exam, describing the steps of the pelvic exam during the visit, and by making an effort to speak Spanish.

Primary Presenter: Victor Trevisanut

Project Title: *Feasibility of Outpatient Robot-Assisted Laparoscopic Prostatectomy*

Primary Mentor: Janet Kukreja

Thematic Area: Clinical Science

Abstract: ABSTRACT

## INTRODUCTION/OBJECTIVE

Research demonstrates the benefits of robotic-assisted prostatectomies (RARP) in regard to blood loss and post-operative recovery, there is a paucity in the literature regarding RARP as an outpatient procedure. With minimal operating room capacity during COVID-19, advances in minimally invasive surgical techniques and a relatively healthy patient population, outpatient RARP may be feasible. The aim of our study was to demonstrate the safety and feasibility of RARP as a same day outpatient procedure.

## METHODS

A retrospective cohort study at a single institution was performed by four fellowship trained surgeons who routinely perform RARP. Patients were identified through billing records who underwent RARP between January 2019 and December 2021. Patients were divided into two cohorts, inpatient (one stay past midnight) and outpatient (defined as same day surgery with no stay past midnight). Individual surgeons' admission necessity during COVID-19 limitations. We then extracted data using the electronic health record (EHR). The two groups were then



compared using standard statistical methods for cohort studies. Statistical significance was defined as  $p < 0.05$ .

## RESULTS

Over a two-year period, a total of 497 RARP were performed with 139 (28%) outpatient cases.

There was no difference in baseline demographics between the cohorts. There was a statistically significant difference in estimated blood loss (142 vs 102 mLs,  $p = < 0.001$ ) and operative time (193 vs 180 mins,  $p = 0.004$ ) in the inpatient vs outpatient cohorts, respectively. There was no significant difference in cancer stage, prostate size, or node/margin positivity between cohorts.

There was a higher rate of readmissions (5% vs 0%,  $p = 0.007$ ) and number of ED presentations (0.15 vs 0.05,  $p = 0.019$ ) in the inpatient group. There was no difference in complication rates between the groups. Importantly, there was no significant difference in burden on the clinical staff demonstrated by no difference in number of phone calls to clinic, number of EHR messages, or opioid prescriptions on discharge.

## CONCLUSIONS

Overall, our data suggests that in a well selected patient group, RARP can safely be performed as an outpatient procedure with no significant differences on clinic staff workload or oncologic outcomes. While there was no pre-defined algorithm to determine outpatient vs inpatient surgery, the similarity in demographics and pre-operative characteristics between the groups

lends support to performing this procedure as an outpatient with inpatient admission being reserved for select patients.

Primary Presenter: Woro George

Project Title: *Nuclear Medicine Shunt Study to Assess Shunt Function*

Primary Mentor: Michael Handler

Thematic Area: Clinical Science

Abstract: Objective

A shunt which has been in place for an extended period may develop fractures along its course.

The presence of a gap does not provide evidence that the shunt is non-functional, as there can be preserved flow along a tract within the body's soft tissues. Even in cases where a shunt appears intact, questions may arise regarding its functionality. Assessing the presence of flow is crucial in determining whether operative intervention is necessary. A nuclear medicine shunt study can provide that information.

Methods

We reviewed the records of Children's Hospital Colorado for pediatric neurosurgery over a twenty-year period and identified nuclear medicine studies on patients with shunts. Demographic data, result of the study, and subsequent patient management and outcome were recorded.

Results

63 patients were identified to have the procedure, 60 with shunts in place with a question about flow, and with adequate data. Flow was documented in 34/60(57%) patients, and no flow in

26/60(43%). Of patients documenting flow, 31(91%) had no imaging sign or clinical symptoms of malfunction, of whom 2(6%) developed them before elective revision. 13(38%) of patients with flow did not receive shunt revision, for several reasons. Of the 26 patients documenting no flow, all were asymptomatic at the time of the nuclear medicine study. They were deemed to be shunt independent and no revision operation offered. Of these, 2 patients (8%) subsequently developed signs or symptoms of malfunction and later required a shunt, implying that the flow study was incorrectly performed or interpreted.

### Conclusion

The nuclear medicine shunt study is highly accurate when correctly performed. Though infrequently described it can provide invaluable information to guide patient management.

### Significance

The utilization of the nuclear medicine shunt study has the potential to transform the approach to managing patients with shunts. This diagnostic tool ensures tailored, effective care and optimizes the use of healthcare resources. Implementing informed and precise treatment strategies ultimately leads to improved patient outcomes while simultaneously reducing healthcare costs.

Primary Presenter: Whitney Kelly

Project Title: *Medical Student Perceptions of LGBTQIA Inclusivity in Anesthesiology*

Primary Mentor: Angela Selzer

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract: Background: LGBTQIA+ identifying medical students' perception of inclusivity within a specialty is highly predictive of their specialty choice. An LGBTQIA+ inclusive culture has a positive impact on student learning, patient care, and employee health and well-being.

While the importance of inclusivity and diversity in health care is known, there is little data on medical students' perception of inclusivity in anesthesiology for LGBTQIA+ students.

Methods: To create a survey for medical students to assess their perception of how inclusive the field of anesthesiology is for LGBTQIA+ identifying students. This single-center, multi-class anonymous survey was generated from 1 and distributed to medical students at the University of Colorado School of Medicine (CUSOM). Participants that did not complete an anesthesiology rotation were excluded from the survey. Data were analyzed on R-Studio, utilizing Chi-Squared Testing and Fisher's Exact Testing.

Results: Collected data indicate the feasibility of a questionnaire survey for assessing the perception of how inclusive the field of anesthesiology is for LGBTQIA+ identifying students.

Analyzed results demonstrated several statistically significant differences between how

LGBTQIA+ and non-LGBTQIA+ students answered survey questions, with the perceptions of decreased inclusivity among the LGBTQIA+ identifying .

Conclusion: This study provides evidence that an online questionnaire can be used to evaluate the perception of inclusivity in the field of anesthesiology for LGBTQIA+ and non-LGBTIA+ medical students. The study provides a framework for investigating this work and warrants conduction on the national level. These support that LGBTQIA+ students perceive the field of anesthesiology to be less inclusive in comparison to other medical specialties. Establishing baseline perceptions of inclusivity in our specialty is important so that interventions to improve inclusivity can be evaluated for effectiveness. Further studies are necessary to establish if these data are reproducible on a national level.

Primary Presenter: Danielle Gilbert

Project Title: *A Critical Analysis of Community-Based Substance Use Interventions in Refugee and Immigrant Populations.*

Primary Mentor: Janet Meredith

Thematic Area: Global Health

Abstract: Abstract

Background: Though substance use disorder and mental health concerns are widely recognized issues within displaced populations, problematic alcohol use within the Burmese refugee population of Denver in particular has been identified as an issue of importance by members of the community itself. Many of these refugees have experienced violence and persecution at the hands of a military junta, resulting in high rates of post-traumatic stress disorder and substance use. The Burmese refugee population faces alcohol-related challenges, including availability in camps on the Thai-Burma border. Through prior partnerships with University of Colorado medical students utilizing a community-based participatory research (CBPR) approach, problematic alcohol use was identified as a theme for health literacy intervention by the community. In the setting of numerous contributing factors, this project instead demonstrated key areas of consideration for conducting CBPR, working in immigrant and refugee communities, and future considerations to best engage communities. In this critical analysis, we will examine the strategies that were employed in conducting this study and highlight current literature support in conducting substance use interventions in diverse communities..

## Methods:

IRB approval was granted to conduct focus groups within the Burmese refugee population of Denver to develop a health literacy program with administration of standardized pre- and post-course surveys. However, attempts to recruit participants and engage with the community were unsuccessful, and initial aims were not carried out. The researchers identified and discussed the barriers to success experienced within the framework of published literature exploring common obstacles to conducting research within communities similar to the target population (ie. displaced, refugee, Burmese, experiencing substance use disorders).

## Results:

Literature discussing barriers to engagement of refugee populations with substance use treatment programs and to engagement with CBPR was considered, as well as literature exploring recommendations for more successful community engagement. Many of the barriers experienced by the authors in attempts to engage the target community were aligned with those discussed in literature, with major themes including stigma of the topic, challenges posed by the COVID-19 pandemic, obstacles to forming trusting relationships within the closed community, and difficulty engaging a representative audience.



Conclusions: There are many barriers to conducting CBPR, especially within communities dealing with sensitive and stigmatized issues. Researchers should consider barriers discussed in literature to improve rates of success.

Primary Presenter: Keanu Chee

Project Title: *The role of the piriform cortex in temporal lobe epilepsy: A current literature review*

Primary Mentor: Daniel Kramer

Thematic Area: Clinical Science

Abstract: Temporal lobe epilepsy is the most common form of focal epilepsy and can have various detrimental consequences within many neurologic domains. Recent evidence suggests that the piriform cortex may also be implicated in seizure physiology. The piriform cortex is a primary component of the olfactory network and is located at the junction of the frontal and temporal lobes, wrapping around the entorhinal sulcus. Similar to the hippocampus, it is a tri-layered allocortical structure, with connections to many adjacent regions including the orbitofrontal cortex, amygdala, peri- and entorhinal cortices, and insula. Both animal and human studies have implicated the piriform cortex as a critical node in the temporal lobe epilepsy network. It has additionally been shown that resection of greater than half of the piriform cortex may significantly increase the odds of achieving seizure freedom. Laser interstitial thermal therapy has also been shown to be an effective treatment strategy with recent evidence hinting that ablation of the piriform cortex may be important for seizure control as well. We propose that sampling piriform cortex in intracranial stereoelectroencephalography (sEEG) procedures with the use of a temporal pole or amygdalar electrode would be beneficial for further understanding the role of the piriform cortex in temporal lobe epilepsy.



Primary Presenter: Bruck Gezahegn

Project Title: *Complex Interplay of Forkhead BoxP3, Interleukin 22, and Interleukin 17 in Multiple Sclerosis Patients on Disease Modulating Therapy*

Primary Mentor: David Wagner

Thematic Area: Clinical Science

Abstract: Multiple Sclerosis (MS) is an autoimmune demyelinating disease affecting the central

nervous system. Dysregulation in the immune system prompts an attack on autoantigens,

specifically targeting the insulating sheath of neurons known as myelin. This damage disrupts the

efficiency and speed of electrical impulses, leading to inflammation and demyelination.

Clinically, MS presents with symptoms such as fatigue, optic neuritis, paresthesia, weakness,

spasticity, and bladder dysfunction.

Various predisposing factors including genetics, vitamin D deficiency, viral infections, age,

gender, and geography have been identified. The course of the disease varies depending on these

factors and the level of inflammation, which is influenced by the balance between regulatory and

inflammatory immune cells along with their respective cytokines.

Disease-modifying therapies aim to control the progression of MS by targeting the down

regulation of inflammatory immune cells and pro-inflammatory cytokines. Our study focused on

Interleukin-17 (IL-17), a key pro-inflammatory cytokine, Interleukin-22 (IL-22), a cytokine with

anti and pro-inflammatory properties, and Forkhead box protein P3 (FoxP3), a transcription

factor expressed in regulatory T cells (Tregs). We also measured the levels of these biomarkers in T helper 40 cells (Th40), a subset of CD4+ T cells up-regulated in MS.

Our findings revealed an expansion of TH40 cells in MS patients. Furthermore, FOXP3 and IL22 levels were lower in MS samples, while IL17 levels exhibited variations depending on the treatment regimen. Treatment with TGF Beta, IL22, and IL17 modulates these biomarkers, suggesting their potential as therapeutic targets in MS. Further research is warranted to elucidate the underlying mechanisms and translate these findings into clinical practice for the improved management of MS patients.

Primary Presenter: Kisha Thayapran

Project Title: *Prostacyclin Analog Treprostinil Enhances Neonatal Rat Lung Endothelial Cell Growth And Angiogenesis In Vitro*

Primary Mentor: Steven Abman

Thematic Area: Basic Biomedical Science

Abstract: Purpose of Study

Bronchopulmonary dysplasia (BPD) is the chronic lung disease that often follows preterm birth. Characterized by abnormal lung structure due to impaired alveolar and vascular growth, BPD is strongly associated with mechanisms such as postnatal hyperoxia and the risk for pulmonary hypertension (PH). Previously, we found that treprostinil (TRE), a synthetic prostacyclin analog, preserved lung structure and function, improved vascular growth, and prevented right ventricular hypertrophy in a hyperoxia-induced neonatal rat model of BPD. To determine whether the effect of TRE on neonatal lung development is partly due to the stimulation of angiogenesis, we studied the effect of TRE on rat lung endothelial cell (LEC) growth and tube formation in vitro.

Methods Used

LECs were isolated from 2-week old rats and grown in 10% FBS. To assess cell proliferation, LECs were plated in 2.5% FBS (5000 cells/well), grown in normoxia with daily media changes, and counted after 3 days. To assess angiogenesis, LECs were plated in 1% FBS (10,000

cells/well) on collagen and fixed in 4% PFA after 18-24hrs in normoxia. Cells were imaged at 10x and tube formation was assessed by counting branch points per high powered field. For both assays, the following treatments were studied: untreated FBS (control), TRE (1uM), Axitinib (AX, selective VEGF receptor inhibitor; 10nM), and TRE+AX.

### Summary of Results

TRE increased LEC growth and tube formation by 109% and 51%, respectively ( $p < 0.01$  and  $p < 0.05$ ). AX alone did not decrease LEC growth, and when TRE was administered with AX, the effect of TRE was not attenuated. However, AX alone decreased tube formation by 38% ( $p < 0.01$ ) but TRE administration with AX restored tube formation to control values.

### Conclusions

TRE enhances LEC growth and angiogenesis in vitro, supporting our previous findings that TRE improves lung alveolar and vascular growth in vivo. Further, we found that VEGF receptor blockade reduces tube formation but not cell growth, but this effect can be reversed by TRE. We speculate that these findings suggest interactions between the VEGF and prostacyclin pathways that can be targeted to develop novel therapies to prevent BPD and BPD-associated PH.





Primary Presenter: Wyanet Bresnitz

Project Title: *Potassium Channels in the Uterine Vasculature: Role in Healthy and Complicated Pregnancies*

Primary Mentor: Ramon Lorca

Thematic Area: Basic Biomedical Science

Abstract: A progressive increase in maternal uterine and placental blood flow must occur during pregnancy to sustain the development of the fetus. Changes in maternal vasculature enable an increased uterine blood flow, placental nutrient and oxygen exchange, and subsequent fetal development.  $K^+$  channels are important modulators of vascular function, promoting vasodilation, inducing cell proliferation, and regulating cell signaling. Different types of  $K^+$  channels, such as  $Ca^{2+}$ -activated, ATP-sensitive, and voltage-gated, have been implicated in the adaptation of maternal vasculature during pregnancy. Conversely,  $K^+$  channel dysfunction has been associated with vascular-related complications of pregnancy, including intrauterine growth restriction and pre-eclampsia. In this article, we provide an updated and comprehensive literature review that highlights the relevance of  $K^+$  channels as regulators of uterine vascular reactivity and their potential as therapeutic targets.

Primary Presenter: Romney Hanson

Project Title: *The presence of submucous cleft palate in patients with isolated cleft lip and middle ear dysfunction*

Primary Mentor: Brian Herrmann

Thematic Area: Clinical Science

Abstract: Introduction: Recent studies have suggested that children with isolated cleft lip (CL) are more likely to develop middle ear disease and eustachian tube dysfunction (ETD). This may be related to abnormal palatal musculature or an undiagnosed submucous cleft palate.

Objectives: To determine the prevalence of submucosal cleft palate in patients with CL who exhibit significant ETD.

Methods: A retrospective chart review was performed for children with an isolated CL requiring tympanostomy tubes over a 20-year period at an academic tertiary care medical center.

Demographic, clinical, and surgical data were collected.

Results: Three hundred twelve patients had an isolated cleft lip, and 29 (9.3%) children required tympanostomy tubes. Of those, nine (31%) were also found to have a submucous cleft palate (7 males, 6 Caucasian). The average age at CL repair was  $3.94 \pm 1.03$  months, and the average age at tympanostomy tube placement was  $13.68 \pm 13.8$  months. All 9 patients had chronic otitis media, with 4 having mild conductive hearing loss and 3 having moderate conductive hearing loss. The submucous cleft palate was diagnosed at the time of CL diagnosis (4), after CL diagnosis with

the diagnosis of chronic otitis/ETD (2) and after a diagnosis of chronic otitis/ETD (3). Seventy-seven percent of patients were enrolled in speech therapy, with 2 (22.2%) patients having velopharyngeal insufficiency.

Conclusion: To our knowledge, this is the first study in the United States to look at rates of submucous cleft palate in children with isolated CL and middle ear disease and/or ETD. While our rates of middle ear disease/ETD are lower than has been previously cited in the literature, the prevalence of submucous cleft palate in this population is not insignificant and suggests that the palatal exam should be revisited to rule out an occult submucous cleft in patients with isolated CL and middle ear disease and/or ETD.

Primary Presenter: Lauren Arguinchona

Project Title: *SARS-CoV-2 Mediates TGF-beta Hijacking and Immune Dysregulation Through a Novel Gain of Function Mutation in its NSP15 Protein*

Primary Mentor: James Maloney

Thematic Area: Basic Biomedical Science

Abstract: **Rationale:** The coronavirus disease of 2019 (COVID-19) pandemic caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has killed millions. COVID-19 mortality remains high for those hospitalized with severe disease. The early immune suppression of SARS-CoV-2 and subsequent inflammation suggests its ability to cause host immune dysregulation is a key mechanism. Host Transforming Growth Factor  $\hat{I}^2$  (TGF- $\hat{I}^2$ ) is an immune-suppressing and profibrotic cytokine frequently exploited by microbes to evade immune detection. We discovered a KRFK amino acid domain in the SARS-CoV-2 nonstructural 15 (NSP15) protein, which is an activating motif for latent TGF- $\hat{I}^2$ , potentially explaining immune evasion features of SARS-CoV-2. We hypothesized that the SARS-CoV-2 NSP15 protein causes immune dysregulation by activation of latent TGF- $\hat{I}^2$  and subsequent activation of immunosuppressive T-regulatory (Treg) cells, and that substantial TGF- $\hat{I}^2$  is present in the lungs of COVID-19 acute respiratory distress syndrome (ARDS) patients.

**Methods:** We evaluated TGF- $\hat{I}^2$  concentrations in endotracheal aspirates (ETA) of 27 COVID-19 ARDS patients by Enzyme Linked Immunoassay (ELISA). We produced recombinant SARS-CoV-2 NSP15 protein in *E. coli* and tested its ability to activate latent TGF- $\hat{I}^2$  using in vitro

assays. TGF- $\hat{I}^2$  inhibitors were assessed for their ability to block any NSP15 effects. We obtained blood mononuclear cells from healthy subjects and isolated T regulatory cells (Tregs) to assess their activation via intracellular smad-2 phosphorylation (pSMAD2) with flow cytometry.

Results: High concentrations of both active and total TGF- $\hat{I}^2$  were detected in ETA of COVID-19 ARDS patients (150 +/- 34 pg/ml active; 1,819 +/- 304 pg/ml total); these free TGF- $\hat{I}^2$  concentrations were in a range previously shown to affect T cell function. NSP15 at 2.4 nM increased activation of latent TGF- $\hat{I}^2$  (0.5 nM) 12-fold (vs. vehicle) ( $p < .001$  vs. vehicle), compared to an 11% activation with the positive control thrombospondin-1 (TSP1; 10 nM).

