



University of Colorado **Anschutz Medical Campus**

## **35th ANNUAL STUDENT RESEARCH FORUM**

COLLEGE OF NURSING

GRADUATE SCHOOL

SCHOOL OF DENTAL MEDICINE

SCHOOL OF MEDICINE SCHOOL

OF PHARMACY SCHOOL OF

PUBLIC HEALTH

JANUARY 11, 2021  
ANSCHUTZ MEDICAL CAMPUS  
Virtual

35<sup>th</sup> ANNUAL  
UNIVERSITY OF COLORADO  
ANSCHUTZ MEDICAL CAMPUS  
STUDENT RESEARCH FORUM

Monday, January 11, 2021

**Poster Sessions**

1:00-2:00 pm

2:00-3:00 pm

4:30-5:30 pm

ANSCHUTZ MEDICAL CAMPUS  
Virtual

The Student Research Forum organizing committee wishes to acknowledge, with gratitude, the financial support for student research provided by:

**The University of Colorado Denver  
School of Medicine Dean's Office *And*  
Undergraduate Medical Education Office**

**Poster Session Judges**

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

Jill Alldredge  
Marsha Anderson  
Jennifer Armstrong  
Natarajan Balasubramanian  
Nirmal Banda  
Cathy Battaglia  
Traci Bekelman  
Aimee Bernard  
Shilpa Bhatia  
Manisha Bhide  
Sarah Billups  
Benjamin Bitler  
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Dany Gaillard  
Bonnie Gance-Cleveland  
Marsha K Guess  
Karen Hampanda  
Patricia Heyn  
Jacob Holzman  
Srividhya Iyer  
Meghan Jeffres  
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Samantha Stonbraker  
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Sarah Tevis  
Suhong Tong  
Stacy Trent  
Lori Walker  
Jeffrey Wong  
Junwang Xu

## **2020-2021 AMC Student Research Forum Award and Funding Donors**

The organizing committee is especially grateful to the following schools, departments, divisions, and programs for their generous contribution of financial support for the forum and/or a \$320 research prize awarded to the top scoring posters at the event.

Barbara Davis Center for Diabetes	Department of Orthopedics – Foot and Ankle Podiatry
Center for Bioethics and Humanities	Department of Otolaryngology
Center for Children’s Surgery	Department of Pediatrics
Center for Women’s Health Research	Department of Pediatrics – Hematology, Oncology, Bone Marrow Transplant
Colorado Clinical and Translational Sciences Institute	Department of Pediatrics – Section of Neonatology
Colorado Program for Skeletal Research	Department of Pharmacology
Colorado School of Public Health	Department of Physiology and Biophysics
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Department of Medicine	Department of Psychiatry – Child Division
Department of Medicine - CVP	Department of Radiation Oncology
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Department of Neurology	Immunology and Microbiology
Department of Obstetrics & Gynecology	Marcus Institute for Brain Health
Department of Obstetrics & Gynecology – Division of Gynecologic Oncology	School of Medicine
Department of Ophthalmology	School of Dental Medicine
Department of Orthopedics	School of Nursing
	Skaggs School of Pharmacy and Pharmaceutical Sciences
	The Graduate School

**Primary Student Presenter:** Keisha Alexander

**Presenting School:** Pharmacy

**Degree Seeking:** PhD

**Year:** 4th

**Mentor:** Angelo D'Alessandro

**Poster Title:** Evaluation of Sex on RBC Storage Hemolysis: Considerations for Transfusion Medicine

**Final Category:** Metabolism and Endocrinology

**Abstract:**

Evaluation of Sex on RBC Storage Hemolysis: Considerations for Transfusion Medicine

RBC transfusion is the most common inpatient medical procedure, offering life-saving therapy to ~5 million Americans every year. Storage within the blood bank is a logistic necessity to enable blood transfusion as a commodity. However, it comes at the cost of the progressive accumulation of a series of biochemical and morphological alterations to the stored erythrocyte. These alterations are collectively referred to as the “storage lesion”. Clinically, the storage lesion has been implicated with increased risk of pulmonary complications such as transfusion-related acute lung injury (TRALI), multi-organ failure (MOF), and mortality 1-2. The progression and severity of the storage lesion is impacted by several donor-specific biological factors such as age, ethnicity, and sex<sup>3-4</sup>. Most notably, the male hormone testosterone was identified as an etiological mechanistic contributor to the storage lesion<sup>3,4</sup>. Testosterone has been shown to increase store RBCs propensity to hemolyze creating heterogeneity of regularly issued blood products 3-4. However, despite this recent evidence, little is known about the mechanism by which donor sex and testosterone levels affect RBC propensity to hemolyze. To investigate potential mechanisms mediated by testosterone, omics-based technology was employed to determine systemic and red cell-specific metabolic signatures of testosterone. These signatures were later validated and compared to subjects with sub and supra-physiological levels of testosterone. Metabolites of the arginine pathway, as well as acylcarnitines and fatty acids, were found to be mediated by testosterone. However, further investigation is still needed to identify how testosterone mediation directly affects these pathways and ultimately RBC hemolyze.