TGF- $\hat{I}^2$  inhibitors blocked NSP15 effects on latent TGF- $\hat{I}^2$  activation and intracellular TGF- $\hat{I}^2$  signaling in a bioassay by over 95% ( $p < .01$ ). At tested concentrations (25, 50, 100 nM) NSP15 increased Treg pSMAD2 levels via activation of 2 nM latent TGF- $\hat{I}^2$ , exceeding levels seen in Tregs stimulated with 400 pM of active TGF- $\hat{I}^2$  (positive control) (pSMAD2 + cells: vehicle 1.1%, active TGF- $\hat{I}^2$  43%, NSP15/latent TGF- $\hat{I}^2$  49-56%).

Conclusions: High concentrations of active and total TGF- $\hat{I}^2$  are present in the ETA of COVID-19 ARDS patients, suggesting SARS-CoV-2 uses host TGF- $\hat{I}^2$  hijacking as a mechanism for immune evasion. The NSP15 protein of SARS-CoV-2 potently activates latent TGF- $\hat{I}^2$  in vitro, leading to Treg activation as one mechanism of immune suppression and host evasion in early COVID-19 infection, while immune dysregulation and increased TGF- $\hat{I}^2$  airway levels may

contribute to later fibroproliferative stages of ARDS. Current TGF- $\hat{I}^2$  inhibitors are potent inhibitors of NSP15 effects. A strategy to block NSP15-mediated effects with TGF- $\hat{I}^2$  inhibitors is an innovative therapy worthy of testing in COVID-19 prevention and treatment trials.

Primary Presenter: Abby Thorne

Project Title: *Clinical Utility of Repeat Magnetic Resonance Imaging Studies Among Children with Acute Hematogenous Osteomyelitis*

Primary Mentor: Justin Searns

Thematic Area: Clinical Science

Abstract: Abstract

Background and Objectives: There is limited guidance for whether repeat magnetic resonance imaging (MRI) studies are clinically impactful among children with acute hematogenous osteomyelitis (AHO) who fail to improve as expected. This study aimed to determine whether repeat MRIs changed management among children with AHO and identify clinical characteristics predictive of which patients benefit from repeat MRIs.

Methods: Children admitted to a quaternary care pediatric hospital with AHO were identified during a 9-year period. Patients with chronic symptoms, non-hematogenous infections, or significant contributing comorbidities were excluded. Medical records were retrospectively reviewed for all MRIs performed 3 weeks prior to admission to 24 months after discharge. An MRI was considered clinically impactful if it identified a new infectious process (e.g., abscess not seen on initial MRI) or if it resulted in surgical intervention within 24 hours. Bivariable comparisons of categorical variables were performed, and multivariable logistic regression was used to assess the clinical factors of impactful repeat MRIs.

Results: Among 239 included patients, 41 (17%) had more than 1 MRI performed during their clinical course, the majority of whom (53.7%) had a repeat MRI that impacted care. Patients who underwent repeat MRIs had longer hospitalizations (7 vs 5 days,  $P < 0.01$ ), were more likely to have C-reactive protein (CRP) levels  $> 20\text{mg/dL}$  (41% vs 10%,  $P < 0.01$ ), and were more likely to have delayed transition to oral antimicrobials (8.4 vs 3.3 days,  $P < 0.01$ ). Peak CRP  $> 20\text{mg/dL}$  and prolonged bacteremia were found to be associated with increased odds of having an impactful repeat MRI with adjusted odds ratios of 3.9 ( $P = 0.007$ ) and 3.4 ( $P = 0.03$ ) respectively.

Conclusions: When used judiciously among ill children with complicated AHO, repeat MRI can be clinically impactful. Prospective studies are needed to better define which children with AHO benefit from repeat MRI.

Level of Evidence: This is a retrospective cohort study interested in determining the clinical utility of repeat magnetic resonance imaging studies for children with osteomyelitis. This study meets criteria for Level II evidence.



Primary Presenter: Marie Stewart

Project Title: *COMMUNITY VOICES: DOCUMENTARY EDUCATION ON RACIAL DISPARITIES IN INFANT AND MATERNAL HEALTHCARE*

Primary Mentor: Janet Meredith

Thematic Area: Public Health and Epidemiology

Abstract: Substantial disparities exist in Black infant and maternal mortality. Black birthing women are three to four times as likely to experience pregnancy-related morbidity or mortality compared to their white counterparts. Similarly, Black babies are 50% more likely than white babies to be born pre-term and twice as likely to have low birth weight or die in their first year of life. Despite growing knowledge of these disturbing disparities over the past few decades, little has changed in these rates over time. Additionally, racial disparities in infant and maternal mortality cannot be fully explained by individual factors such as income, education level, and environmental exposures, nor by structural factors like access to quality health care, health insurance coverage, food availability, and unemployment rates. The inability to fully explain these inconsistencies indicates that there is likely an implicit factor of healthcare that perpetuates these inequalities - institutional racism and personal racism, often due to unconscious biases. Anti-racist education is needed to help illuminate the role of racism in infant and maternal health outcomes and promote meaningful change.

This intervention evaluates the effectiveness of a documentary film, *Community Voices*, and a group debrief in educating healthcare workers about infant and maternal mortality disparities.

The film contains women's stories of racism and mistreatment in gynecologic and obstetric settings. The following debrief discusses the participant's understanding of the disparities, opportunities for advocacy, and incorporating solutions into the participant's practices.

Primary Presenter: Austin Almand

Project Title: *A Qualitative Investigation of Space Exploration Medical Evacuation Risks*

Primary Mentor: Benjamin Easter

Thematic Area: Global Health

Abstract: INTRODUCTION: Exploration beyond low Earth orbit requires innovative solutions

to support the crew medically, especially as the

opportunity for timely evacuation to Earth diminishes. This includes assessing the risks and

benefits that a complicated

medical evacuation (MEDEVAC ) poses to the injured crewmember, the crew, and the mission.

This qualitative study

identifies common MEDEVAC risk assessment principles used in spaceflight and other extreme

environments to better

inform future risk assessment tools and exploration mission concepts.

METHODS: Semistructured interviews were conducted with subject matter experts in

spaceflight and analog domains, including

polar operations, undersea operations, combat medicine, and mountaineering. Transcripts were

analyzed using the

qualitative method of Thematic Analysis with the technique of consensus, co-occurrence, and comparison.

RESULTS: Subject matter experts described 18 themes divided into two main categories:

Primary Risk Considerations (e.g., crew,

mission, resources, time) and Contributing Factors (e.g., psychological considerations, medical preparation, politics).

DISCUSSION: Primary Risk Considerations can assess MEDEVAC risk across mission phases, with Contributing Factors acting as

premission tools to adjust those risks. Inter- and intracategory connections identified medical support considerations,

MEDEVAC support considerations, and philosophy as the most impactful Contributing Factors.

Medical support

considerations, psychological considerations, and political considerations were found to have unique aspects given

the distances and societal impact of exploration vs. low Earth orbit spaceflight. The Contributing

Factor theme of

decision making was determined to be unique due to its impacts across both categories. These findings expand current considerations and are important inputs for exploration mission MEDEVAC Concepts of Operations.

Primary Presenter: Madelyn Mendlen

Project Title: *Investigating Wellness and Burnout Initiatives for Medical Trainees -- The Gratitude Journal Mobile Application*

Primary Mentor: Steven Lowenstein

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract: KEY POINTS

Burnout affects residents and practicing physicians across most specialties, and it is especially widespread in emergency medicine, critical care, and anesthesiology.

Physicians and residents who have burnout are more likely to be involved in medical errors and suffer lapses in professionalism, which may undermine the medical teamwork dynamic and patient safety.

Although data from qualitative studies and randomized trials are limited, the available evidence suggests that interventions to reduce burnout and promote resident wellness are most successful when they are led or co-led by residents, and when they have buy-in from both administration and resident leaders.

Individuals who journal about gratitude report higher positive states of alertness, enthusiasm, determination, attentiveness, and energy compared with individuals who focus on hassles or a downward social comparison.

Primary Presenter: Alexandra Verosky

Project Title: *Patient comprehension of breast pathology report terminology: The need for patient-centered resources*

Primary Mentor: Sarah Tevis

Thematic Area: Clinical Science

Abstract:

Background:As health care continues to evolve toward information transparency, an increasing number of patients have access to their medical records, including result reports that were not originally designed to be patient-facing. Previous studies have demonstrated that patients have poor understanding of medical terminology. However, patient comprehension of terminology specific to breast pathology reports has not been well studied. We assessed patient understanding of common medical terms found in breast pathology reports.

Methods:A survey was administered electronically to patients scheduled for a screening mammogram within a multisite health care system. Participants were asked to objectively define and interpret 8 medical terms common to breast biopsy pathology reports. Patient perception of the utility of various educational tools was also assessed. Demographic information including health literacy, education level, previous cancer diagnosis, and primary language was collected.

Results:In total, 527 patients completed the survey. Terms including "malignant" and "benign" were the most correctly defined at 80% and 73%, respectively, whereas only 1% correctly

defined "high grade." Factors including race/ethnicity and education level were correlated with more correct scores. Patients preferred educational tools that were specific to their diagnosis and available at the time they were reviewing their results.

Conclusion: Patient comprehension of common medical terminology is poor. Potential assumptions of understanding based on patient factors including education, past medical history, and occupation are misinformed. With the newly mandated immediate release of information to patients, there is a pressing need to develop and integrate educational tools to support patients through all aspects of their care.



Primary Presenter: Ashlyn Richie

Project Title: *IMAGINE: A Trial of Messaging Strategies for Social Needs Screening and Referral*

Primary Mentor: Andrea Nederveld

Thematic Area: Public Health and Epidemiology

Abstract: Abstract:

Introduction: Health-related social needs are associated with poor health outcomes. Many primary care practices now screen and refer patients with health-related social needs to assistance organizations, but some patients decline screening or assistance. Improving communication about health-related social needs screening and referral could increase screening response and assistance acceptance rates.

Study Design: This is a pragmatic, nonrandomized 3-stage trial of messages and communication strategies for health-related social needs screening and referral. Messages and strategies were informed by qualitative analysis of stakeholder interviews and were developed through an iterative, patient-, and stakeholder-engaged process.

Setting/Participants: Settings included 3 primary care clinics serving primarily low-income patients in western Colorado. Intervention: Stage 1 includes usual clinic processes for health-related social needs screening (form given to patients at the front desk without additional explanation), Stage 2 includes adding written patient-friendly messages regarding the purpose of

health-related social needs screening and referral to usual clinic processes, and Stage 3 includes adding verbal messages delivered by a medical assistant (form given to patients by a medical assistant during the rooming process).

Main Outcome Measures: Primary outcomes include (1) screening form response rate and (2) acceptance of referral for assistance rate among patients with health-related social needs.

Secondary outcomes include (1) comfort with screening, (2) perceived helpfulness of screening, and (3) receipt of explanation about screening.

Results: All data collection and analysis occurred in 2021. Study Stage 2 was not associated with significant changes in any outcomes. Stage 3 was associated with decreased odds of screening form response at 2 of the 3 clinics relative to those of Stage 1 (OR=0.1, 95% CI=0.1, 0.3; OR=0.4, 95% CI=0.2, 0.7) but with increased odds of assistance acceptance (OR=2.1, 95% CI=1.1, 4.0) among patients with needs who responded to the screening form. Stage 3 was also associated with higher odds of patients perceiving screening as helpful and receiving an explanation about screening.

Conclusions: Altering practice workflows to provide verbal explanations of health-related social needs screening may reduce response rates but may encourage responders to accept assistance.

Primary Presenter: Rebecca Henkind

Project Title: *Left Out in the Cold: Homicide Among Persons Experiencing Homelessness*

Primary Mentor: Catherine Velopulos

Thematic Area: Public Health and Epidemiology

Abstract: Background: There is no American population-level study comparing the

characteristics of homicides involving

victims who were vs were not experiencing homelessness at time of death. We aim to identify

variables surrounding homeless homicide that are unique, and intervenable.

Methods: In this retrospective cohort study, we reviewed the National Violent Death Reporting

System (NVDRS)

from 2003 to 2018 and compared the characteristics surrounding homicides of victims who were

not-homeless

(cohort 1) vs experiencing homelessness (cohort 2) at death. We utilized the available perpetrator

data to

characterize the average perpetrator for each cohort. We considered housing status to be our

primary predictor

and recorded NVDRS variables, such as age of victims and likelihood to know perpetrators, to

be our primary

outcomes.

Results: 81,212 Homicide Victims and 60,982 Homicide Perpetrators were included in analysis.

Homeless cohort

victims were more likely younger, White, male, and to have a known mental health or substance abuse disorder.

PEH were also more likely to have co-morbid mental health and substance abuse disorders but were roughly half

as likely to be getting treatment for said disorders. Circumstances surrounding incidents,

including geographic

location, mechanism of injury, and premeditation, varied; homeless cohort victims were more likely to die in

random acts of violence, but were less likely to die via firearm.

Conclusions: There is room for targeted interventions against homeless homicides.

Level of evidence: Epidemiological, Level IV

Primary Presenter: Adom Netsanet

Project Title: *Antenatal Betamethasone Improves Lung Structure and Function, Prevents Pulmonary Hypertension, and Promotes Placental Pro-Angiogenic Signaling in an Animal Model of Chorioamnionitis-Induced Bronchopulmonary Dysplasia*

Primary Mentor: Steven Abman

Thematic Area: Basic Biomedical Science

Abstract: Premature birth in the setting of antenatal inflammation predisposes infants to underdeveloped lungs with suboptimal function. Insults to the developing pulmonary structures from antenatal inflammation impede lung function both acutely following birth and chronically, leading to bronchopulmonary dysplasia (BPD), the chronic lung disease associated with preterm birth. Despite the widespread introduction of antenatal steroids, which reduce mortality, hasten lung development, and improve outcomes for preterm infants at risk for BPD, the prevalence of BPD has not changed in the last two decades. Furthermore, the role of the placenta as an indirect modulator of pulmonary development is a burgeoning and promising area of research to help elucidate mechanisms of lung injury in the setting of antenatal inflammation. This study will focus on understanding both the direct mechanisms in the lung and the indirect mechanisms in the placental-pulmonary niche that may be implicated in lung injury following antenatal inflammation and subsequent fortification with antenatal steroid treatment. We use a well-studied model of chorioamnionitis (CA)-induced BPD where antenatal inflammation is induced with intraamniotic (IA) endotoxin (ETX) in rats.



Primary Presenter: Gavin Chiem

Project Title: *Effect of Femoral Nerve Stimulation on Patellar Redislocation Rates After Tibial Tubercle Osteotomy in Pediatric Patients*

Primary Mentor: Jay Albright

Thematic Area: Clinical Science

Abstract: Abstract

Objective: Tibial tubercle osteotomy (TTO) is a surgical procedure that involves medial translation of the tibial tubercle to correct malalignment of the patella in patients with patellar instability. Determining the appropriate amount of translation is difficult because the anesthetized patient cannot produce the dynamic forces involved in patellofemoral tracking. Femoral nerve stimulation (FNS) is a technique that can be used intra-operatively to stimulate the quadriceps muscle and assess tracking of the patella to determine the distance needed for translation. This study aims to elucidate the differences in patellar dislocation rates after TTO in pediatric patients who received FNS versus those who did not.

Methods: This was a retrospective case series review that included patients aged 7-18 diagnosed with patellar instability who underwent a TTO at Children's Hospital Colorado locations by two orthopaedic surgeons from 1/2010-12/2019. Charts were reviewed for height, weight, BMI, surgical intervention(s), types of anesthesia used, pre- and post-operative clinical exam data, and patient-reported episodes of instability. Patients were divided into two cohorts, those who

received FNS and those who did not. Post-operative recurrence of instability using patient data and clinical exam data were compared between these two groups.

Results: A total of 26 pediatric patients met our inclusion criteria with 37 unique knees operated on. The average patient age at the time of surgery was 15.85 years old. Thirty-two of the patients were female (74.4%). Of the 37 knees, twenty-six received intraoperative FNS. Average BMI of those who received FNS was 25.6, while those who did not was 30.1 ( $p=0.08$ ). Of those who received FNS, 5 unique post-operative instability events were reported compared to 1 instability event in those who did not receive FNS ( $p=0.65$ ). Overall translation in the FNS group was 12.1 mm compared to 10.7 mm in the no FNS group ( $p=0.16$ ).

Conclusion: There was no significant difference in dislocation rates between patients who received FNS compared to patients who did not receive FNS.



Primary Presenter: Nicholas Girardi

Project Title: *During Postless Hip Arthroscopy, Male Patients, High Body Mass Index, Low Beighton Scores, and Limited Range of Motion Require High Traction Force*

Primary Mentor: Omer Mei-Dan

Thematic Area: Clinical Science

Abstract: Abstract

### Purpose

To determine the effects of demographic and anatomic factors on traction force required during postless hip arthroscopy.

### Methods

A prospectively collected database was retrospectively analyzed on patients undergoing hip arthroscopy by the senior author, including patient sex, age, body mass index (BMI), Beighton Hypermobility Score (BHS), hip range of motion (ROM) in clinic and under anesthesia, hip dysplasia, acetabular version, and femoral version. All patients underwent postless hip arthroscopy under general anesthesia. At the initiation of hip arthroscopy, the traction force required to distract the hip joint was measured prior to and following inter-portal capsulotomy. Multiple regression analysis was performed to determine the effects of demographic and anatomic factors on measured distraction force.

### Results

In total, 352 hips (114 male, 238 female) were included with a mean age of 32.6 years and a mean BMI of 24.1 kg/m<sup>2</sup>. Mean initial traction force was 109 lbs and decreased to 94.3 lbs following capsulotomy ( $p < 0.0001$ ). The starting traction force was significantly higher in males ( $p < 0.001$ ), patients with a lack of hypermobility (BHS score of 0-2) ( $p = 0.026$ ), and in patients with lower abduction ( $p < 0.001$ ), lower internal rotation ( $p = 0.002$ ), and lower external rotation ( $p = 0.012$ ) on multiple regression analysis. When performing a sub-analysis divided by sex, male patients with elevated BMI required significantly higher starting traction force ( $p = 0.014$ ). Lateral center edge angle, sourcil angle, and the presence of hip dysplasia did not demonstrate a significant correlation with traction force.

#### Conclusion

Males, patients with reduced preoperative hip ROM, patients with a lack of joint hypermobility, and males with an elevated BMI require higher initial traction force during postless hip arthroscopy.

Level of Evidence: IV, retrospective case series

Primary Presenter: Nisha Batta

Project Title: *Implementation of Extreme Risk Protection Orders in Colorado from 2020-2022: Firearm Relinquishment and Return and Petitioner characteristics*

Primary Mentor: Marian (Emmy)/ Chris/ Leslie Betz/ Knoepke/ Barnard

Thematic Area: Public Health and Epidemiology

Abstract: Introduction: Firearm injury and death remains a strong public health concern, with nearly 50,000 firearm-related deaths in the United States (US) in 2021. Extreme Risk Protection Orders (ERPOs) are civil restraining orders that intend to reduce firearm deaths by temporarily removing firearms from individuals who are threatening violence to themselves or others. The present study aims to evaluate firearm relinquishment and petitioner characteristics among ERPOs filed and granted in Colorado.

Methods: All ERPO petitions filed in Colorado (1/1/2020-12/31/2022) were analyzed using an established abstraction tool and standardized team-based approach. Case data abstracted from petitions and court documents were analyzed descriptively.

Results: Over three years, there were 353 ERPO petitions filed in Colorado. Only 39% percent of granted petitions had documentation of firearms being relinquished. The average number firearms relinquished was 1.8 with a range of 1 to 31 firearms. One third (37.7%) of petitions mentioned a mental health issue, 10% had a renewal request, and half (54.6%) of petitions were

filed by law enforcement (LE). LE petitions filed were more likely to be granted temporary ERPOs (94.3% vs. 35.0%,  $p < .0001$ ) and full year ERPOs (79.7% vs. 39.3%,  $p < .0001$ ).

Conclusion: Results from these analyses shed light on data gaps surrounding ERPO use and implementation. Differences in LE versus non-LE ERPO outcomes suggest a need for additional research and training/education among the public. ERPOs' efficacy hinges on removing firearms from those at risk. A lack of documentation on this limits the ability to evaluate ERPOs and their efficacy. This suggests a need to standardize the process for reporting and collecting petitions to ensure ERPO utilization and impact can be properly evaluated. Keywords: Firearm, Injury, Extreme Risk Protection Order

Primary Presenter: Vivian Lu

Project Title: *Risk factors and outcomes of delayed presentation of diabetic retinopathy patients to a county hospital*

Primary Mentor: Niranjana Manoharan

Thematic Area: Clinical Science

Abstract: Purpose: To identify risk factors and outcomes of treatment-naïve patients presenting to a county hospital with delayed presentation of diabetic retinopathy (DR).

Methods: Retrospective record review.

Results: The study comprised 562 diabetic patients who had never received DR treatment who presented for the first time to the eye clinic at Denver Health (Denver, CO). Patients presenting with advanced DR had worse visual acuities at initial and final visits ( $p < 0.0001$ ) and a significant proportion underwent ophthalmic treatment. Risk factors for delayed presentation including Spanish as a primary language ( $p = 0.007$ ), lack of PCP ( $p = 0.0002$ ), kidney disease ( $p = 0.002$ ), and insurance status ( $p = 0.001$ ). Proliferative diabetic retinopathy at presentation was associated with lack of insurance (19.2%) at approximately twice the rate of the no DR and early DR groups ( $p = 0.001$ ).

Conclusions: Risk factors associated with late presentation were lack of insurance, Spanish as a primary language, and lack of PCP. Patients presenting at initial visit with advanced DR had worse visual outcomes and greater need for treatment.



Primary Presenter: Jordan Stellern

Project Title: *Emotion Regulation Across Psychiatric Conditions*

Primary Mentor: Joshua Gowin

Thematic Area: Clinical Science

Abstract: The ability to regulate emotions effectively has been associated with resilience to psychopathology. Emotion regulation difficulties have been proposed as a component of clinical disorders and are a primary target of a form of psychotherapy known as dialectical behavior therapy (DBT). Poor emotion regulation has been associated with specific psychiatric disorders, however, to date, no study has attempted to estimate the magnitude of the difference in emotion regulation capacity between individuals with different psychiatric disorders and healthy controls by reviewing the existing literature. In this review we are examining cross-sectional studies that compare a diagnosed psychiatric group to a healthy control group using validated and commonly used self-report emotion regulation (ER) measures (ex. DERS, ERQ, ERSQ, CERQ). The primary measure used for the meta-analysis will be mean difference in total ER scores as well as the standardized mean difference to estimate the effect size (Hedge<sup>g</sup>) for total scores.

Primary Presenter: Jeffrey Wong

Project Title: *University of Colorado SOM Diversity Documentary: A Cohort of Resilience*

Primary Mentor: Shanta Zimmer

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract: Background:

The percentages of matriculating underrepresented minority (URM) students are not meeting the demand for a diverse physician workforce. Several solutions have been proposed, including pipeline programs to inspire the next generation at earlier stages of development. Few have created documentaries following the journeys of URM students from start to finish of medical school.

Description:

This is a 4-person team of medical students: one technology expert and three interviewers. The cohort includes the only two Black men in the class of 2024, a Colorado native Latinx woman, a student with cerebral palsy, a Black mother, a Korean American veteran of the U.S. Army, a daughter of Vietnamese refugees with a schizophrenic sister, a gay Muslim man, and a student of color from rural America. Most come from low-income backgrounds and are the first to attend college/graduate school. Each student and interviewer are paired for 4 years. Interviews are conducted in-person, on Zoom during COVID, and on campus post-COVID.

Outcomes:



- 1.) Foster a sense of community amongst the cohort.
- 2.) Raise awareness about real issues in medical school, such as mental health, inclusion, and lack of diversity in healthcare leadership.
- 3.) Showcase the film to aspiring medical students from URM backgrounds.

Conclusions:

Emerging themes from our project include

- \* Imposter syndrome
- \* Trauma (refugee status, veterans, racism, poverty)
- \* Classism
- \* Using the documentary to build community (especially amongst a medical school class that started in a pandemic)
- \* Implicit bias in patient care

Primary Presenter: Brian Carter

Project Title: *Mucosal Ulceration in Gastrointestinal Stromal Tumor is an Independent Predictor of Progression-Free Survival*

Primary Mentor: Martin McCarter

Thematic Area: Clinical Science

Abstract: -----

Abstract

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**Introduction:** Gastrointestinal stromal tumors (GISTs) are the most common mesenchymal tumors of the gastrointestinal (GI) tract. Known prognostic features of GISTs include tumor mitotic rate, size, and location, yet one common feature of primary GISTs for which prognostic significance is unknown, is mucosal ulceration. This study aims to investigate the significance of mucosal ulceration in GISTs.

**Materials and methods:** A retrospective study was conducted of 513 patients at a tertiary referral center with a suspected or documented diagnosis of primary GIST between the years of 2000 and 2020. Ulceration was confirmed by definitive documentation in the endoscopic or histopathologic report. The significance of ulceration in GIST was compared to other prognostic factors.

Results:Of the 513 patients reviewed, 310 primary GIST patients with known ulceration and disease status were identified. Of those, 27.4% (n = 85) demonstrated mucosal ulceration.

Mucosal ulceration in GISTs is associated with GI bleeding, mitotic rate, tumor size, and exon 11 mutations. After a median follow-up of 35.4 (interquartile range = 17.1-62.2) mo, patients with ulcerated GISTs experienced higher rates of tumor progression (40.0% versus 14.2%,  $P < 0.0001$ ). In multivariate analysis, ulceration of GISTs was highly associated with disease progression ( $P < 0.0001$ ) and progression-free survival (hazard ratio = 2.4 [1.2-4.7],  $P = 0.01$ ).

Conclusions:Mucosal ulceration in GISTs is associated with GI bleeding, mitotic rate, tumor size, and exon 11 mutations. Overall, ulceration in GISTs is associated with elevated risk of tumor progression and is an independent prognostic factor. In multivariate analysis, ulceration in GIST remains an independent risk factor for disease progression.

Primary Presenter: Alec McCranie

Project Title: *Exploration of Patient Retention in Seeking a Second Opinion*

Primary Mentor: Sarah Tevis

Thematic Area: Clinical Science

Abstract: Introduction:

It is common for cancer patients to seek a second opinion for a variety of reasons. Understanding what drives patients to choose to receive treatment with their second opinion provider may uncover opportunities to improve the second opinion process. Therefore, we sought to identify the patient, disease, and treatment characteristics that were associated with second opinion retention rates in patients seeking a second surgical opinion for breast, colon, and pancreatic cancer.

Methods:

We conducted a retrospective cohort study to evaluate patients who sought a second opinion within a large, academic healthcare system for breast, colon, and pancreatic cancer. Electronic medical records were reviewed for second opinions. Patient demographics and characteristics were collected and compared between the retained group and the non-retained groups.

Results:

A total of 237 patients obtained second opinions for breast, colorectal, and pancreatic cancer.

Patients that were offered a different treatment plan at their second opinion were more likely to be retained for systemic therapy ( $P=0.009$ ) for pancreatic cancer and any treatment for colon cancer ( $P=0.003$ ). Seeing a radiation oncologist ( $P=0.007$ ) or a plastic surgeon ( $P=0.02$ ) during the multidisciplinary consultation increased retention rates for breast cancer.

Conclusion:

Surgeons can better identify patients that are more likely to be retained after a second opinion by the individual patient characteristics and treatment factors. Understanding the factors that lead to retention for these three cancer types may help physicians provide the best possible resources for most patients presenting for second opinion evaluations.

Primary Presenter: Cian O'Sullivan

Project Title: *Identifying Factors Underlying Readmission via Retrospective Chart Review*

Primary Mentor: Maria Klimenko

Thematic Area: Clinical Science

Abstract: Introduction: Preventing hospital readmissions has become an increasingly popular topic, as readmissions are now a metric of quality care and have an impact on reimbursement.<sup>1</sup> They are also associated with adverse outcomes as well as increased costs to both patients and hospital systems.<sup>2-3</sup> There have been numerous attempts to prevent readmissions with studies failing to show a single strategy to be superior.<sup>4</sup> The purpose of this study was to perform a retrospective chart review of readmitted patients at the University of Colorado Hospital to better characterize factors underlying readmissions and guide future interventions.

Methods: A retrospective chart review of 48-hour readmissions during June and July 2022 was carried out by two researchers independently. A total of 30 initial encounters and their corresponding readmissions were reviewed and subsequently analyzed.

Results: Our retrospective chart review revealed that there was a variety of conditions and complications leading to readmission, with infections (33%) and shortness of breath (20%) being the most common diagnoses during the initial admission. Additionally, 10 of the 30 patients (33%) in our readmission data set were advised to remain hospitalized at discharge of their initial admission by the primary team.

Conclusions: Future interventions to prevent readmissions could be targeted toward patients admitted with a primary diagnosis of infection/sepsis or shortness of breath for the greatest impact. We propose that the most effective intervention for this hospital system would be able to address a multitude of conditions and complications, such as post-discharge phone calls. Future interventions could also aim to improve against medical advice (AMA) discussions between providers and patients.

Primary Presenter: Micah Pascual

Project Title: *Dermatology Access and Needs of American Indian and Alaska Native People*

Primary Mentor: Lucinda Kohn

Thematic Area: Public Health and Epidemiology

Abstract: Background. American Indians and Alaska Native people experience significant barriers to accessing dermatology care related to social determinants of health, including lower education, economic instability, and disadvantages associated with neighborhoods and the built environment. There is a paucity of knowledge regarding the prevalence of skin disease in this population, and their ability to access skin care from dermatologists.

Objectives. To describe skin disease prevalence, barriers to healthcare, and telehealth preferences regarding dermatological care among American Indians and Alaska Natives.

Methods. Data were collected via self-report surveys administered in person at two community powwows in Denver, Colorado in 2021 and 2022.

Results. Most American Indian and/or Alaska Native respondents (94.5%, n=225) reported at least one skin disease. The top three active skin diseases among adolescents were acne, scarring, and eczema. The top three among adults were dry skin, hair loss, and acne. Only 20.9% (n=47) of respondents with skin disease saw a dermatologist. Approximately one-third of respondents (34.0%, n=81) were open to engaging with teledermatology in their home; 43.3% (n=103) were



open to engaging with teledermatology in their local clinic; 42.0% (n=100) were not interested in engaging teledermatology from their home or in their local clinic.

Conclusions. Skin disease is prevalent and access to dermatologic care is poor among American Indian and Alaska Native people.

Primary Presenter: Gabrielle Montalbano

Project Title: *Positive Toxoplasma IgG Serology Is Associated with Increased Overall Mortality - A Propensity Score-Matched Analysis*

Primary Mentor: Andres Henao Martinez

Thematic Area: Clinical Science

Abstract: *Toxoplasma gondii* is a prevalent parasitic disease with significant morbidity and mortality in immunocompromised populations. We lack long-term outcomes for latent infections. We aimed to elucidate the relationship between latent *T. gondii* infection and mortality risk. We queried TriNetX, an international multicenter network, to validate mortality risk differences among patients with positive or negative toxoplasma IgG through propensity score matching (PSM). We excluded patients with toxoplasmosis disease by International Classification of Diseases codes or polymerase chain reaction testing. We found 28,138 patients with available toxoplasma IgG serology. Seropositive patients were older and had a male preponderance. More seropositive patients identified as Hispanic, Latino, or Black persons. Patients who were positive for *T. gondii* IgG serology were slightly more likely to have underlying heart failure, a transplanted organ or tissue, malignant neoplasms of lymphoid or hematopoietic tissues, and diseases of the nervous system than seronegative controls. After PSM of patients with positive (N = 6,475) and negative (N = 6,475) toxoplasma IgG serologies, toxoplasmosis-positive patients were more likely to have long-term drug use but less likely to suffer from behavioral disorders. The overall PSM 1- and 5-year mortality was higher among

patients with a positive toxoplasma IgG serology. The risk of schizophrenia was increased at 5 years. We found a prevalence of toxoplasma IgG positivity of 0.03% during the last 3 years.

Latent *T. gondii* associates with a higher overall mortality risk. The study of social determinants of health and follow-up studies are necessary to corroborate the findings and find possible causal mechanisms.

Primary Presenter: Arman Saeedi

Project Title: *Comparison of Handheld Ultrasound Devices used in Carotid and Abdominal Aortic Vascular Studies*

Primary Mentor: Juliana Wilson

Thematic Area: Clinical Science

Abstract: Introduction: Point-of-Care Ultrasound (POCUS) has become common in many clinical care settings. Many devices exist with several different, mostly overlapping functions. This study is one of the first studies to compare the image quality of commercially available handheld POCUS devices.

Methods: A prospective study was conducted to evaluate the image quality and clinical utility of the Butterfly IQ, GE Vscan Air,  $\phi$ , Phillips L12-4 (Linear), and Phillips S4-1 (Phased array) devices. An expert panel of reviewers examined the compiled images and answered a survey-based questionnaire. Repeated measures ANOVA will be used to compare scores.

Results: Twenty-five participants met the inclusion criteria and 122 scans were studied. Most participants were female (52%). Mean BMI was  $23.70 \pm 3.71$ . When scored on a 0-10 Likert scale, examinations performed with the GE Vscan Air,  $\phi$  resulted in comparatively higher quality studies for both the carotid (5.24,  $p = 0.03$ ) and aortic (4.91,  $p = 0.04$ ) protocols when compared to the Butterfly IQ+ and Lumify devices. All three devices scored favorably for educational value with no statistical preference for transducer,  $\chi^2(df = 2, N = 122) = 4.75, p = 0.09$ .

Conclusion: Although the GE Vscan Air,, $\phi$  resulted in statistically significant and higher recommendation scores, all three device groups globally scored low on recommendability. While lacking statistical significance between transducers, reviewers did support use of the tested handheld devices for educational purposes. Despite the variety of commercial POCUS options, additional peer-reviewed data comparing these devices is needed.

Primary Presenter: Courtney Olson

Project Title: *The Impact of Nutrition Classes at Urban Peak on the Nutritional Status and Dietary Patterns of Unhoused Youth*

Primary Mentor: Janet Meredith

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract: **Background:** Unhoused youth are a highly underserved community facing nutritional vulnerability due to food insecurity, lack of nutritional knowledge, and inadequate intake.

Studies have previously investigated the nutritional deficiencies and the associated health implications of malnourishment impacting unhoused youth. However, few teams have explored the impact of nutritional education on the dietary patterns of unhoused youth.

**Objective:** This project aimed to implement nutrition classes at Urban Peak, an unhoused youth shelter in Denver for clients ranging in age from 15 €“ 20, to evaluate the impact of education on the dietary patterns and nutritional status of this population.

**Methods:** Using ideas generated by the youth clients and Urban Peak staff, the project rotated through eight weekly lesson plans focused on nutritional education. Before each lesson, the youth completed a pre-survey to assess their current knowledge and dietary behaviors concerning the topic. After each lesson, they completed a post-survey to evaluate for understanding and impact. Approximately one month later, the youth completed an additional post-survey to assess for information retention and dietary changes. The surveys were utilized to determine if nutrition classes improve the nutritional knowledge and dietary patterns of unhoused youth.

Conclusions: Following the implementation of the curriculum at Urban Peak, it was evident that the youth have a strong foundational knowledge of nutrition and retained information from the lessons in the short-term indicating the curriculum's beneficial impact. However, given the complexity of working with unhoused populations, the long-term efficacy of the curriculum on the dietary patterns and nutritional status of the youth could not be evaluated and remains an important area for future investigation. Based on feedback provided by the youth, the design of the curriculum was modified to emphasize small-group discussion and mentorship to better support the relationship-building between the medical student participants and the youth clients. With Urban Peak established as a sustainable service-learning site through the University of Colorado School of Medicine, there are many future directions for the project to take to further support the shifting needs of the youth, investigate the long-term impact of nutritional education, and better address the nutritional disparities this population faces.

Primary Presenter: William Herold

Project Title: *Adolescent Trust in Sex Education*

Primary Mentor: Amanda Bogart

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract: Purpose: Sex education in adolescents covers an ever-increasing array of topics and is ideally given through medically accurate information from multiple sources to achieve the evidence-based comprehensive model, including healthcare providers, school-based educators, parents/guardians, and peers. Over the past decade, there has been a significant reduction in adolescents' receipt of formal sex education despite increases in federal funding. While it is speculated that adolescents may have turned to non-formal sources for sexual and reproductive health information, it is unknown which sources they perceive are the most accurate and trustworthy.

Methods: A cross-sectional survey amongst adolescents aged 12-19 years old was conducted between March - July 2022. A likert-type scale was used to assess the perception of accuracy and trustworthiness in both formal and non-formal sources of sexual and reproductive health information. Additionally, we assessed whether there was a difference in the trustworthiness of information sought out vs. given to them by each source.

Results: A total of 105 adolescents participated in this study. Middle adolescents (age 15-17) were more likely to perceive the internet or their social media as a trustworthy source for



information on sexually transmitted infections than early or late-aged adolescents (28.6% vs. 59.1% vs. 34.6%;  $P=0.038$ ). Adolescents who identified as queer were less likely than participants who identified as heterosexual to perceive information regarding sexual and reproductive health and sexual identity/orientation from their parent(s)/guardian as trustworthy (72.2% vs. 91.2%;  $P=0.015$ , 48.6% vs. 69.8%;  $P=0.045$ , respectively). Also, participants who noted they had a parent born outside of the United States were more likely to perceive information regarding sexually transmitted infections from the internet and their social media as trustworthy and less likely from their parent(s)/guardian (56.8% vs. 30.8%;  $P=0.014$ , 66.7% vs. 86.8%;  $P=0.023$ , respectively).

Conclusions: While formal sources (healthcare providers, schoolbased educators) of sex education were perceived as medically accurate and trustworthy, focus on including medically accurate information from the internet or social media alongside education and inclusion of parent(s)/guardians may help adolescents receive medically accurate information from trustworthy sources.

Sources of Support: Children's Hospital Colorado Department of Adolescent Medicine.

Primary Presenter: Nikita Deng

Project Title: *Re-examining the Pre-medical Years as an Integral Part of Professional Identity Formation: A Narrative Literature Review*

Primary Mentor: Anjali Dhurandhar

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract: RE-EXAMINING THE PREMEDICAL YEARS AS A CRUCIAL PERIOD FOR PROFESSIONAL IDENTITY FORMATION (PIF)

Nikita Deng<sup>[[1]]</sup> (#\_ftn1) (MD., SOM), Anjali Dhurandar<sup>[[2]]</sup> (#\_ftn2) (MD, FACP)

Background: It has been well established that there is a decrease in empathy in medical students during their clinical years of medical school. The skills that help prevent empathy decline such as reflection are not adequately developed or addressed during medical school or during premedical years. Empathy development and preservation is part of a physician's Professional Identity Formation (PIF) which is affected by the messaging of both premedical and medical school years.

Objective/Hypothesis: Analyze the premedical and medical school curriculum regarding the development of skills that preserve empathy, and where there is room for improvement.