**Primary Student Presenter:** Sara Amaral

**Presenting School:** Pharmacy

**Degree Seeking:** PharmD

**Year:** 3rd

**Mentor:** Sarah Billups

**Poster Title:** Description of Acute and Chronic Prescribed Headache Therapy in Patients with an Emergency Department Visits for Migraine

**Final Category:** Other

**Abstract:**

Description of Acute and Chronic Prescribed Headache Therapy in Patients with an Emergency Department visits for Migraine. S Amaral, (PharmD., SSPPS), SJ Billups, and E Gilliam, Department of Clinical Pharmacy, University of Colorado Skaggs School of Pharmacy and Pharmaceutical Sciences.

The aim of this study was to evaluate medication prescribing patterns in accordance with migraine treatment guidelines in patients admitted to the emergency department (ED) for migraine before, during, and after their ED visit to identify potential opportunities for education or therapeutic intervention. We conducted a retrospective cohort study to characterize prescribed medications before, during, and after an ED visit with a primary diagnosis for migraine. Prior to the patients' ED visit, the majority of them were not on any migraine specific abortive therapy (76%). In the ED, most patients received antiemetic therapy (73%). Corticosteroid use during the visits were low (13%), and opioids were seen to be used in 6% of all visits. After the ED visit it was seen that 68% of patients were not prescribed any migraine specific abortive therapy. Use of corticosteroids in the ED to prevent headache recurrence remains low, and opioids are still being offer to patients presenting to the ED despite recommendations. The addition of migraine specific medications following an ED visit was low indicating a possible point of intervention for the ED team to address.

**Primary Student Presenter:** Kseniya Anishchenko

**Presenting School:** Medicine

**Degree Seeking:** MD

**Year:** 2nd

**Mentor:** Liron Caplan

**Poster Title:** Clinical Characteristics of Late-Onset Spondyloarthritides.

**Final Category:** Immunology and Autoimmune Diseases

**Abstract:**

Clinical Characteristics of Late-Onset Spondyloarthritides. KY Anishchenko (MD, GS), E Cheng, L Caplan, Rocky Mountain VAMC, Denver, CO.

**Purpose:** Spondyloarthritides are a group of inflammatory rheumatic diseases with a global prevalence of 1%. Early and late-onset SpA are considered pathologically similar, but small observational studies suggest that they present with different clinical characteristics. Further, few research studies have quantified the effectiveness of tumor necrosis factor inhibitor (TNFi) therapy in late-onset SpA. This study examined the clinical differences and reasons for TNFi discontinuation in early-onset (EOSpA) and late-onset SpA (LOSpA).

**Methods:** US veterans enrolled in the Program to Understand the Longterm Outcomes in Spondyloarthritis from 2007 – 2019 who were diagnosed with ankylosing spondylitis, psoriatic arthritis, reactive arthritis, undifferentiated spondyloarthritis, or IBD-associated arthritis were included. LOSpA was defined as symptom onset beginning after age 50.

**Summary:** 115 individuals with LOSpA and 136 TNFi courses were compared to 424 individuals with EOSpA and 498 TNFi courses. The mean age of enrollment was 65.73 for the late-onset group and 51.86 for the early-onset group. Significantly more patients with EOSpA were human-leukocyte antigen B27 positive ( $P < 0.01$ ). The most common reason for TNFi discontinuation was secondary failure (42% EOSpA, 36% LOSpA), defined as loss of efficacy after >6 months of treatment, followed by adverse events (23% EoSpA, 27% LoSpA).

**Conclusions:** This study suggests that late-onset SpA patients have a lower frequency of HLA B27 and similar reasons for TNFi discontinuation as early-onset patients. In contrast to prior studies, use of the data of symptom onset, rather than the date of diagnosis, likely resulted in a more accurate classification of cases. Further studies should evaluate clinical outcomes in LoSpA patients to better quantify the effectiveness of treatments for this population.