Methods: A comprehensive literature review was done via PubMed. A list of MeSH (Medical Subject Headings) terms were created in collaboration with a librarian to find articles of interest regarding graduate medical education, medical school, medical education, empathy, compassion,

reflection, medical curriculum, hidden curriculum, and other terms. In addition to the use of the MeSH terms on PubMed, certain key phrases were also used to search PubMed such as empathy decline, premedical burnout, hidden curriculum. Additionally, some papers were found via recommended articles and reference lists of other papers.

Conclusions: The premedical years remain a potential period to help students develop the skills necessary to develop and maintain clinical empathy. The premedical years are a crucial phase of a physician's Professional Identity Formation. Currently, the premedical years do little to develop humanistic medicine skills actively and intentionally such as reflection, mindfulness, and discussion-based learning, all of which are important for developing and maintaining empathy for physicians. The premedical years has a hidden curriculum that contains underlying messaging that values natural sciences and devalues the humanities and the humanistic aspect of medicine. In particular, the framing of a career in medicine through a checklist of grades, classes, research, and test scores does little to develop awareness of the humanistic skills necessary to PIF. Overall, we ought to treat the premedical years as equally important to PIF and look at the kind of preparation students receive to be humanistic physicians and the skills necessary be able to preserve their empathy through clinical training and practice.

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Primary Presenter: Michaele Francesco Corbisiero

Project Title: *Medicaid coverage and access to obstetrics and gynecology subspecialists: findings from a national mystery caller study in the United States*

Primary Mentor: Tyler Muffly

Thematic Area: Public Health and Epidemiology

Abstract: **BACKGROUND:** Previous research suggests that access to healthcare may influence the diagnosis and treatment of obstetrical and gynecologic pathologies. Audit studies, a single-blinded and patient-centered design, have been employed to measure access to care for health services. To date, no study has assessed the dimensions of access to obstetrics and gynecologic subspecialty care based on insurance type (Medicaid vs commercial). **OBJECTIVE:** This study aimed to evaluate the mean appointment wait time for a new patient visit to female pelvic medicine and reconstructive surgery, gynecologic oncology, maternal-fetal medicine, and reproductive endocrinology and infertility when presenting with Medicaid vs commercial insurance.

**STUDY DESIGN:** Each subspecialty medical society has a patient-facing physician directory of physicians across the United States. Of note, 800 unique physicians were randomly selected from the directories (200 per subspecialty). Of the 800 physicians, each physician was called twice.

The caller presented with Medicaid or, in a separate call, with Blue Cross Blue Shield. The order in which the calls were placed was randomized. The caller asked for the soonest appointment available for respective medical conditions based on subspecialty: stress urinary incontinence,

new-onset pelvic mass, preconceptional counseling after an autologous kidney transplant, and primary infertility.

RESULTS: From 800 physicians initially contacted, 477 responded to at least 1 call in 49 states plus the District of Columbia. The mean appointment wait time was 20.3 business days (standard deviation, 18.6). A significant difference was found in new patient appointment wait times by type of insurance, with 44% longer wait time for Medicaid (ratio, 1.44; 95% confidence interval, 1.34-1.54;  $P < .001$ ). When the interaction between insurance type and subspecialty was added to the model, it was also highly significant ( $P < .01$ ). More specifically, Medicaid patients in female pelvic medicine and reconstructive surgery had a longer wait time than commercially insured patients. Patients seeking care in maternal-fetal medicine had the least difference, but Medicaid-insured patient wait times were still longer than commercial-insured patient wait times.

CONCLUSION: Typically, a patient can expect to wait 20.3 days for a new patient appointment with a board-certified obstetrics and gynecology subspecialist. Callers presenting with Medicaid insurance experienced significantly longer new patient appointment wait times than callers with commercial insurance.

Primary Presenter: Nicole Russell

Project Title: *How Do Colorado Public Libraries Respond to Patron Queries About Opioid Use Disorder? A Secret Shopper Study.*

Primary Mentor: Tyler Coyle

Thematic Area: Public Health and Epidemiology

Abstract: Abstract

Background:

Colorado's age-adjusted fatal opioid overdose rate increased over 400% from 2000-2020.

Public libraries are increasingly valuable community resources for accessing health-related information. We sought to evaluate the availability and types of opioid use disorder (OUD)-related resources offered through Colorado Public Libraries in different settings using secret shoppers to collect data.

Methods:

This was a cross sectional study of 272 Colorado Public Libraries in 2021. Anonymous auditors posed as library patrons asking a brief standardized script about availability of OUD-related resources over the phone. We conducted descriptive analyses of the libraries contacted, the response types of OUD resources provided, and information about naloxone availability.

Results:

Approximately 50% of libraries were classified as urban. Most (81%) of the libraries offered a valid OUD-resource, and over half (51%) provided a referral to a treatment center offering at least one medication for OUD. Over a third (36%) of librarians referenced the statewide naloxone standing order allowing patients to obtain naloxone from a pharmacy without prescription. One in ten libraries provided at least one invalid referral resource.

#### Conclusions:

Libraries may benefit from the development of a standard for OUD-related resource training/education in public libraries that can be distributed across the state to create a safe space for community members to obtain resources related to substance use.



Primary Presenter: Laveen Khoshnaw

Project Title: *Iraqi Migrant Mental Health Needs, Perceptions, and Experiences:  
A Qualitative Analysis*

Primary Mentor: Janet Meredith

Thematic Area: Public Health and Epidemiology

Abstract: Immigrants and refugees, coined under the umbrella term "migrant", are considered vulnerable populations in healthcare due to the existence of the pre and post migration stressors they face. Migrants in the US are under special consideration given the amount of resettlement the last two decades. Iraqi migrants are particularly vulnerable; 147,000 of them have resettled in the U.S since 2001, with 87,000 entering from 2007-2013. Pre-migration stressors stem from exposure to violence, political conflicts, and religious persecution. Post-migration stressors are due to the cultural and language barriers that affect access to quality healthcare. With a group of 3500+ Iraqi migrants living in Colorado, we wanted to gain insight into the health concerns of this group of people who are living in American communities with little to no access to culturally competent and Arabic proficient providers. Our aim with this qualitative research project was to characterize Iraqi migrants' perceptions of their health as well as their experiences accessing and navigating the U.S. healthcare system.

Primary Presenter: Christopher Le

Project Title: *Diagnostic yield of workups ordered by pediatric ophthalmologists for bilateral pediatric cataracts at a tertiary pediatric hospital in the United States*

Primary Mentor: Michael Puente

Thematic Area: Clinical Science

Abstract: BACKGROUND

Children with unexplained bilateral cataracts routinely undergo testing for genetic, infectious, and metabolic etiologies. We evaluated the diagnostic yield of various tests ordered by pediatric ophthalmologists to evaluate bilateral cataracts in children at a single institution.

METHODS

We retrospectively identified all children with bilateral unexplained cataracts who underwent cataract surgery by a pediatric ophthalmologist at Children's Hospital Colorado from 2006 to 2022. We reviewed the results of genetic, infectious, and metabolic testing ordered by pediatric ophthalmologists to evaluate the cataracts in these children.

RESULTS

A total of 43 children met inclusion criteria. Of these, 34 (79%) had genetic testing, 34 (79%) had infectious disease testing, 33 (77%) had galactosemia testing, and 17 (40%) had urine-reducing substances testing performed during their cataract evaluation. Of the genetic tests ordered, 17 (50%) revealed a pathogenic mutation associated with cataracts. Twenty-three (68%)

patients were IgG-positive for a TORCH infection, but no child was found to be positive on confirmatory testing. Of the galactosemia and URS tests ordered, 3 tests (9%) and 1 (6%) test were initially found to be abnormal, respectively, but confirmatory testing and clinical judgment ruled out metabolic disease in each case.

## CONCLUSIONS

Genetic testing should be strongly considered in all cases of unexplained bilateral pediatric cataracts. Metabolic and infectious testing is best considered only after consultation with the child's pediatrician, guided by the patient's clinical context and the availability of genetic testing. ( J AAPOS 2023;27:271.e1-5)

Primary Presenter: Ahmed Alsafar

Project Title: *Targeted Approach to Improve Diversity in Phase I Oncology Clinical Trials: A Single Institution Experience at the University of Colorado Cancer Center*

Primary Mentor: Jennifer Diamond

Thematic Area: Clinical Science

Abstract: **Background:** Despite continued improvements in cancer outcomes, disparities persist between racial, ethnic, and socioeconomic groups. One potential driver is the lack of appropriate representation in clinical trials, including dose-finding studies. We implemented a set of initiatives including patient education and outreach, a Spanish-speaking bicultural clinic, and regular review of enrollment by race and ethnicity. To investigate the impact of these initiatives, we examined phase I clinical trial patient demographics and treatment outcomes before and after the intervention.

**Methods:** We performed a retrospective review of patients enrolled in 2018-2019 (cohort 1[C1], pre- intervention) and 2022-2023 (cohort 2[C2], post-intervention). We collected patient data including age, sex, race, ethnicity, language, insurance type, area deprivation index (ADI), body mass index (BMI), ECOG performance status, and tumor type. The differences between cohorts were evaluated with T-tests for continuous variables, the Chi-Square test for categorical variables, and the Fisher Exact test for categorical variables with low cell counts. Progression-free survival (PFS) and overall survival (OS) were calculated using the Kaplan-Meier method. Hazard ratios and their associated p-values for univariable and multivariable models were

derived using the cox proportional hazards method. For patient with colorectal cancers (CRC), the best-fitting multivariable model was selected using the Akaike information criterion.

Results: A total of 361 patients (C1 N = 209, C2 N = 152) were included. Overall, 52.4% of patients were Female. The most common tumor types were gastrointestinal (38.5%), sarcoma (12.2%), breast (10.8%) and lung (10.5%). Overall race was 85.0% White, 3.3% Asian, 1.4% Black with 9.1% of patients being ethnically Hispanic. In comparison, cancer incidence in Colorado was 92.8%, 1.6% and 3.3% and 10.0%, respectively. Following our intervention, there was a statistically significant increase in language preference other than English from 1.91% (4/209) in C1 to 6.58% (10/152) in C2 ( $p = 0.028$ ) and in translated consents from 1.44% (3/209) to 5.92% (9/152) ( $p = 0.033$ ). There was no statistically significant difference in race, ethnicity, insurance, or tumor type between C1 and C2, although there was an increase in Hispanic patients from 8.13% to 10.53%, trending towards significance. Median PFS was 2.83 months in C2 compared to 1.91 months in C1 (Hazard ratio (HR) = 0.72, 95% Confidence Interval (CI) 0.57-0.90,  $p = 0.003$ ). By univariable analysis, ECOG 1 v. 0 was associated with inferior OS (HR:1.35, 95% CI 1.06-1.73,  $p = 0.017$ ), and BMI of  $\geq 18.5$  v.  $< 18.5$  was associated with superior OS (HR = 0.59, 95% C.I. 0.37-0.95,  $p = 0.030$ ). A multivariable model of our most common tumor type, CRC (n = 66), revealed that ADI scores of 6-10 were associated with worse PFS and OS ( $p = 0.022$  and  $p = 0.001$ , respectively) compared to ADI scores of 1-5.

Conclusion:

Our multi-faceted intervention resulted in an increase in enrollment of non-English speaking patients, however, there was not yet a statistically significant change in overall race and ethnicity. Our study confirms poorer clinical outcomes for patients with higher ADI scores.

Further research and intervention are warranted to mitigate disparities in clinical trial accrual and improve clinical outcomes for disadvantaged patients.

Primary Presenter: Nazar Akhverdyan

Project Title: *Changes in Transient Elastography with Glucagon-like Peptide-1 Receptor Agonist Use in Metabolic Dysfunction-Associated Steatotic Liver Disease*

Primary Mentor: Thomas Jensen

Thematic Area: Clinical Science

Abstract: Introduction: Recent guidelines recommend the use of glucagon-like peptide-1 receptor agonists (GLP-1RAs) in patients with Metabolic Dysfunction-Associated Steatotic Liver Disease (MASLD). This study assessed the effects of GLP-1RAs in patients with MASLD, as measured by changes in Vibration-Controlled Transient Elastography (VCTE) and metabolic parameters in a real-world clinical scenario.

Methods: We retrospectively analyzed 96 patients with MASLD who underwent VCTE at baseline and follow-up. Changes in controlled attenuation parameter (CAP), liver stiffness measurement (LSM), anthropomorphic data, and laboratory studies were compared between GLP-1RA users and non-users, as well as responders and non-responders based on a CAP change  $> 38$  dB/m, using two sample t-tests or Wilcoxon rank sum tests.

Results: GLP-1RA users had significant improvements in weight (-8.1 kg vs. -3.5 kg  $p=0.009$ ), BMI (-2.9 kg/m<sup>2</sup> vs. -1.3 kg/m<sup>2</sup>  $p=0.012$ ), ALT (-15.0 IU/L vs. -4.0 IU/L  $p=0.017$ ), AST (-5.0 IU/L vs. -1.0 IU/L  $p=0.021$ ), hemoglobin A1c (-0.7% vs. 0.1%  $p=0.019$ ), and CAP (-59.9 dB/m vs. -29.1 dB/m  $p=0.016$ ). Responders had significant improvements in weight (-9.2 kg vs. -1.9 kg  $p<0.001$ ), BMI (-3.3 kg/m<sup>2</sup> vs. -0.7 kg/m<sup>2</sup>  $p<0.001$ ), diastolic blood pressure (-6.1 mmHg

vs. -0.7 mmHg  $p=0.028$ ), hemoglobin A1c (-0.8% vs. 0.3%  $p<0.001$ ), and LSM (-1.5 kPa vs. 0.1 kPa  $p<0.001$ ).

Conclusions: Patients with MASLD treated with GLP-1RAs showed significant improvements in CAP and metabolic parameters with weight loss as the likely mechanism for liver improvement.

CAP change  $>38$  dB/m is linked to improvements in weight, LSM, and other metabolic parameters, suggesting the utility of VCTE in the surveillance of MASLD.



Primary Presenter: Paige Romer

Project Title: *Learning How to Learn Medicine: A Student-Led Initiative to Foster Active Learning Strategy Adoption*

Primary Mentor: Tai Lockspeiser

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract: Abstract

Background:

\* Active recall and spaced repetition are learning strategies that have been associated with better student outcomes.

\* Passive learning strategies, such as rereading notes, are associated with worse long-term recall.

\* Despite strong evidence on how best to learn, many medical students do not uniformly effective strategies and struggle with adjusting to medical school.

\* Peer teaching has long been recognized as an effective approach to education but has rarely been used to teach learning skills.

Project Description:

\* Paige Romer, a former teacher with a master's<sup>€™</sup>s in education psychology and current medical student at CUSOM, worked with UME faculty to develop a talk on learning science, active learning strategies, and learning in medical school.

\* Evidence-based learning strategies were interwoven with reflections from Paige and other students about learning in medical school.

\* This talk has now reached over 600 students and faculty members and has led to the development of a similar talk focused on clinical learning.

\* The session has been evaluated similarly to all other lectures in medical school.

## Results

\* 81% of students thought it was more effective to have a peer present this material compared to a faculty member.

\* On average, 77.3% of students stated that the project provided them with information and concrete approaches to maximize their learning in medical school.

## Conclusions:

\* Peer-teaching about learning science has been positively received by students at CU School of Medicine.

\* When teaching learning science, it is important to emphasize the universality of effective learning strategies.

Primary Presenter: Maya Katz

Project Title: *Caring for Homebound Veterans during COVID-19 in the U.S. Department of Veterans Affairs Medical Foster Home Program*

Primary Mentor: Leah Haverhals

Thematic Area: Clinical Science

Abstract: The onset of the COVID-19 pandemic made older, homebound adults with multiple chronic conditions increasingly vulnerable to contracting the virus. The United States (US) Department of Veterans Affairs (VA) Medical Foster Home (MFH) program cares for such medically complex veterans residing in the private homes of non-VA caregivers rather than institutional care settings like nursing homes. In this qualitative descriptive study, we assessed adaptations to delivering safe and effective health care during the early stages of the pandemic for veterans living in rural MFHs. From December 2020 to February 2021, we interviewed 37 VA MFH care providers by phone at 16 rural MFH programs across the US, including caregivers, program coordinators, and VA healthcare providers. Using both inductive and deductive approaches to thematic analysis, we identified themes reflecting adaptations to caring for rural MFH veterans, including care providers rapidly increased communication and education to MFH caregivers while prioritizing veteran safety. Telehealth visits also increased, MFH veterans were prioritized for in-home COVID-19 vaccinations, and strategies were applied to mitigate the social isolation of veterans and caregivers. The study findings illustrate the

importance of clear, regular communication and intentional care coordination to ensure high-quality care for vulnerable, homebound populations during crises like the COVID-19 pandemic.

Primary Presenter: Vivian Rajeswaren

Project Title: *Healthcare Resource Utilization and Costs in an At-Risk Population with Diabetic Retinopathy*

Primary Mentor: Niranjan Manoharan

Thematic Area: Public Health and Epidemiology

Abstract: Purpose: Several investigators have suggested the cost-effectiveness of earlier screening, management of risk factors, and early treatment for diabetic retinopathy (DR). We aimed to evaluate the extent of health care utilization and cost of delayed care by insurance type in a vulnerable patient population.

Methods: A retrospective analysis of DR patients was conducted using Electronic Medical Record (EMR) data from January 2014 to December 2020 at Denver Health Medical Center, a safety net institution. Patients were classified by disease severity and insurance status. DR-specific costs were assessed via Current Procedural Terminology (CPT) codes over a 24-month follow-up period.

Results: Among the 313 patients, a higher proportion of non-English speaking patients were uninsured. Rates of proliferative diabetic retinopathy at presentation differed across insurance groups (62% of uninsured, 42% of discount plan, 33% of Medicare/Medicaid,  $p = 0.016$ ). There was a significant difference in the total median cost between discount plan patients (\$1258, IQR: \$0 - \$5901) and both Medicare patients (\$751, IQR: \$0, \$7148,  $p = 0.037$ ) and Medicaid patients (\$593, IQR: \$0, \$6299,  $p = 0.025$ ).

Conclusions: There were higher rates of proliferative diabetic retinopathy at presentation among the uninsured and discount plan patients and greater total median cost in discount plan patients compared to Medicare or Medicaid. These findings prioritize mitigating gaps in insurance coverage and barriers to preventative care among vulnerable populations.

Translational Relevance: Advanced diabetic disease and increased downstream healthcare utilization and cost vary across insurance type, suggesting improved access to preventative care is needed in these specific at-risk populations.

Primary Presenter: Brittini Driscoll

Project Title: *Surgeon Perceptions of the Integration of Patient-Reported Outcome Measures into Clinical Practice*

Primary Mentor: Ethan Cumbler

Thematic Area: Clinical Science

Abstract: Introduction: Patient-reported outcome measures (PROMs/PROM) are standardized, validated instruments used to measure the patient's perception of their own health status including their symptoms, functional wellbeing, and mental health. Although PROMs were initially developed as research tools, their use in clinical practice for shared decision-making and to assess the impact of disease and treatment on quality of life of individual patients has been increasing. There is a paucity of research exploring providers' perspectives on the clinical integration of PROMs. We sought to use a qualitative methodology to understand surgeons' perceptions of integrating PROMs into their clinical practices.

Methods: Semistructured interviews were performed from November 2019 until August 2020.

All interviews were recorded and transcribed verbatim. Thematic saturation was achieved after interviewing nine surgeons representing eight surgical specialties. Qualitative interview data were thematically analyzed using an inductive approach facilitated by Atlas.ti qualitative software.

Results: Forty seven unique codes were identified that fit into 21 themes that revealed five novel insights. Key insights included: (1) PROM data can modify surgical practice on an individual

and institutional level, (2) Surgeon's view PROM clinical integration as a potential method of advancing patient-centered care, (3) There are various institutional processes that must be in place, including strong leadership and an integrative platform, to enable successful clinical PROM integration, (4) Surgeons appreciate challenges of integrating PROMs into surgical practice including risks of incorrect use or interpretation, and (5) A PROM platform must be adaptable to the diversity within surgery and to unique physician workflows.

Conclusions: Surgeons perceived value from integrating PROMs into routine care to better inform patients during preoperative discussions and to help identify at-risk patients in the postoperative period. However, they also identified numerous barriers to the implementation of an integrated system for the routine use of PROMs in clinical practice and expressed concern about using PROMs to compare operative outcomes between surgeons. Based on this work, institutions that want to incorporate PROMs into surgical practice need a leadership team capable of supporting the change management necessary for effective integration and use a PROM platform that gives individual surgeons and surgical teams the ability to customize platforms for their unique practices.



Primary Presenter: Folake Adegboye

Project Title: *Barriers to Mental Healthcare for Vulnerable Populations: Lessons Learned from Online Public Testimonies and Implications for Medical Education*

Primary Mentor: Steve

Janet Lowenstein

Meredith

Thematic Area: Public Health and Epidemiology

Abstract: The barriers faced by communities in seeking mental healthcare is not well understood.

Elucidating the barriers can inform medical school curricula to prepare trainees to provide high quality, patient-centered care. This community based study sought to describe the impact of the current mental health system on patient and family wellbeing and identify the barriers faced by community members attempting to access mental health care.

Sixty-nine online public testimonies were retrieved from the Colorado Department of Human Services Behavioral Health Task Force from September 2019 through March 2020. Researchers transcribed audio-video recordings, developed a codebook validated by a community advisory board, and used qualitative thematic analysis to characterize community member experiences.

The analysis identified four primary barriers. Common structural barriers include political and socioeconomic barriers. Social inequities included stigma, poor education, and lack of awareness of available resources. Population specific needs were identified among the Deaf and Hard-of-Hearing, incarcerated persons, those experiencing homelessness, and patients suffering from

substance use disorders. Training and educational barriers identified in the analysis included lack of cultural awareness, identifying, and diagnosing complex illnesses, and care coordination.

This study highlights the importance of integrating the experiences of caregivers navigating the complexities of the mental healthcare system into medical education. These testimonies may represent a critical tool that medical professionals can use to address patient and caregiver concerns to improve the quality of patient care.

Primary Presenter: David Duarte-Corado

Project Title: *Impact Of Culturally Competent Care In Post-transplant Clinical Outcomes Among Hispanic Kidney Transplant Recipients*

Primary Mentor: Jose Henao Cordero

Thematic Area: Public Health and Epidemiology

Abstract: Impact of Culturally Competent Care in Post-Transplant Clinical Outcomes Among Hispanic Kidney Transplant Recipients

Introduction: On January of 2018, the UCH Hispanic Kidney Transplant Clinic (UC-HTC) opened its doors. Staffed by bilingual personnel with an affinity for Hispanic culture, its goal is to provide culturally competent care to Spanish-speaking Hispanic kidney transplant recipients (SSHKTR), in order to improve patient satisfaction, compliance, clinical outcomes and quality of life. Its implementation has been associated with improved adherence and completion of steps in the transplant process as seen in the literature. However, data on the impact of culturally competent programs on post-transplant graft and infection-related outcomes is lacking. Yet, infections are a major cause of morbidity/mortality in the 1st year post-transplantation. Moreover, foreign-born Hispanic patients are at increased risk of recrudescence of endemic infections after solid organ transplantation (SOT).

Methods: To answer these questions, a single center retrospective cohort study was designed with the objective of evaluating the incidence of infections during first-year post-transplant in SSHKTR who received a kidney before and after the implementation of the UC-HTC and

compare it to that of matched non-Hispanic KTR during the same time. Noninfectious outcomes were also evaluated, including rejection, need for RRT, graft failure, clinic visits, medication noncompliance, mortality, and hospital admissions. 90 patients identified through the EMR met the criteria. 28 transplanted between 01/2015-12/2017 and 62 between 01/2018-12/2020. Each patient was matched with a Non-Hispanic, English-speaking counterpart, based on Sex/Age/Date of transplantation. Data was collected for 12 months following transplantation, including variables such as: Insurance, Donor Type, Comorbidities, Serologies, amongst others. Statistical analysis was performed with stataIC 16 software.

Results: Outcomes showed no major differences in overall infection rates between SSHKTR and non-Hispanic KTR. But despite this, patients seen in the UC-HTC had a trend to lower UTI rates which could be associated to closer follow up/communication with their provider. We found no difference in post-transplant outcomes between Hispanics and non-Hispanics including Mortality and Graft survival, however, culturally Competent care showed a significant decrease in medication noncompliance in UC-HTC patients with reported rates much lower than their pre-intervention Hispanic counterparts (3.2% vs 19.3%, p 0.01).

Conclusion: Development of a Culturally competent transplant program with a multidisciplinary team approach integrating Infectious Diseases in the peri-transplant care of Hispanic SOT candidates/recipients may prove beneficial to maximize screening, follow-up, and treatment.

Larger, prospective studies are needed to better evaluate the impact of this multidisciplinary approach.

Primary Presenter: Moriah Mabry

Project Title: *New Frontier: The First Year of an Adult Neurodevelopmental Disabilities Clinic*

Primary Mentor: Jessica Solomon Sanders

Thematic Area: Clinical Science

Abstract: ABSTRACT

Background: As patients with neurodevelopmental disorders (NDDs) transition from pediatric to adult health care systems, they often have difficulty finding providers to address their NDD-related needs. In response to this care gap, we established a new consultation clinic in an adult neurology department within a behavioral neurology clinic to address the neurodevelopmental concerns of these adult patients.

Objective: To characterize the population of adult patients with NDDs seen in the adult NDD clinic in its first year.

Method: Data were obtained by a retrospective chart review of all patients with NDDs seen in the adult NDD clinic from September 2020 through December 2021.

Results: Of the 86 patients who were seen in the adult NDD clinic, the average age was 34 years (SD = 15, range = 18–74). Developmental diagnoses included intellectual disability (63%), autism spectrum disorder (47%), Down syndrome (15%), cerebral palsy (9%), and other genetic disorders (26%). Comorbidities addressed included behavioral concerns (34%), anxiety (29%), seizures (22%), and depression (15%). Behavioral and/or mental health concerns prompted 65%

of the initial clinic visits. The most common recommendation made was to begin or increase exercise (59%), followed by facilitating connection to community, social, and employment resources.

Conclusion: This paper describes adult patients with NDDs who were seen in a new adult NDD clinic. The patients had diagnoses, comorbidities, and concerns that are similar to, but also distinct from, those addressed in other adult neurology clinics. This study addresses the need for, and feasibility of, tailoring care for the diverse population of patients with NDDs in an adult neurology setting.

Primary Presenter: Gary Shahinyan

Project Title: *Technical Aspects of Robotic-Assisted Laparoscopic Fistula Repair: Case Report and Retrospective Cohort Analysis*

Primary Mentor: Brian Flynn

Thematic Area: Clinical Science

Abstract: TECHNICAL ASPECTS OF ROBOTIC-ASSISTED LAPAROSCOPIC FISTULA

REPAIR: Case Report and Retrospective Cohort Analysis

Introduction and Objectives: Urinary tract fistulas (UTF) are a diverse set of abnormal anatomical connections, most commonly from iatrogenic causes. Traditionally, repairs have been performed in an open fashion, but as minimally invasive techniques become more widespread, the robotic-assisted laparoscopic (RAL) platform has been successfully employed in these complex repairs. The aim of our study is to highlight our institution's recent experience with RAL UTF repairs and to highlight our surgical technique.

Methods: We retrospectively reviewed the medical records of all female patients who underwent RAL UTF repairs by a single surgeon. These included vesicovaginal (VVF), vesicouterine (VUF), vesicocervical (VCF), ureterovaginal (UVF), rectovaginal (RVF) and colovesical (CVF) fistula repairs. We analyzed patient demographics, fistula characteristics, perioperative factors, complications, and outcomes. The video highlights our RAL surgical technique for a representative UVF repair in a 33-year-old female.



Results: 17 females underwent robotic fistula repairs between 12/2013 and 7/2021. 94% of the fistulas were iatrogenic, 53% of the fistulas were between the bladder and female organs, 24% were GI fistulas, and the remaining 24% were ureterovaginal. All cases were completed robotically with only 1 intraoperative complication of a ureteral injury. Median hospital LOS was 1 day. All cases included a concomitant procedure. At a median follow-up of 5 months, 5 patients had recurrences (71% success rate). Of the 5 patients that recurred, 2 had hx of cancer and 1 had a history of radiation. No other 90-day complications were recorded.

Conclusions: RAL approaches to UTFs offer feasible repairs with good success rates and low rate of complications.

Primary Presenter: Christina Cheung

Project Title: *Parent and provider perspectives on family navigation for early identification of children with autism spectrum disorder*

Primary Mentor: Jacqueline Jones

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract: Early identification can improve developmental outcomes among children with autism spectrum disorder (ASD), but underdiagnosis and undertreatment are common among low-income families and children of racial/ethnic minorities. The Screening and Linkage to Services for Autism (SaLSA) trial (ClinicalTrials.gov Identifier: NCT02374541) demonstrated that autism family navigation (AFN) improved the likelihood that young children at risk for ASD completed a diagnostic evaluation. We recruited parent participants, healthcare and EI providers and staff, and project staff from the SaLSA trial to participate in semi-structured telephone interviews on acceptability and feasibility of AFN services for families seen in urban safety-net clinical settings. Secondary qualitative content analysis was performed. A community focus group was conducted for data source triangulation to improve validity. Results demonstrated four main themes: (1) "It's all in a name: the risk of engagement" ; (2) "Community partnerships require authentic trust" ; (3) "System interactions and interrelationships" ; and (4) "What is an AFN: family navigation or clinical role?" This study adds perspectives of interested parties of AFN within an urban underserved population. Recommendations for navigation

program content and delivery based on these findings can inform future modifications to AFN programs in the context of the communities they serve.

Primary Presenter: Mary Fuhlbrigge

Project Title: *Participant Diversity in Stroke-Related Medical Device Trials: Historical Context and Ongoing Challenges*

Primary Mentor: Karen Orjuela

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract: Despite an acknowledgement of the ethical and clinical importance of recruiting diverse populations into clinical trials, there is a continued under enrollment of patients with diverse demographic characteristics within the field of Neurology and more specifically, in stroke-related device trials. Efforts on the part of the United States Congress, the National Institutes of Health, the Food and Drug Administration, and the Centers for Medicare and Medicaid Services over the last several decades have attempted to increase trial participant diversity with varying success. This historical context provides an important lens for analyzing diversity proposals and their bearing on device trials in the field of stroke neurology. Despite economic and logistical challenges, recruitment of appropriately diverse clinical trial populations through policy change and community engagement is critical to continuing to advance health equity goals.

Primary Presenter: Benjamin Schenkel

Project Title: *Correlations of Opioid Intake During Different PredischARGE Time Frames with Postdischarge Opioid Use Following Inpatient Surgery*

Primary Mentor: Ana Fernandez-Bustamente

Thematic Area: Clinical Science

Abstract: Previous work has shown that predischARGE opioid use is the most reliable and practical predictor of postdischarge opioid intake after inpatient surgery. However, the most appropriate predischARGE time frame for operationalizing this relationship into more individualized prescriptions is unknown. We compared the correlations between the quantity of opioids taken during 5 predischARGE time frames and self-reported postdischarge opioid intake in 604 adult surgery patients. We found that the 24-hour predischARGE time frame was most strongly correlated ( $r = 0.60, P < .001$ ) with postdischarge opioid use and may provide actionable information for predicting opioid use after discharge. (A&A Practice. 2024;18:e01753.)

Primary Presenter: Camila Vargas

Project Title: *Do adult patients with congenital colorectal conditions know their diagnosis?*

Primary Mentor: Andrea Bischoff

Thematic Area: Public Health and Epidemiology

Abstract: Purpose: Limited research exists about the knowledge that adult patients have about their congenital colorectal diagnosis.

Methods: This was an IRB approved, prospective study of patients in the Adult Colorectal Research Registry who completed surveys between October 2019 and March 2022. Surveys were administered through REDCap after patients consented to being contacted for research purposes. Patients provided demographic data, which was linked to surgical records, and the diagnoses provided by patients were compared with diagnoses recorded by the original surgeons.

Results: One hundred and thirty-one questionnaires were collected, 115 patients had anorectal malformations (ARM) and 16 had Hirschsprung disease (HD). Seven patients who had ARM were unaware that they had an ARM or HD. The type of ARM recorded by the surgeon was unavailable for comparison with the patient's reported diagnosis in four cases. Of the 111 remaining patients with ARM, only 32 of them (29%) knew what their own type of anomaly was. Female patients recalled their diagnosis more often than male patients (42.4% vs 13.5%). All 16 participants with HD correctly identified their diagnosis severity as HD with or without total colonic aganglionosis.

Conclusion: The results of this study demonstrate patient's limited understanding of their type of ARM and highlight the urgent need to enhance communication and education strategies, such as issuing patients with medical diagnosis identification cards. It is critical for clinicians to better communicate with patients to ensure that they and their relatives truly understand their precise diagnosis. Adequately informed patients can better advocate for themselves, adhere to treatments and precautionary recommendations and navigate the complexities of transitional care. Consequently they can more effectively manage their lifelong complications.

Primary Presenter: Khashayar Rishsefid Mahalleh

Project Title: *Iraqi Migrant Mental Health Needs, Perceptions, and Experiences:  
A Qualitative Analysis*

Primary Mentor: Janet Meredith

Thematic Area: Public Health and Epidemiology

Abstract: Immigrants and refugees, coined under the umbrella term "migrant", are considered vulnerable populations in healthcare due to the existence of the pre and post migration stressors they face. Migrants in the US are under special consideration given the amount of resettlement the last two decades. Iraqi migrants are particularly vulnerable; 147,000 of them have resettled in the U.S since 2001, with 87,000 entering from 2007-2013. Pre-migration stressors stem from exposure to violence, political conflicts, and religious persecution. Post-migration stressors are due to the cultural and language barriers that affect access to quality healthcare. With a group of 3500+ Iraqi migrants living in Colorado, we wanted to gain insight into the health concerns of this group of people who are living in American communities with little to no access to culturally competent and Arabic proficient providers. Our aim with this qualitative research project was to characterize Iraqi migrants' perceptions of their health as well as their experiences accessing and navigating the U.S. healthcare system.



Primary Presenter: Kaden Parks

Project Title: *The Hidden Cost of Chronic Pain: A Narrative Review of the Environmental Impact of Outpatient Spine and Musculoskeletal Care*

Primary Mentor: Patricia Heyn

Thematic Area: Clinical Science

Abstract: Healthcare is a major driver of greenhouse gas emissions and is closely intertwined with industrial processes responsible for air, water, and soil pollution. Chronic pain €“ particularly as it relates to spine and musculoskeletal diagnoses €“ comprises a significant portion of healthcare utilization and affects millions of people worldwide. Despite the prevalence of chronic spine and musculoskeletal pain, there has been limited discussion of the environmental impacts of outpatient clinic and interventional processes as they relate to these conditions. This narrative review explores the environmental impact related to diagnostics, pharmacologics, and common non-operative interventional procedures utilized in the management of patients with chronic musculoskeletal and spine pain. Topics explored include energy utilization, production and disposal of pharmaceuticals, and waste production from interventional procedures. This study aims to educate providers involved in spine and musculoskeletal disease management regarding the possible environmental consequences of their practices. The article also focuses on alternative approaches to patient care that are more sustainable as well as highlighting areas in need of further investigation.

Primary Presenter: Salina Goff

Project Title: *Testing of Multiple Autoantibodies Identifies Expansion of Targeted Antigens and a Method to Identify Imminent Onset of Clinical Rheumatoid Arthritis*

Primary Mentor: Kevin Deane

Thematic Area: Clinical Science

Abstract: Purpose of Study: Rheumatoid arthritis (RA) has a period termed "pre-RA" during which there are autoantibody elevations prior to the onset of clinically-apparent inflammatory arthritis (i.e. clinical RA). Multiple autoantibody systems including antibodies to citrullinated proteins (ACPA), rheumatoid factor (RF), anti-peptidyl arginine deiminase (anti-PAD) and anti-carbamylated proteins (anti-CarP) have been described in pre-RA; however, few studies have tested all antibodies in a single pre-RA cohort. The objective of this study was to test multiple autoantibody systems in pre-RA, and evaluate the role of these autoantibodies in potentially identifying a signature in the pre-RA period that indicates imminent onset of clinical RA.

Methods Used: We evaluated 148 individuals with two pre- and one post-RA diagnosis serum samples available from the Department of Defense Serum Repository (DoDSR), and matched controls. Samples were tested for anti-CCP3, five ACPA fine specificities, anti-PAD, anti-CarP and RFIgA and IgM (Werfen). Positive levels for autoantibodies were determined using levels present in  $\leq 1\%$  in a separate set of DoDSR controls. Analyses included comparison of positivity of autoantibodies over time in pre-RA and post-RA, and comparisons between RA and controls.

Summary of Results: The individuals with RA had a mean age at diagnosis of RA of ~37 years, were ~55% female and had post-RA positivity of anti-CCP3 of 60.8%, RFIgA of 45.9% and RFIgM of 45.9%. Positivity of anti-CCP3, RFIgA and IgM, anti-PAD1 and PAD4, anti-vimentin 2, anti-fibrinogen and anti-histone 1 increased over time in pre-RA and were significantly different than controls; however, positivity rates were overall similar in immediate pre-RA samples compared to post-RA samples. Counts of autoantibodies also increased over time in pre-RA, and within anti-CCP3 positive samples, a higher total autoantibody count was significantly associated with a time period  $\leq 3$  years prior to RA diagnosis.

Conclusions: Multiple autoantibodies including anti-CCP3, RFIgA and M, ACPA fine specificities and anti-PAD antibodies are present in pre-RA, although anti-CCP3 and RFs have the highest positivity rates. This confirms prior findings, however also expands upon them by demonstrating the rates of these antibodies in a single cohort. In addition, in anti-CCP3 positive samples, an increasing total antibody count indicates a sample is  $\leq 3$  years prior to RA diagnosis; when further validated, that could serve as a model to predict imminent RA.

Primary Presenter: Hashem Anabtawi

Project Title: *Seroprevalence of SARS-CoV-2 in a Guatemalan Agricultural cohort and Virus-Specific Antibody Kinetics*

Primary Mentor: Mario Santiago

Thematic Area: Basic Biomedical Science

Abstract: The height of the COVID-19 pandemic called for the utilization of government enforced methods to prevent disease transmission such as work from home and social distancing. Essential workers were exempt from such restrictions and thus put at a heightened risk of disease transmission, health burden, and subsequent economic loss. Limited data from the United States suggests an increased COVID-19 burden among essential workers in low to middle income countries (LMIC). Agricultural workers play a role in global food security and represent a major economic force. In Guatemala, these workers make up ~35% of the labor force and agricultural products make up ~45% of the country's exports, including supplying ~50% of the United States' bananas. In this cohort, we specifically aimed to investigate the seroprevalence for SARS-COV-2 over 1 year and the clinical correlation. Additionally, we aimed to investigate the chemical kinetics of SARS-COV-2 specific antibodies such as anti-spike and anti-nucleocapsid. Data regarding nucleocapsid antibody titers over time and the relationship these titers have to clinical symptomatology and viral infectivity can strengthen our understanding of immunity as it relates to SARS-COV-2. Preliminary data suggests seroprevalence between June 2020 and March 2021 increased from 0.20 at the time of enrollment to 0.43. With vaccination strategies in

place and the possibility of re-infection in mind, we estimate the seroprevalence will continue to increase in this cohort. Preliminary results regarding antibody kinetics demonstrate approximately a 95% decrease in detectable nucleocapsid antibody within 6 months with an estimated decrease of 0.13 per day

Primary Presenter: George Burnet

Project Title: *Muffins and Meditation: Combatting Burnout in Surgical Residents*

Primary Mentor: Kshama Jaiswal

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract: Objective: To quantify the prevalence of burnout in our surgical residency program and to assess the impact of a weekly wellness program for surgical residents through validated tools measuring mindfulness, self-compassion, flourishing, and burnout. Our hypothesis was that participants with more frequent attendance would: 1) be more mindful and self-compassionate and 2) experience less burnout and more flourishing.