**Primary Student Presenter:** Jeremy Ansah-Twum

**Presenting School:** Medicine

**Degree Seeking:** MD

**Year:** 2nd

**Mentor:** Armando Vidal

**Poster Title:** Biomechanical Comparison of Knotted Transosseous Equivalent Versus Speed-Bridge Rotator Cuff Repair Techniques: A Systematic Review

**Final Category:** Surgery

**Abstract:**

Biomechanical Comparison of Knotted Transosseous Equivalent Versus Speed-Bridge Rotator Cuff Repair Techniques: A Systematic Review. JK Ansah-Twum, (M.D., SOM), CK Cannizaro, JW Belk, and AF Vidal, M.D., Department of Orthopedics, University of Colorado, Denver, CO.

This study compared the biomechanical outcomes of knotted transosseous equivalent (TOE) and knotless transosseous equivalent (KL-TOE) rotator cuff repair (RCR) techniques. A systematic review was performed according to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines using PubMed, Embase, and the Cochrane Library to identify studies that compared the biomechanical properties of knotted TOE and KL-TOE (Speed-bridge) RCR techniques. The search phrase used was (Double Row) AND (rotator cuff) AND (repair) AND (biomechanical). 9 studies (150 cadaveric shoulders) met the inclusion criteria. Of the 9 studies, 6 showed improved biomechanical properties using the knotted TOE method compared to KL-TOE RCR technique. Ultimate load to failure ranged from  $310 \pm 82$  N to  $549 \pm 163$  N in knotted TOE repairs while ranging from  $166 \pm 87$  N to  $416.8 \pm 120.0$  N in KL-TOE repairs. 1 study found no significant difference in medial row fixation point displacement, construct stiffness, and ultimate load to failure when comparing knotted and knotless medial anchor sutures in a TOE double-row RCR. Of the remaining 2 studies, 1 indicated that KL-TOE repair shows an improved self-reinforcement effect, without diminishing footprint contact, compared to the same repair with medial knots. The other suggested strain at the medial suture level was significantly greater when the medial sutures were tied compared with those untied. Preliminary results of this systematic review indicate that the biomechanical properties of yield load, ultimate load, footprint contact area, and footprint pressure are significantly improved with reduced gap formation in knotted TOE RCR compared to KL-TOE repairs.

**Primary Student Presenter:** Salman Ashraf

**Presenting School:** Medicine

**Degree Seeking:** MD

**Year:** 2nd

**Mentor:** Anna Malykhina

**Poster Title:** Therapeutic Approaches to Urologic Chronic Pelvic Pain Syndrome

**Final Category:** Other

**Abstract:**

REVIEW OF UROLOGIC CHRONIC PELVIC PAIN SYNDROME THERAPEUTIC APPROACHES AND TRANSLATIONAL STUDIES

Salman Ashraf, Allison Xie, Anna Malykhina

University of Colorado, Department of Surgery – Urology, Aurora, CO

**Introduction:** Urologic Chronic Pelvic Pain Syndrome (UCPPS) is a complex disorder characterized by chronic pain originating in the pelvic organs, and significantly impacts quality of life in affected patients. The syndrome occurs in both females and males with an estimated prevalence of up to 26.6% across the world (Tam, Loeb, Grajower, Kim, & Weissbart, 2018). The pathophysiological mechanisms underlying UCPPS are not well understood making it difficult to develop effective therapeutic approaches

**Background:** The diagnosis of UCPPS is primarily based on the exclusion of other potential causes of chronic pelvic pain, and includes a thorough physical and medical history examination, followed by appropriate selection of first- and second-line therapies. Currently available treatment options include both pharmaceutical and non-pharmaceutical interventions. Treating the symptoms of the condition to improve the quality of life of patients is at the forefront.

**Methods:** A comprehensive overview of the published clinical and translational studies summarizing UCPPS pathological mechanisms, treatment options and their efficacies was performed using PubMed.

**Results:** An accurate diagnosis of UCPPS is critical in order to reduce patient frustration associated with visiting multiple physicians before receiving the final diagnosis. Physicians can utilize the plethora of existing symptoms that are associated with UCPPS alongside a thorough physical examination, history, imaging techniques, and labs in order to reach an accurate diagnosis. First-line treatments for UCPPS can be made more reproducible based off existing data regarding the efficacy of non-pharmaceutical and pharmaceutical interventions.