Design: An optional one-hour weekly breakfast conference was facilitated by a senior surgical faculty member with the time protected from all clinical duties. Following a guided meditation, participants were given time for reflection and dialogue about their training experiences or led in a wellness exercise. TRANCE (tolerance, respect, anonymity, non-retaliation, compassion, egalitarianism) principles were utilized to create a safe and open environment. Residents were surveyed at the end of the study period, which was from March 2017 through June 2018.

Setting: The conference and data analysis was conducted at Denver Health Medical Center, affiliated with the University of Colorado School of Medicine.

Participants: This study analyzed survey responses from 85 surgical residents.

Results: Following the wellness program, when answering the two-question Maslach Burnout Inventory, 35.7% of residents reported feeling burned out by their work once a week or more, and 29.7% reported feeling more callous toward people once a week or more. After multivariate analysis, the only independent predictors of increased burnout were not being married or in a committed relationship, lower positive affect, and higher negative affect. Qualitative feedback was overwhelmingly positive, and residents expressed gratitude for the conference, the opportunity for self-reflection, and open dialogue with attendings and colleagues.

Conclusions: The prevalence of burnout is high among surgical residents. Allowing time to practice a mindfulness meditation while providing space for residents to share their experiences may be protective, and efforts should be made to reduce barriers to participation.

Key Words: General Surgery, Burnout, Graduate Medical Education, Quality of Life, Resident Education

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Primary Presenter: Ahana Ghosh

Project Title: *A narrative review of rural access to vascular care*

Primary Mentor: Max Wohlauer

Thematic Area: Public Health and Epidemiology

Abstract: Objective: In order to characterize rural populations' access to vascular care, this paper consolidates a literature review of various vascular medical presentations and their prevalence in the rural community.

Background: As vascular surgery cases shift away from general surgery practice, rural populations have increasing disparities in accessing vascular care. There are multiple factors leading to this discrepancy, including long travel distances, lack of specialized medical care, facilities without proper equipment, and more. The recent regionalization of specialized surgical care has somewhat improved access, but vascular health still has a long way to go. Rural patients have much higher rates of mortality in high-risk presentations such as acute coronary syndrome, acute ischemic stroke, high-risk aortic disease, chronic limb ischemia, and end-stage renal disease.

Methods: This paper concentrates on the intersection of rural populations with vascular surgery care. The literature review consists of mostly original investigations and mainly those in or translated into English. Most of the references were found by Medical Subject Heading (MeSH) search on PubMed and reviewing citations in relevant literature. Key words for the literature search were "vascular surgery" AND "rural health" OR "rural population" OR



€rural health services€ OR €hospitals, rural.€ The literature review revealed 54 appropriate papers.

Conclusions: Despite the implementation of programs and policies to address these disparities, they continue to persist especially in high-risk medical presentations.

Primary Presenter: Medha Gudavalli

Project Title: *Colorado Physicians' Preparedness, Attitudes, and Practices for Management of Intimate Partner Violence*

Primary Mentor: Karen Hampanda

Thematic Area: Public Health and Epidemiology

Abstract: Abstract

## Introduction

Intimate partner violence (IPV) is a significant public health concern with an estimated lifetime prevalence of 30% of the general patient population identifying as women. Patients experiencing IPV report poor experiences with the healthcare system, and physicians report a lack of confidence and resources in response to patient IPV disclosure. This study aims to measure physicians' self-reported preparedness to diagnose and manage IPV and to better understand the factors influencing physicians' preparedness and attitudes across various specialties.

## Methods

Surveys were sent to a sample of volunteer, community-based faculty at the University of Colorado School of Medicine. Participants (n=182) completed a modified online version of the Physician Readiness to Manage Intimate Partner Violence Survey (PREMIS). Descriptive statistics, ANOVA, and simple and multivariable regression analyses were performed.

## Results

Regression models indicated that previous IPV training and IPV clinic protocols significantly influenced perceived preparedness to manage IPV, victim-centered attitudes, and ability to diagnose IPV. About 40% of respondents had previous IPV training, and 40% reported IPV protocols in place at their clinical site. Factors such as age, gender, years in practice, and practice were not statistically significant influencers of preparedness, attitudes, or ability to diagnose IPV.

## Discussion

Results from this study indicate a need for additional IPV training among physicians in Colorado and implementation of clinic-based IPV protocols.

Primary Presenter: Lily Kong

Project Title: *Secondary Placement of Adjustable Continence Therapy (ProACT,, $\phi$ ) Using Open Perineal Technique: Case Report of ProACT Placement in a Man with a Devastated Urethra Following Pelvic Trauma and Multiple AUS Erosions*

Primary Mentor: Brian Flynn

Thematic Area: Clinical Science

Abstract: Adjustable continence therapy (ProACT) is an underutilized treatment option in men with stress urinary incontinence. The device is placed using a perineal percutaneous tunneled approach. We demonstrate a salvage technique for ProACT placement in a man with a devastated urethra following pelvic trauma and multiple artificial urinary sphincter (AUS) erosions who failed a tunneled approach. Our novel technique has utility in those at high risk for intra-operative trocar injury to the urinary tract with a tunneled approach. An open approach may also be a viable option in high-risk patients who have failed a conventional ProACT approach, male sling, or AUS.

Primary Presenter: Sterling Lee

Project Title: *Opioid Prescribing Practices for At-Risk Pediatric Populations Undergoing Ambulatory Surgery*

Primary Mentor: Melissa Masaracchia

Thematic Area: Clinical Science

Abstract: Opioid Prescribing Practices for At-Risk Pediatric Populations Undergoing

Ambulatory Surgery

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## ABSTRACT

**OBJECTIVE:** Pediatric patients with sleep-disordered breathing (SDB) and obesity are at risk for opioid-induced respiratory depression. Although monitoring in the inpatient setting allows for early recognition of opioid-related adverse events, there is far less vigilance after ambulatory surgery as patients are discharged home. Guidelines for proper opioid dosing in these pediatric

subsets have not been established. We sought to determine if at-risk children were more likely to receive doses of opioids outside the recommended range.

**METHODS:** Baseline opioid prescribing data for all outpatient surgery patients receiving an opioid prescription between January 2019 and June 2020 were retrospectively reviewed. Patients with SDB or obesity were identified. To obtain more information about prescribing practices, we analyzed patient demographics, size descriptors used for calculations, and prescription characteristics (dose, duration, and prescribing surgical service).

**RESULTS:** A total of 4674 patients received an opioid prescription after outpatient surgery. Of those, 173 patients had SDB and 128 were obese. Surgical subspecialties rendering most of the opioid prescriptions included otolaryngology and orthopedics. Obese patients were more likely (64%) to be prescribed opioids using ideal weight at higher mg/kg doses ( $>0.05$  mg/kg; 83.3%;  $p < 0.0001$ ). When providers used actual body weight, lower mg/kg doses were more likely to be used (53.7%;  $p < 0.0001$ ). No prescriptions used lean body mass.

**CONCLUSIONS:** Overweight/obese children were more likely to receive opioid doses outside the recommended range. Variability in prescribing patterns demonstrates the need for more detailed guidelines to minimize the risk of opioid-induced respiratory complications in vulnerable pediatric populations.

Primary Presenter: Lorena Ramirez-Renteria

Project Title: *Assessing Literature of Efforts in Diversity, Equity, and Inclusion Within Cardiothoracic Surgery Training Programs*

Primary Mentor: Jessica Rove

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract: It is common knowledge that cardiothoracic surgery training programs, and thus the field itself is not diverse in the aspects of race, gender, and ethnicity. That knowledge has not been synthesized nor quantified longitudinally beyond recognizing the deficits in diversity, equity, and inclusion (DEI). As underrepresented communities grow across the U.S., it has become even more important to recruit, train, and retain trainees from underrepresented minorities (URM) that bring new perspectives to the field and can provide an understanding and enhanced level of care for URM patients. To create effective strategies that bring more URM medical students and residents to thoracic surgery, there needs to be a baseline understanding of current knowledge and efforts in the field to better understand what avenues for innovation exist beyond what is already being done to fully incorporate URM trainees into the surgical academic sphere. This literature review aimed to collect all available published works into one document to allow CT surgery programs to have a central reference to understand their role in being data-driven agents of change to bolster DEI initiatives at their institution. Literature was searched through PubMed and EMBASE databases between October 2021 and June 2022. 16 articles were evaluated that were specific to DEI efforts in cardiothoracic surgery specific to URM. Given the

limited quantity of literature available in this topic, selection criteria included all published works in English given the cultural/geographic context of this topic, and exclusion criteria pertained to works that were not available in full text or that were not relevant to DEI efforts specific to URM trainees in cardiothoracic surgery.



Primary Presenter: John Schutz

Project Title: *Establishing the Role of Inflammatory Markers in the Diagnosis and Treatment of Acute Hand Infections in the Pediatric Population*

Primary Mentor: Sarah Sibbel, MD

Thematic Area: Clinical Science

Abstract: Introduction: Distinguishing the severity of the diagnosis and an appropriate treatment plan in pediatric hand infections can be complex due to the variable amount of information available at the presentation. Inflammatory blood markers, including white blood cell count, erythrocyte sedimentation rate, and C-reactive protein are reported to aid in determining the severity of infection and response to treatment in adult hand infections. The purpose of this study was to identify the relevance of inflammatory marker levels in pediatric patients with hand and wrist infections and to determine their utility in diagnosis and treatment.

Methods: This multicenter, retrospective, cohort study included patients aged 0 to 18 who received treatment for an acute hand or wrist infection between 2009 and 2020. Data collected included demographics, time to presentation, diagnosis, inflammatory markers, culture results, antibiotic treatment, and surgical treatment. Infections were categorized as deep (osteomyelitis, tenosynovitis, abscess) and superficial (paronychia, felon, cellulitis). Exclusion criteria included: patients above 18 years of age, chronic infection, open fractures, and absence of any documented inflammatory markers. Statistically, t tests were used to compare mean differences in

inflammatory markers between patients who did and did not receive pretreatment antibiotics and between patients who had superficial versus deep hand infections.

Results: A total of 123 patients met the inclusion criteria. Pretreatment with antibiotics before definitive management was not significantly associated with differences in laboratory markers compared with patients not pretreated with antibiotics. Deep hand infections had inflammatory markers similar to superficial infections. Patients with deep hand infections required a bedside or operative procedure 78.9% of the time compared with superficial infections (21.2%) ( $P < 0.001$ ).

Patients with an isolated methicillin-resistant *Staphylococcus aureus* infection had inflammatory marker values that were not significantly different from patients infected with all other microbes.

Conclusions: Inflammatory markers were not significantly different between patients who received pretreatment with antibiotics and those who did not. While deep infections were often treated with bedside or surgical procedures, the inflammatory marker values were similar to those of superficial infections. The same held true for patients infected with culture-positive, isolated methicillin-resistant *Staphylococcus aureus* bacteria. Consequently, inflammatory markers may be useful to identify the presence of infection and monitor the response to treatment, they did not aid in determining the specific type of infection or selection of a treatment plan.

Primary Presenter: Robert Sumner

Project Title: *System Interventions to Increase MDPOA Documentation at University of Colorado Hospital*

Primary Mentor: Samuel Porter

Thematic Area: Clinical Science

Abstract: Advanced care planning (ACP) plays a crucial role in ensuring end-of-life care aligns with patients' preferences, particularly in the face of increasing healthcare demands and an aging population. Despite its importance, the completion of medical durable power of attorney (MDPOA) documentation remains insufficient, posing challenges to healthcare systems, providers, and patients alike. This study addresses the issue of low MDPOA completion rates at University of Colorado Hospital (UCH) through a systematic intervention. The intervention involved posting MDPOA forms outside patient rooms, with or without provider notification, in a randomized format across hospitalist services. Data collected revealed a notable increase in MDPOA completion rates following the intervention, particularly when MDPOA forms were posted alone. While the effect size of the intervention was modest, it signified a measurable improvement in ACP documentation, underscoring the potential for simple, easily implementable solutions to address complex healthcare challenges. Discussion highlights the implications of the intervention, including its contribution to improving communication efficiency and enabling staged discussions for ACP. Despite limitations in statistical significance, the presence of non-random variation supports the efficacy of the intervention.

Future directions include further refinement of the intervention, engagement with additional healthcare stakeholders, and exploration of long-term effects on ACP completion rates. This study underscores the importance of proactive ACP initiatives within healthcare settings, offering insights into practical strategies to enhance end-of-life care planning and advance patient-centered healthcare delivery.

Primary Presenter: Heami Yi

Project Title: *Emergency contraception in a historic southern city: mystery caller study in Birmingham, Alabama*

Primary Mentor: Carol Stamm

Thematic Area: Public Health and Epidemiology

Abstract: Background

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Alabama's Human Life Protection Act (the Act) signed in 2019 became law in 2022, making provision of abortion a felony offense.

Objective

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In 2020, we assessed the accessibility of emergency contraception (EC) pills in Birmingham, Alabama prior to the Act's enactment given the probable increased need for EC access due to abortion criminalization.

Study design

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Pharmacy staff were asked about availability, price, location, and identification requirements to obtain EC.

## Results

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Of 69 pharmacies, 59% had levonorgestrel EC and none had ulipristal acetate EC available.

## Conclusion

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There are persistent barriers to EC accessibility that should be addressed as abortion is increasingly restricted.

Primary Presenter: Alla Yousif

Project Title: *Assessing Barriers Among HIV, Substance Use Disorder, and Trans Patients During the COVID-19 Pandemic*

Primary Mentor: Erik Wallace

Thematic Area: Public Health and Epidemiology

Abstract: Background

COVID-19's effects on the health of vulnerable populations (i.e. racial and ethnic minority groups) are still emerging; however, current data suggest a disproportionate burden of illness and death among groups with substance use disorders (SUD), HIV/AIDS and the transgender community. The widening of healthcare disparities in the setting of COVID-19, makes it important to explore the new implicit and explicit barriers faced by vulnerable populations in accessing healthcare during this time.

Objective

To explore socioeconomic barriers by surveying healthcare providers at Fenway Health about the impacts of COVID-19 on their patients' healthcare access and to create avenues to mitigate barriers that widen the health disparities for vulnerable patients, especially during a public health crisis.

Methods

A total of 74 providers completed a survey administered via email. The cross-sectional survey was conducted during July 2020 at Fenway Health, a large multi-site community health center with locations in Boston and South End. Z-test and Fisher's exact test were used for statistical analysis.

## Results

Analysis of survey data demonstrates a significant correlation with the frequency of outcomes reported when comparing "before" and "during" COVID-19. The frequency of outcomes showed an increase in mental health concerns ( $p < 0.001$ ) and the number of patients lacking access to transportation ( $p < 0.001$ ). Also, most providers (87.8%) reported that their patients were not informed of the resources available to them through the CARES Act and have identified financial barriers (66%) to be the most common while language barriers (22%) were the least common.

## Conclusion

Based on the findings, it is evident that a lot of work needs to be done to facilitate efficient transportation, provide mental health services, and make appointments more convenient for these patients. Most of the providers surveyed identified a lack of education and understanding among their patients to access resources under the CARES Act. This revelation indicates a need for providing an outreach and education department to ensure that patients are aware of their options



and resources. Furthermore, financial barriers were the most common, which lends to a bigger picture of institutional and governmental resources in curbing this huge disparity, which was seen more so during the Covid 19 pandemic. Language barriers proved to be the least common barrier faced by these patients, begging the question of if there are a huge population of immigrants in this patient population, or if the facility has well mitigated these issues by providing efficient means of translation for the non-native English speakers.

Primary Presenter: Carson Platnick

Project Title: *Adipose Insulin Resistance Relates to Perturbed Renal Hemodynamics in Obese Youth with and without Type 2 Diabetes*

Primary Mentor: Petter Bjornstad

Thematic Area: Clinical Science

Abstract: Our objective was to compare renal hemodynamic function between obese youth with and without type 2 diabetes (T2D) and relate these measures to adipose insulin resistance (IR).

We assessed insulin sensitivity and kidney function in obese youth with (n=31, 15.8 ± 1.8 years, BMI 35.6 ± 6.6 kg/m<sup>2</sup>), and without (n=20, 15.3 ± 2.1 years, BMI 38.2 ± 7.4 kg/m<sup>2</sup>) T2D. A hyperglycemic clamp was performed with 20% dextrose to maintain mild hyperglycemia for 240 minutes. Free fatty acids (FFA) were measured at baseline and every 10 minutes during the steady state. FFA suppression (baseline FFA subtracted from steady state FFA) was used to estimate adipose IR. Iohexol and p-aminohippurate clearances were used to measure GFR and renal plasma flow, respectively. Renal hemodynamic parameters were calculated using Gomez equations.

FFA suppression was attenuated in youth with T2D compared to obese controls (55.6% vs. 92.1%, p<0.0001). Impaired FFA suppression was associated with higher intraglomerular pressure (r= -0.49, p=0.005), higher efferent arteriolar resistance, (r= -0.53, p=0.002) and higher renal vascular resistance (r= -0.59, p=0.0005).

Youth with T2D had impaired FFA suppression compared to obese controls, indicating adipose IR. Impaired FFA suppression was associated with perturbed renal hemodynamics, indicating a potential role for adipose IR in the development of early diabetic kidney disease.

Primary Presenter: Sarah Groover

Project Title: *Development and Distribution of a Know Your Rights Car Sticker*

Primary Mentor: Maurice Scott

Thematic Area: Public Health and Epidemiology

Abstract: Background: Police use of force is not a new phenomenon, and in certain situations may be necessary to protect themselves or the public. However, recent events in the United States have prompted several groups to declare that law enforcement's use of excessive force is a matter of public health. The most common reason for contact with the police is being a driver in a traffic stop.

Objective: While police reform is the only way to address the root problem, symptomatic treatment that focuses on educating and empowering people to know their rights when being stopped may save their life. This project seeks to outline the creation, testing, printing, and distribution of a Know Your Rights (KYR) car sticker.

Methods: Similar to an oil-change sticker on the driver's side windshield of the vehicle, the KYR sticker will be placed in an area easily viewable by the driver. The sticker will include a review of the driver's legal rights and responsibilities in the event of a traffic stop including but not limited to the right to remain silent, right to refuse search consent, right to a lawyer if arrested, and showing your driver's license and proof of insurance when requested.

Quantitative and qualitative data will be gathered using virtual interviews in order to evaluate

participant driving habits, experiences with law enforcement in a traffic stop, knowledge of rights and responsibilities during a traffic stop, and thoughts on the KYR car sticker.

Progress: We have received funding for this project in the amount of \$1500 from the Injury and Violence Prevention Center at the Colorado School of Public Health. We have also received IRB exemption status for the collection of data during focus groups and distribution events. We have partnered with the American Civil Liberties Union of Colorado, who have agreed to assist us with the design and legal aspects of the sticker. We have also had conversations with the Aurora Police Department to hear their input on this project.

Primary Presenter: Avalon Swenson

Project Title: *The Role of Religious Leaders in Public Health: Historically Informed Approaches to Promoting Novel Vaccinations and the Equitable Provision of Care*

Primary Mentor: Joshua Williams

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract: The rapid development and implementation of novel mRNA vaccines in response to the COVID-19 pandemic, and the accompanying vaccine hesitancy it has prompted, harkens to the discovery and subsequent distribution of cowpox vaccination throughout early 19th century England in the face of smallpox epidemics. As COVID-19 vaccination initially rates stalled and disparities in access broadened by race and ethnicity, creative partnerships were felt to be increasingly important to dispel vaccination myths and promote health equity. Faced with a similar crisis of confidence in the novel cow-pox vaccine in the early 19th century, Reverend Rowland Hill befriended Edward Jenner and became an ardent cow-pox vaccination advocate and public health practitioner. Hill sought to (1) educate diverse English communities on the benefits of proper vaccination, (2) engage clergy as influential community-based vaccination advocates and providers, and (3) increase vaccination equity. Importantly, his efforts contributed to the decline of smallpox in 19th century England. Today, his example should continue to instruct public health practitioners and community leaders. However, gaps exist in current literature to tie together the historical anti-vaccination movement in the context of novel vaccines and the role that religious officials can have in public health efforts. This paper will address that

gap and describe how vaccination advocates can learn from Hill€™s context and example to defend COVID-19 vaccines against anti-vaccination rhetoric, engage community leaders as advocates, and increase vaccination access. Ultimately, Hill€™s success in propagating a novel cow-pox vaccination throughout pre-Victorian England is an encouragement that coordinated campaigns can overcome hesitancy, engage community leaders, and promote vaccine equity.

Primary Presenter: Sarah Nofal

Project Title: *A Retrospective Analysis Investigating Racial Bias in Police Encounters at a Medical Research University*

Primary Mentor: Regina Richards

Thematic Area: Public Health and Epidemiology

Abstract: Introduction

Black and Hispanic/Latino individuals are disproportionately represented in law enforcement encounters that result in health and socioeconomic disparities. We aim to investigate racial/ethnic disparities in police encounters and arrests in a public university setting at the University of Colorado<sup>ETMs</sup> (CU) Anschutz Medical Campus in Aurora, Colorado.

Methods

We performed a retrospective analysis of 5118 Anschutz CU police encounters from 2010 to 2019. Data was collected from police encounters documented by the campus police department. We evaluated for associations between race/ethnicity with proportions of arrest and the type of crime committed during police encounter. We calculated risk ratios (RR) with 95% confidence intervals (CI) using Poisson regression.

Results

13.2% of police encounters resulted in arrests. Black and Hispanic/Latino individuals were 1.52 and 1.41 times more likely to have an encounter lead to arrest compared to White individuals,



respectively after adjusting for age, sex, crime classification, and reason for being on campus.

Black individuals were 7.79 times more likely to be arrested for a suspicious incident and American Indian/Alaskan Native individuals were 5.5 times more likely to be arrested for an assault than White individuals. American Indian/Alaskan Native, Black and Hispanic/Latino individuals were more likely to be arrested if they were unaffiliated with the campus.

### Conclusion

Black and Hispanic/Latino individuals are at higher risk of arrests than White individuals at a public research university and medical campus setting. Disparities in arrest rates in racial and ethnic minorities at a research University may result in increased mistrust with health and medical institutions.

Primary Presenter: Rita Molem

Project Title: *Just-in-Time Simulation-Based Mastery-Learning for Internal Medicine Residents in Primary Care Procedures*

Primary Mentor: Brandon Fainstad

Thematic Area: Clinical Science

Abstract: Internal medicine clinical practice often necessitates invasive bedside procedures.

However, there remains to be a lack of a standardized assessment process in resident education that determines proficiency or readiness to perform procedures autonomously. The methods and quality of resident procedural training are highly variable. Subsequently, this gap creates a deficit in the procedural proficiency of graduating residents, along with logistical and liability challenges for their credentialing process as fully licensed providers. It has been suggested that simulation-based mastery learning (SBML) enhances resident procedural performance, long-term retention, and patient outcomes. The incorporation of Just-In-Time (JiT) and Just-in-Place (JiP) training may further enhance these benefits. In the context of office-based procedures, utilizing a combination of Just-In-Time and Just-In-Place simulation-based mastery learning has yet to be adequately studied. To address this, our team has a single-blinded randomized control trial underway to evaluate the impact of such training on four commonly performed internal medicine primary care procedures within an established resident procedure clinic.

Resident procedural confidence can be bolstered by the learning opportunities and education provided to them. This study aims to investigate the effects of JiT and JiP SBML on resident

procedural performance, patient experience, and intraprocedural cognitive load. Other ultimate goals are to demonstrate the low-cost feasibility and reproducibility of implementing such a program as well as developing a standardized procedural proficiency assessment tool for theoretically assessing resident readiness. My personal interest in this mentored scholarly activity is born from having a passion for procedures and appreciating firsthand that practice can play a role in alleviating anxiety when performing them.

Primary Presenter: Cheril Patel

Project Title: *Improving Discharge Coordination for Abscess Drain Patients*

Primary Mentor: Samuel Porter

Thematic Area: Clinical Science

Abstract: The hospital discharge process is known to be a vulnerable period for patients with a high potential for medical errors, including completing recommended imaging post-discharge.

We aim to improve missed follow-up imaging following hospital discharge for patients with abscesses that require outpatient management of drains. We identified an initial data set showing a 40% 30-day readmission/ED visit rate & a 67% error/near miss rate within the patient population and proceeded to complete PDSA cycles to improve these rates. We have completed 1 PDSA cycle with the implantation of a transition of care coordinator and specific AVS material for required follow-up imaging. This resulted in a similar 30-day readmission/ED visit rate & a lower error/near miss rate of 50%. Further PDSA cycles are currently being done to continue decreasing readmission and ED visit rates and errors.

Primary Presenter: Ellie Rhodes

Project Title: *Inpatient Management of Infectious Keratitis at Denver Health Medical Center*

Primary Mentor: Michael Chen

Thematic Area: Public Health and Epidemiology

Abstract: Inpatient Management of Infectious Keratitis at Denver Health Medical Center

Ellie Rhodes<sup>1</sup>, Anne Strong Caldwell<sup>1</sup>, Nihaal Mehta<sup>1</sup>, Michael Chen<sup>1</sup>

<sup>1</sup> Ophthalmology, Sue Anschutz-Rodgers Eye Center, University of Colorado Anschutz Medical Campus, Aurora, Colorado, United States

Purpose:

Infectious keratitis (IK) is a painful and vision threatening condition caused by a variety of organisms. The American Academy of Ophthalmology preferred practice pattern recommends large or visually significant ulcers are treated with two fortified topical antibiotics with a loading dose of drops, followed by hourly instillation. IK is typically treated as an outpatient, however, a subset of patients require inpatient admission. Little research has examined the reason for admission or visual outcomes. At Denver Health Medical Center, a safety net hospital system, the hourly drop requirement necessitates admission to the intensive care unit, representing a

significant use of resources. This study characterizes reason for admission and outcomes in patients requiring hospitalization for management of IK.

#### Methods:

All patients admitted to Denver Health for primary treatment of IK between January 1, 2017, and December 31, 2022, were included. This study was exempt from the Colorado Multiple Institutional Review Board Review due to the retrospective nature and was conducted in compliance with the Declaration of Helsinki. A database was created which included information on demographics, ocular and medical risk factors associated with IK, treatment, reason for admission, presenting and final visual acuity (VA), organism identified by culture, and size of ulcer at admission. Patients admitted for an alternate medical problem with concurrent IK treatment were excluded.

#### Results:

After exclusion criteria was applied, 15 patients and 18 admissions were included for analysis. Concern for drop compliance in an outpatient setting was the most common reason for admission (followed by demonstrated lack of compliance in an outpatient setting. Average length of stay

was 7 days  $\pm$  5.72. The majority of patients (73%) were seen at least once after discharge. Of patients seen at DHMC for follow-up, 33% had VA of 20/200 or better and 33% of patients had improved VA compared to VA on admission.

#### Conclusion:

This study sought to categorize characteristics of IK managed by inpatient admission. At Denver Health, there is significant resource utilization due to ICU admission, highlighting the importance of risk factor identification and consideration of social barriers when managing . Alternate treatment approaches including the use of subconjunctival antibiotics should be evaluated as a viable treatment option for IK.

Primary Presenter: Yaswanth Chintaluru

Project Title: *Title: Combination of glutamic acid decarboxylase (GAD) gene therapy and deep brain stimulation (DBS) into the subthalamic nucleus (STN) in Parkinson's disease (PD)*

Primary Mentor: Drew Kern

Thematic Area: Clinical Science

Abstract: **Objective:** The purpose of this study is to determine the outcomes of patients who received GAD gene therapy treatment and subsequently underwent DBS for Parkinson's Disease.

**Background:** Several therapies for Parkinson's disease (PD) target brain function via electrical stimulation or gene infusion. We conducted a retrospective analysis of PD patients that participated in a gene therapy trial via stereotactic injection of adeno associated viral (AAV)-mediated delivery of GAD (glutamic acid decarboxylase). We studied the outcomes of a subset of patients who did not benefit adequately from GAD gene therapy and subsequently underwent subthalamic nucleus (STN) deep brain stimulation (DBS).

**Method:** This study focuses on 4 patients from the gene therapy study who received GAD gene therapy and later underwent DBS. Data at baseline and at 3-, 6-, and 12-months post GAD and DBS were collected from this subset of patients. Analysis was performed in three conditions: pre surgical treatment (pretreatment), upon receiving GAD (post GAD), and upon subsequent DBS (post GAD+DBS). Potential effects were assessed via the MDS-Unified Parkinson's Disease Rating Scale Part III and levodopa equivalent daily dose (LEDD).



Results: ANOVA analysis of compressed time points for Pre-GAD and Post GAD+DBS of LEDD and UPDRS patient data were performed. Results yield significant differences between Pre- GAD and Post GAD+DBS for LEDD ( $p=.027$ ) and UPDRS off medication ( $p=.079$ ), but not UPDRS on medication ( $p=.414$ ) scores. LEDD Dunn-Šidák post-hoc analysis found significant differences between Pre-GAD vs. Post GAD+DBS at 3- ( $p=.041$ ), 6- ( $p=.06$ ), and 12-month time points ( $p=.018$ ). LEDD Dunn-Šidák post hoc analysis also revealed significant differences between Post GAD vs. Post GAD+DBS at the 12-month timepoint ( $p=.006$ ). UPDRS on medication score Dunn-Šidák post hoc analysis found that there were significant differences between Post GAD 12 month vs. Post GAD+DBS at 6( $p=.041$ ) and 12-month timepoints ( $p=.036$ ).

Conclusion: The clinical effects of combining GAD gene therapy and DBS have not been fully assessed. In this subset of patients treated with GAD gene therapy and subsequent STN-DBS, UPDRS scores and LEDD scores show improvements after combined treatment compared to pretreatment baseline and to post GAD treatment measures. Positive outcomes in patients receiving both therapies suggest the treatments are compatible.

Primary Presenter: Benjamin Wharton

Project Title: *The Effects of Obstructive Sleep Apnea Risk on Post-Operative Recovery Following Rotator Cuff Repair*

Primary Mentor: Eric McCarty

Thematic Area: Clinical Science

Abstract: Abstract

Background: Rotator cuff injuries are the most common tendon injury in the adult population affecting nearly 30% of adults over the age of 60 years. Obstructive Sleep Apnea (OSA) is a similarly common condition that is characterized by repeated episodes of respiratory pathway obstruction throughout a period of sleep. OSA has been shown to worsen patient reported outcomes post-surgery.

Purpose: The purpose of this study was to determine whether patients at high risk for OSA experience worse outcomes after surgical treatment for rotator cuff repair via a retrospective cohort study.

Methods: Included patients completed STOP-BANG surveys in which scores greater than 3 were considered high risk for OSA as per standard guidelines (Chung 2016). Five mixed model repeated measures ANCOVAs were performed for five different outcome measures: VAS pain scores, SANE scores, VR-12 mental and physical scores, and total ASES scores, measured pre-operatively, 3 months, 6 months, and 1 year post-operatively.

Results: There was a significant group by time interaction for the Veterans Rand (VR)-12 mental scores ( $F = 3.66$ ,  $p = .0128$ ): scores consistently increased over time for patients at high risk of OSA, while patients at low risk of sleep apnea did not exhibit a significant difference post-operatively. There was a significant group effect, time effect ( $F = 56.59$ ,  $p < .0001$ ), group by time interaction, and effect of BMI on the VR-12 physical scores. Patients at high risk of OSA had on average lower scores by 3.35 points ( $F = 7.27$ ,  $p = .0076$ ). While scores increased on average over time for patients at low risk and high risk of OSA, patients at low risk showed a quicker and greater improvement overall ( $F = 4.36$ ,  $p = .005$ ), while patients with a higher BMI performed significantly worse ( $F = 6.76$ ,  $p = .01$ ).

Conclusions: Our findings suggest that rotator cuff repair (RCR) in patients at high-risk of obstructive sleep apnea (OSA) can expect similar improvements in patient reported outcomes (PROs) of shoulder function and shoulder pain; while in some cases, greater improvements in mental health at 1 year post-operatively, compared to their low-risk counterparts. However, in contrast to their low-risk counterparts, our results suggest that patients at high risk of OSA cannot expect similar improvements in physical health one-year post RCR. Hence, orthopedists should take into consideration that while high-risk OSA patients can anticipate achieving similar levels of recovery following RCR, their progress towards these results may be markedly slower for certain parameters of recovery.



Primary Presenter: Kevin Kamel

Project Title: *Surveying Student Health Professionals to Assess Source of Information Utilization early*

Primary Mentor: Robert Dellavalle

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract: Abstract:

Background:

During the COVID-19 pandemic, news outlets and social media were

utilized as extensive methods for the dissemination of information about the pandemic,

identification of new scientific studies, and sharing of diagnostic and treatment options.

However, it is exceedingly vital to ensure that the information derived from these

sources is accurate, peer-reviewed, and obtained from a reliable source. For example,

although social media can have numerous advantages, it can portray information that is

not current, exaggerated, or falsified. This can induce fear, stress, and invalid

perceptions regarding the COVID-19 virus. It is of the utmost importance for healthcare

professionals to obtain their information from reliable sources. Healthcare professionals

have a predominant role in relaying information to patients, providing necessary

treatment, and minimizing the spread of the virus. Therefore, inaccurate information can have dire effects. Our study aims to investigate the information sources utilized by students in healthcare professions and the extent to which students feel like they are well-informed.

#### Methods:

Survey questions were developed to assess student attitudes, perceptions, and behaviors surrounding the pandemic and were provided to participants in April 2020 after review and approval by educational offices at the University of Colorado Anschutz Medical Campus. The questionnaire was delivered anonymously through the Qualtrics platform. Dental, Graduate, Medical, Nursing, Physician Assistants, Pharmacy, and School of Public Health students responded to the survey (total n=302). Self-reported Likert scale frequencies of COVID-19 information source usage were analyzed by student age group, gender, training program, how well-informed students felt about COVID-19, and minutes spent per day learning about the pandemic in the month leading up to the survey using Pearson's chi-squared. Significant correlations warranted

further examination.

## Results:

How well-informed students felt was significantly correlated with gender ( $p=0.01$ , men were more likely to feel informed) and greater time spent per day on COVID-19 learning ( $p=0.0003$ ).

More time spent was significantly correlated with older age ( $p = 0.02$ , more students age 31 and older dedicated  $>40$  minutes/day to learning about the virus), reading local public health department updates ( $p=0.009$ ), government/Centers for Disease Control updates ( $p=0.02$ ), and studying coronavirus-related coursework ( $p=0.01$ ). Older students were also more likely to read newspapers ( $p = 0.0002$ ) and scientific literature ( $p = 0.0002$ ) for information, and less likely to use social media ( $p = 0.01$ ) or rely on friends and family ( $p = 0.001$ ). Women were slightly more likely to consult friends and family as a source of COVID-19 news ( $p =0.01$ ). Lastly, MD program students more often utilized coursework ( $p=0.0004$ ) and other healthcare professionals ( $p=0.0003$ ) as resources, as compared to students in other training programs.

Conclusion: Assessing sources of information student healthcare professionals utilize is paramount due to their future roles of promoting wellness and preventing disease. Our results indicate that gender and age play a significant role in feeling more informed and time spent

learning about COVID-19, respectively. Training program also had an impact on sources of information used. Further research can be done to identify ways to make reliable sources more accessible to healthcare professionals.



Primary Presenter: Sydney Tyler

Project Title: *Mixed Methods Evaluation of the Impact of the COVID-19 Pandemic on Immigrant Families*

Primary Mentor: Lisa DeCamp

Thematic Area: Public Health and Epidemiology

Abstract: Introduction: Little is known about the experiences of immigrant families with COVID-19 illness. This mixed methods study compared child and household experiences at the time of a child's COVID-19 diagnosis between immigrant and US-born parents and explored immigrant Latino perspectives on underlying causes of COVID-19 disparities between immigrant and US-born families.

Methods: Study data includes surveys of parents of a child with a positive SARS-CoV2 test resulting at Children's Hospital Colorado and focus groups with Latino immigrant adults. We compared household COVID-19 experiences, use of mitigation measures, vaccine intention and sociodemographic information between survey participants stratified by nativity and completed thematic qualitative data analysis.

Results: Findings from quantitative data were reinforced by qualitative data including: lower socio-economic status and higher employment in essential services increased infections and spread in immigrant families and higher risk of limited information access related to language barriers and prevalent misinformation. Survey results showed no difference in COVID-19

vaccine intention by nativity. Focus group participants reported limited access to non-English language culturally-tailored vaccine information and competing work demands decreased uptake.

Conclusion: Avoiding exacerbating disparities in the face of another public health emergency requires focused investments in policies and approaches specifically directed at immigrant communities.

Primary Presenter: Lisa Viltz

Project Title: *Investigating the Role of ApoE in Alzheimer's Disease*

Primary Mentor: Dr. Noah Johnson

Thematic Area: Basic Biomedical Science

Abstract: Alzheimer's disease (AD) is a neurodegenerative disease and the most common form of dementia, characterized by impairment of memory and cognition. The etiology of AD remains unknown, however primary pathological features identified during disease progression include extracellular amyloid- $\beta$  ( $A\beta$ ) plaques, intracellular neurofibrillary tau tangles, synapse deterioration, neurodegeneration, and neuronal death. Apolipoprotein E (ApoE) is a cholesterol carrier that plays an important role in  $A\beta$  metabolism. Inheritance of certain ApoE polymorphic variants is a major genetic determinant of developing sporadic AD. There are three allelic variants of ApoE in humans: E2, E3, and E4. Individuals carrying the E2 allele have a two-fold decreased risk of AD, whereas carriers of one copy of the E4 allele have a three- to five-fold increased risk of AD, and those with two copies of E4 allele have an over ten-fold increased risk of AD compared to carriers of the E3 "normal" allele. Evidence suggests that ApoE isoform-dependent clearance and aggregation of  $A\beta$  accounts for the varying degrees of AD risk associated with inheritance of each allele. Current models propose that ApoE4 binds to  $A\beta$  and catalyzes its conversion to toxic  $A\beta$  filaments, leading to eventual neurodegeneration and cell death. Due to the critical contribution of ApoE to AD pathogenesis, future therapies targeting ApoE activity may be effective for alleviating or preventing AD progression. Through the use of

cerebral organoids and ApoE4 assay screening, we will investigate potential molecules that target ApoE4 and have potential therapeutic function through the disruption of ApoE activity.