**Conclusion:** UCPPS is a chronic pelvic pain functional disorder complicated by co-morbid conditions, and is characterized by a plethora of symptoms. If an accurate diagnosis of UCPPS is to be reached, it is

imperative that the physicians from multiple disciplines (urologists, urogynecologists, psychologists) work together with the patient to understand and differentiate UCPPS from other conditions using a patient interview, imaging, and lab tests. Timely diagnosis of UCPPS followed by appropriate first-line treatments can significantly improve quality of life in affected patients.

**Primary Student Presenter:** Dylan Bergstedt

**Presenting School:** Medicine

**Degree Seeking:** MD

**Year:** 4th

**Mentor:** Megan Curran

**Poster Title:** Give an Impromptu Lecture about Juvenile Idiopathic Arthritis”: Using Fellows’ Performance on a Pediatric Rheumatology Objective Structured Slinical Examination Scenario to Improve Future Examinations

**Final Category:** Education

**Abstract:**

Dylan Bergstedt (MD candidate)<sup>1</sup>, E. C. Thomas<sup>2</sup>, R. Singh<sup>3</sup>, E. E. Martin<sup>4</sup>, S. Armana<sup>5</sup>, A. Kauser<sup>6</sup>, E. Zaheer<sup>7</sup>, D. D. Sherry<sup>8</sup>, M. L. Curran (faculty mentor)<sup>1,9</sup>

1. University of Colorado School of Medicine
2. Worldwide Clinical Trials Beverly Hills
3. Blue Cross Blue Shield Association, Chicago
4. University of Illinois Chicago School of Medicine
5. University of Illinois College of Medicine
6. Midwestern University Arizona College of Osteopathic Medicine
7. Northeast Ohio Medical University
8. Division of Rheumatology, Perelman School of Medicine, University of Pennsylvania, Children’s Hospital of Philadelphia, Philadelphia
9. Section of Rheumatology, Children’s Hospital of Colorado

**Purpose:** We aimed to validate a lecture on juvenile idiopathic arthritis as a scenario included in an objective structured clinical examination for pediatric rheumatology trainees

**Methods:** Participants were allotted 15 minutes to lecture about juvenile idiopathic arthritis to medical trainees. Faculty utilized a checklist which included 25 medical knowledge items and five teaching ability items, used to form a calculated score. Additionally, faculty and medical students participating as audience members assigned fellows a performance score based on their holistic impression. Comprehensive performance scores across all seven scenarios were calculated by averaging evaluators’

impression scores.

Results: When comparing mean calculated scores by training year the only significant difference was the 3rd year fellow group scored significantly higher than the 1st year fellows. Impression scores were significantly higher than calculated scores. Medical student assessors rated the fellows' performances higher than faculty. Impression scores from the lecture scenario, but not calculated scores, correlated with comprehensive performance scores.

Conclusion: This analysis identifies that all scenarios should incorporate the holistic impression score with the calculated score to form a combined overall score. Revisions will include changing the scenario prompt and checklist items using input from experts within the field and by grounding assessment items within published teaching rubrics.

**Primary Student Presenter:** Dylan Bergstedt

**Presenting School:** Medicine

**Degree Seeking:** MD

**Year:** 4th

**Mentor:** Kevin Deane

**Poster Title:** Combinations of Autoantibodies Improve the Prediction of Timing of Onset of Future Rheumatoid Arthritis

**Final Category:** Immunology and Autoimmune Diseases

**Abstract:**

Combinations of Autoantibodies Improve the Prediction of Timing of Onset of Future Rheumatoid Arthritis

D.T. Bergstedt (MD candidate)<sup>1</sup>, R.A. Peterson<sup>1</sup>, M L. Feser<sup>1</sup>, M C. Parish<sup>1</sup>, J. D. Edison<sup>2</sup>, T.R. Mikuls<sup>3</sup>, Kevin D. Deane (faculty mentor)<sup>1</sup>

1. University of Colorado Denver Anschutz Medical Campus.
2. Walter Reed National Military Medical Center, Bethesda, Maryland.
3. University of Nebraska, Omaha.

**Purpose:**Published data suggest that combinations of Anti-citrullinated protein antibodies (ACPA) and Rheumatoid Factor (RF) are highly predictive of future rheumatoid arthritis (RA) as well as predictive of onset of RA within a relatively short time period. We have evaluated the role of combinations of ACPA and RF testing, and change over time, in predicting the time of onset of future clinically apparent RA.

**Methods:**Using the Department of Defense Serum Repository we identified 214 RA cases. A mean of 3 pre-RA and 1 post-RA diagnosis serum samples were tested for RF immunoglobins (Ig) A, IgG, and IgM and anti CCP 2,3, and 3.1. The timing and trajectories of elevations of autoantibodies were evaluated. A gap-time cox regression model was used to develop hazard ratios for the risk of developing RA. Restricted mean time in state was also determined to predict time until RA diagnosis.