Primary Presenter: Natasha Garamani

Project Title: *Exposure of Medical Students to Topics of Interpersonal Violence in Medical Education: A Scarcity of Training*

Primary Mentor: Steven Lowenstein

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract: Interpersonal violence (IPV) has become increasingly prevalent during the COVID-19 pandemic, and reporting rates have decreased due to increased social isolation. Thus, it is all the more important that physicians feel confident having conversations surrounding IPV and offering support to survivors. We hypothesize that current medical education is lacking in IPV exposure, and that said exposure would help physicians more confidently discuss and offer support to IPV survivors. To investigate this, we conducted a literature review. The National Institute of Health database PubMed and the American Association of Medical Colleges™ journal database MedEdPortal were searched for articles. Search terms included “domestic violence,” “intimate partner violence,” “interpersonal violence,” “medical education,” “trauma-informed care,” and “trauma physician training.” Any article prior to the year 2000 was not included in the search. Article abstracts were scanned for relevance and rigor with opinion pieces and narrative articles excluded. Overall, we found that current medical education exposure to IPV entails single case-based sessions or lectures with no continuity. The studies on the efficacy of such sessions were therefore limited; however, the best outcomes were

achieved when experiential learning was incorporated (beyond simple didactics) and when community resources were involved. Thus, we have identified a lack of longitudinal IPV exposure and a paucity of effective pedagogical methods in IPV training.

Primary Presenter: Sameer Andani

Project Title: *Proof of Concept Clinical Decision Support Tool for Chronic Rhinosinusitis Assists Providers in Guiding Patients Considering Endoscopic Sinus Surgery*

Primary Mentor: Vijay Ramakrishnan

Thematic Area: Clinical Science

Abstract: BACKGROUND

Chronic Rhinosinusitis (CRS) is an inflammatory condition of the paranasal sinuses which is defined by conditions that last greater than 12 weeks despite treatment. If treatments such as antibiotics fail, endoscopic sinus surgery is recommended. Discussing the risks and benefits of surgery requires patient understanding, risk to benefit presentation, and shared decision making between the patient and physician. This study examines the efficacy of a web-based clinical decision support to aid patients considering surgical intervention for chronic rhinosinusitis.

METHODS

A web based clinical decision support tool was creating using R- Shiny apps. The tool uses a mock random-forest based machine learning algorithm with SNOT-22 score as the outcome metric. Surveying of the tool's utility was conducted using the System Usability Scale, Likert based survey questions used in previous clinical decision support tool creations, and optional free-text input for additional comments.

RESULTS

Rhinologists across the nation who perform endoscopic sinus surgeries were surveyed to gauge efficacy of the tool. A total of 9 rhinologists responded to the survey. Survey data indicated that 8/9 participants agreed that they would use the tool frequently, 9/9 thought the tool was easy to use, and 5/9 agreed that the tool would improve clinical decision making and patient care.

## CONCLUSION

In conclusion, the web-based clinical decision support tool created in this study was found to be easy to use and effective in improving clinical decision making and patient care for patients considering surgical intervention for chronic rhinosinusitis. The tool was also well-received by rhinologists, with 8/9 participants agreeing that they would use the tool frequently and 9/9 agreeing that the tool was easy to use. These findings suggest that the tool has the potential to be a valuable tool for rhinologists and patients in making informed decisions about CRS treatment. However, further optimization of the backend algorithms that power the tool should be incorporated when available.



Primary Presenter: Carly Setterberg

Project Title: *Development of H5P Interactive Learning Modules for Medical Education and the Comparison of Student Perception, Satisfaction, and Performance*

Primary Mentor: Danielle Royer

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract: Introduction: Over the past several decades, medical schools across the globe have transitioned from traditional medical school curricula to curricula emphasizing active- learning through problem-based learning and flipped classroom models. In the past, PowerPoint presentations were used in the University of Colorado School of Medicine anatomy block to present the cardiovascular and lymphatic systems. With the curriculum reform starting for the class of 2025, the former “circulatory tools” no longer align with course objectives, thus fostering the need for new, active learning prework focusing on cardiovascular, lymphatic, and nervous systems. The purpose of this study is to implement interactive pre-work modules that align with the Trek Curriculum (TC), assess medical student perception and satisfaction with H5P interactive pre-work modules in the preclinical curriculum, and utilize the data for quality improvement.

Methods: H5P, an online platform used to create, share, and reuse HTML5 content was used to create weekly, interactive modules aligning with the University of Colorado School of Medicine’s TC learning objectives. Each week, learning objectives were placed into four

categories: nervous system, cardiovascular system, regional anatomy, and other. Weekly modules for each category were created using a variety of H5P content types including interactive video, branching scenarios, and interactive books with “accordion” books, layered “agamatto” images, image hotspots, fill in the blank, drag and drop, multiple choice, and mini quizzes. Analytics were continuously captured through H5P and analyzed for student performance. To assess student perception, open-text responses from weekly surveys were collected and categorized to create a qualitative thematic analysis. Feedback was de-identified, evaluated, and utilized to edit and improve pre-work modules to continuously create a user-friendly, engaging experience for medical students.

Results: Open-text feedback submitted in weekly and end-of-course surveys fell into three general themes: user experience, content structure and relevance, time management, and learning preferences. Overall, students shared that the prework successfully introduces the material before lecture and enhances their comprehension of basic cardiovascular, nervous, and regional anatomy topics; however, there were concerns about the relevance of prework to the week's material and appropriate time management to complete the pre-work. Students favored tools that were simple to understand and engage with, had explicit instructions, were visually appealing,

and promoted active learning. Modules that seemed repetitive, had more complex instructions, and required lower levels of engagement were viewed less favorably.

Discussion: Literature review, H5P analytics, and student feedback suggest that introducing complex concepts in medicine through interactive learning modules is an effective way to increase student engagement and perceived comprehension of these concepts. As H5P modules are self-paced and self-directed, it is not possible to prevent students from either clicking through the modules without any engagement or spending additional time with the material. In addition, utilizing optional, free-text responses from students does not offer an adequate assessment of all students' perceptions. Future research should analyze performance on prework modules in comparison to exam scores testing the same learning objectives and assess the effectiveness of individual H5P content types in conveying complex anatomy concepts.

Primary Presenter: Lilia Maeda

Project Title: *The Efficacy of Pre-lab Assignments in First Year Medical Student Gross Anatomy*

Primary Mentor: Danielle Royer

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract: The Efficacy of Pre-Lab Assignments in First-Year Medical Student Gross Anatomy

## ABSTRACT

Introduction: Over the past several decades, medical schools across the globe have transitioned from traditional medical school curricula to curricula that emphasize active-learning through problem-based learning and flipped classroom models. Current research supports the use of pre-lecture assignments for improving student learning outcomes, long-term retention, student confidence, and promotes self-regulated behaviors (Dunlosky et. al., 2003). While the University of Colorado School of Medicine (CUSOM) has no precedence for using pre-lab assignments for human gross anatomy, this project aims to implement interactive pre-work modules that align with the Trek Curriculum (TC) and assess the efficacy of the pre-assigned material qualitatively, via medical student perception and satisfaction with the learning modules, and quantitatively by evaluating student exam learning outcomes.

Methods: Learning objectives (LOs) were placed into four anatomic categories: nervous system, cardiovascular system, regional anatomy, and other, delivered weekly through the online

program H5P. Using a variety of H5P content types, modules were delivered with clear objectives that aligned with course content, integrated active recall and spaced repetition, and was graded for completion. To assess student perception, open-text responses from weekly surveys were collected and categorized to create a qualitative thematic analysis. Feedback was de-identified, evaluated, and utilized to edit and improve pre-work modules with the goal of continuously creating a user-friendly, engaging experience for medical students. To assess student learning outcomes, analytics were continuously captured through H5P and analyzed for student performance. While students were only graded for completion, a cut-off score on the end-of-assignment quiz of 60% was used as the benchmark for appropriate module interaction for analytical purposes.

Results: Open-text feedback submitted in weekly and end-of-course surveys fell into three general themes: user experience, content structure and relevance, time management, and learning preferences. Overall, students shared that the prework successfully introduces the material prior to lecture and enhances their comprehension of basic cardiovascular, nervous, and regional anatomy topics; however, there were concerns about the relevance of prework to the week's material and appropriate time management to complete the pre-work. Students favored tools that were simple to understand and engage with, had explicit instructions, were visually appealing, and promoted active learning. Modules that seemed repetitive, had more complex instructions, and required lower levels of engagement were viewed less favorably. From a quantitative

perspective, it was found that student interaction with pre-assigned learning appears to decrease with curriculum progression. Throughout the curricular year as students progressed through each of the anatomical systems, the number of students obtaining >60% on the end of assignment quizzes began to noticeably decrease with each system. Plotting this data on a linear curve reveals a moderate negative correlation ( $R=0.79$ ) between progression through the curriculum and students obtaining >60%.

Conclusions: Literature review, H5P analytics, and student feedback suggest that introducing complex concepts in medicine through interactive learning modules is an effective way to increase student engagement and perceived comprehension of these concepts. As H5P modules are self-paced and self-directed, it is not possible to prevent students from either clicking through the modules without any engagement or spending additional time with the material. In addition, utilizing optional, free-text responses from students does not offer an adequate assessment of all students' perceptions. Future research should analyze performance on pre-work modules in comparison to exam scores testing the same learning objectives and assess the effectiveness of individual H5P content types in conveying complex anatomy concepts. From a quantitative standpoint, student interaction with pre-assigned learning appears to decrease with curriculum progression with a moderate negative correlation suggesting that as the students progress through the curriculum, they began to "click through" the module more frequently. There are many factors that may contribute to this finding including increasing student workload with intra-

curricular and extracurricular activities, increasing burnout, decreased perceived usefulness of the module and thus decreased module interaction, or increased cognitive load.

Primary Presenter: Daniel Bollinger

Project Title: *Stray Energy Injury During Robotic Versus Laparoscopic Inguinal Hernia Repair: A Randomized Clinical Trial*

Primary Mentor: Edward Jones

Thematic Area: Clinical Science

Abstract: **Background:** Stray energy transfer from monopolar instruments during laparoscopic surgery is a recognized cause of potentially catastrophic complications. There are limited data on stray energy injuries in robotic surgery. We sought to characterize stray energy injury in the form of superficial burns to the skin surrounding laparoscopic and robotic trocar sites. Our hypothesis was that stray energy burns will occur at all laparoscopic and robotic port sites.

**Methods:** We conducted a prospective, randomized controlled trial of patients undergoing elective unilateral inguinal hernia repair at a VAMC over a 4-year period. Surgery was performed via transabdominal preperitoneal approach either laparoscopic-assisted (TAPP) or robotic-assisted (rTAPP). A monopolar scissor was used to deliver energy at 30W coagulation for all cases. At completion of the procedure, skin biopsies were taken from all the port sites. A picro-Sirius red stain was utilized to identify thermal injury by a blinded pathologist.

**Results:** Over half (54%, 59/108) of all samples demonstrated thermal injury to the skin. In the laparoscopic group, 49% (25/51) samples showed thermal injury vs. 60% (34/57) in the robotic group ( $p = 0.548$ ). The camera port was the most frequently involved with 68% (13/19) rTAPP samples showing injury vs. 47% (8/17) in the TAPP group ( $p = 0.503$ ). There was no difference



in the rate of injury at the working port site (rTAPP 53%, 10/19 vs. TAPP 47%, 8/17;  $p = 0.991$ ) or the assistant port site (rTAPP 58%, 11/19 vs. TAPP 53%, 9/17;  $p = 0.873$ ).

Conclusions: Stray energy causes thermal injury to the skin at port sites in the majority robotic laparoscopic TAPP inguinal hernia repairs. There is no difference in stray energy transfer between the laparoscopic and robotic platform. This is the first study to confirm in-vivo transfer of stray energy during robotic surgical procedures. More study is needed to determine the clinical significance of these thermal injuries

Primary Presenter: Katie Martin

Project Title: *Prospective Validation of the Venous Excess Ultrasound (VExUS) Score*

Primary Mentor: Edward Gill

Thematic Area: Clinical Science

Abstract:

Prospective Validation of the Venous Excess Ultrasound (VExUS) Score

\* MARTIN 1, A. LONGINO 1 and E. GILL<sup>2</sup>

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## BACKGROUND

Venous congestion is an under-appreciated contributor to mortality in critically ill patients and is difficult to quantify. Right heart catheterization (RHC) is the gold standard for assessing venous congestion. RHC is invasive, costly, and is not universally available. The VExUS Score is a novel noninvasive means of determining venous congestion using ultrasound measurement of the

inferior vena cava (IVC) and of the hepatic vein, portal vein, and intra-renal venous Doppler waveforms<sup>1</sup>. While VExUS was validated retrospectively against RHC, it was not validated prospectively. We performed a prospective analysis of VExUS against RHC measurements: right atrial pressure (RAP), mean pulmonary artery pressure (mPAP), and pulmonary capillary wedge pressure (PCWP).

## METHODS

81 patients undergoing RHC for a wide variety of indications at Denver Health Medical Center underwent VExUS examination. Investigators were blinded to RHC data during VExUS scoring. We manually abstracted past medical history, demographic information, and echocardiogram data from patient charts. Multivariable linear regression was used to assess the relationship between VExUS and RAP, mPAP, PCWP and NT-ProBNP, controlling for age, sex, and Charlson Comorbidity Index.

## RESULTS

After controlling for age, sex, and Charlson Comorbidity Index, there was a linear association between VExUS Grade and: Right Atrial Pressure (RAP), Pulmonary Capillary Wedge Pressure

(PCWP), and Mean Pulmonary Artery Pressure (mPAP). After controlling for age, sex, and common comorbidities, we observed a significant positive association between RAP and VExUS grade ( $P < 0.001$ ,  $R^2 = .68$ ). VExUS had a favorable AUC for prediction of a RAP  $\geq 12$  mmHg (0.99, 95% CI 0.96-1) compared to IVC diameter (0.79, 95% CI 0.65-0.92).

## CONCLUSIONS

VExUS is a promising noninvasive tool for accurately assessing venous congestion. A safer and more accessible alternative to right heart catheterization for assessing venous congestion.

Primary Presenter: Jonathan Repine

Project Title: *Hyperglycemia in Critically Ill Patients*

Primary Mentor: Ana Fernandez-Bustamante

Thematic Area: Basic Biomedical Science

Abstract: Despite a high amount of medical monitoring in one of the highest levels of care in the hospital, Acute Hyperglycemia still occurs in critically ill patients. Reasons for and consequences of acute hyperglycemia in this fragile patient population are complex.

Controversy exists regarding what the exact treatment regimen should be because there is conflicting data from large clinical trials the most recent of which is in the NICE-SUGAR study (2009). This paper reviews why controversy still surrounds treatment of acute hyperglycemia and how severe hypoglycemia is theorized to be the primary confounder of large clinical trials. I have compiled and analyzed the preliminary data in a rat model to show that treating hyperglycemia while avoiding severe hypoglycemia in an acute lung injury rat model can improve markers of lung injury, which may warrant future clinical trials with a stricter definition of acute hypoglycemia. The data was presented at the Western Society of Clinical Research in Carmel, California in 2021. There is an ongoing need to further investigate and gain additional understanding of proper control of blood glucose levels in hospitalized patients to improve patient morbidity and mortality.

Primary Presenter: John Precoda

Project Title: *Pain Reprocessing Therapy: A Literature Review*

Primary Mentor: Daniel Goldberg

Thematic Area: Clinical Science

Abstract: Research conducted on the alleviation of chronic pain offers a pathway to substantial societal benefits across social, financial, and emotional dimensions. In 2016, the Centers for Disease Control and Prevention (CDC) sought to evaluate the financial implications of chronic pain, estimating its annual contribution to be around \$560 billion (Dalhamer et al., 2016). Pain Reprocessing Therapy (PRT) offers a fresh perspective on chronic pain management. This therapeutic approach entails guided reassessment of pain sensations in various contexts, coupled with interventions targeting psychosocial factors that could intensify pain perception. Moreover, PRT integrates methods to bolster positive emotions and cultivate self-compassion (Ashar et al., 2022). This literature review will delve into the current research being performed on the novel field of PRT and compare it to extant mind-body therapies that aim to improve chronic pain. This literature review employed PubMed, Google Scholar, and ScienceDirect databases, utilizing search queries related to Pain Reprocessing Therapy (PRT) and other established mind-body therapies for pain. Relevant search terms included "Pain reprocessing therapy," "Mind-body pain therapy," "Forms of chronic pain," and "Central sensitization." Only papers published between 2000 and the current year were considered, and only those with full-text availability were included in the review. The initial randomized control study on Pain Reprocessing Therapy

(PRT) demonstrated statistically significant improvement in lower back pain compared to placebo or usual care (Ashar et al., 2022). However, the study's limitations included a small sample size of only 50 individuals in the control arm and a homogeneous study group. Future research in the field of PRT will require enhancements in sample size, generalizability, and inclusion of other forms of chronic pain.

Primary Presenter: Rose Castle

Project Title: *Sleeve Gastrectomy for Liver Transplant Candidates with Obesity and Non-Alcoholic Steatohepatitis*

Primary Mentor: Trevor Nydam

Thematic Area: Clinical Science

Abstract: Sleeve Gastrectomy for Liver Transplant Candidates with Obesity and Non-Alcoholic Steatohepatitis

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Introduction:

Non-alcoholic steatohepatitis (NASH) is one of the leading indications for liver transplantation (LT) in the United States. As with the current obesity epidemic, the incidence of NASH continues to rise. However, the impact of broad utilization of metabolic and bariatric surgery (MBS) for patients with NASH is unknown, particularly in regard to mitigating the need for LT.

Methods:

Markov decision modelling was performed to simulate the lives of 20,000 patients with concomitant obesity and NASH who were deemed ineligible to be waitlisted for LT unless they



achieved a body mass index (BMI)  $<35$  kg/m<sup>2</sup>. Life expectancy following medical weight management (MWM) and sleeve gastrectomy (SG) were estimated. Base case patients were defined as having NASH without fibrosis and a pre-intervention BMI of 45 kg/m<sup>2</sup>. Sensitivity analysis of initial BMI was performed. Model parameters were extracted from literature review.

#### Results:

Simulated base case analysis patients who underwent SG gained 14.3 years of life compared to patients who underwent MWM. One year after weight loss intervention, 9% of simulated MWM patients required liver transplantation compared to only 5% of SG patients. Survival benefit for SG was observed above a BMI of 32.2 kg/m<sup>2</sup>.

#### Conclusion:

In this predictive model of 20,000 patients with concomitant obesity and NASH, surgical weight loss is associated with a reduction in the progression of NASH, thereby reducing the need for LT. A reduced BMI threshold of 32 kg/m<sup>2</sup> for MBS may offer survival benefit for patients with obesity and NASH.

Primary Presenter: Margo Wohlfeil

Project Title: *The Role of CDK12 in Pediatric Medulloblastoma*

Primary Mentor: Rajeev Vibhakar

Thematic Area: Basic Biomedical Science

Abstract: Group 3 Medulloblastoma has the worst prognosis and outcomes largely due to its resistance to radiation and lack of alternative therapeutic targets. A CRISPR-Cas9 screen done on Group 3 MB cells identified that the cyclin dependent kinase CDK12 is up-regulated in Group 3 MB making it a potential therapeutic target. This study intends to confirm that Group 3 MB cells rely on CDK-12 for proliferation, and to show that inhibition of CDK12 using the drug E9 results in a decrease in proliferation of malignant cells. Additional work is needed to confirm the below results, however this study shows that CDK12 is a promising therapeutic target for Group 3 MB.