**Results:**Controlling for age, gender, RFIgA and RFIgM status, if a subject had a positivity for either CCP2 or CCP3.1, they were at 3.3 times greater risk/hazard of developing RA compared to a subject who was not positive for either CCP2 or CCP3.1 ( $p < 0.001$ ). Similarly, a subject positive for RFIgA or RFIgM was at 1.6 times greater risk/hazard of developing RA ( $p = 0.002$ ). These effects mean that a subject testing positive for either CCP test and either RF test would be at 5.4 times greater risk than one who tested positive for neither. Testing positive for CCP3 and any RF resulted in a restricted mean time of 2.16 years compared to 3.59 for only CCP3 positive and 4.27 when negative for CCP3 and all RF isotypes.

Conclusion: If a subject has more positive markers it is more likely they will devolve RA, and the time until onset of clinically apparent RA symptoms will likely be shorter as the number of positive markers increases.

**Primary Student Presenter:** Genna Bonfiglio

**Presenting School:** Medicine

**Degree Seeking:** MD

**Year:** 3rd

**Mentor:** Jeffrey Druck

**Poster Title:** The Sars-CoV-2 Pandemic's Impact on USMLE Testing: Student Perspectives

**Final Category:** Education

**Abstract:**

The Sars-CoV-2 Pandemic's Impact on USMLE Testing: Student Perspectives

G Bonfiglio, B Burgess, T Kincaid, J Druck, MD. University of Colorado School of Medicine, Aurora, CO.

United States Medical Licensing Examination (USMLE) scores are critical to medical students' residency applications in the United States. During the SARS-CoV-2 Pandemic, the National Board of Medical Examiners (NBME) and Prometric, the company which provides testing centers, took 62 days to release a plan for delayed examinations. We aimed to determine student satisfaction with this response to the pandemic, and opinions regarding how examinations could have been better adjusted during the pandemic and can be modified in the future.

Medical students (n=570) from 21 medical schools submitted our survey. We analyzed 483 responses based on a survey completion threshold of 50%.

Five percent (25) of students (n=456) felt the NBME adequately responded to the pandemic. Seventy-three percent (350) of students (n=478) "strongly disagreed" that Prometric provided adequate service during the pandemic. Students described distrust of these entities, and negative mental health consequences. After delays, 69% (326) of students (n=476) felt "very stressed" about USMLE examinations, compared to 3% (15) at baseline. 67% (323) of students felt scheduling delays impacted exam performance "negatively" or "very negatively." Ninety-two percent (420) of students (n=456) felt that medical schools should have administered USMLE examinations earlier in the pandemic; 92% (419) of students (n=455) felt schools should administer them long-term.

Given the impact that delayed exam rescheduling had on students, the NBME must examine USMLE administration logistics, including reevaluating Prometric's contract, testing at medical schools, and avenues for medical students to be active stakeholders in standardized board examination administration. US Medical educators may offer additional support to students affected by these events.

**Primary Student Presenter:** Dillon Boulton

**Presenting School:** Graduate

**Degree Seeking:** PhD

**Year:** 3rd

**Mentor:** Cecilia Caino

**Poster Title:** A Novel Role for MIRO2 in Autophagy.

**Final Category:** Other

**Abstract:**

A Novel Role for MIRO2 in Autophagy. DP Boulton (Ph.D., GS), M Furnish, and MC Caino, Department of Pharmacology, University of Colorado | Anschutz Medical Campus.

Mitochondrial dynamics support their multifunctional roles in maintaining cell function. Improper regulation of mitochondrial dynamics are implicated in a variety of diseases—including neurodegenerative diseases and cancer—supporting a need for a comprehensive understanding of how these dynamics are controlled. Here we identify a novel signaling pathway revolving around Mitochondrial Rho GTPase 2 (MIRO2). MIRO1/2 are outer-mitochondrial membrane proteins known for their roles in mitochondrial trafficking, however recent evidence suggests that MIRO2 may have alternate functions in regulating mitochondrial dynamics in cells where MIRO2 is dispensable for mitochondrial trafficking. Using cell models of immortalized prostate epithelium, we find that MIRO2 knockdown (KD) dramatically reduces proliferation rates and increases cellular reactive oxidative species (ROS). To further characterize the role of MIRO2 in these cells, we performed proteomics to identify novel effectors of MIRO2. One of the top hits was mammalian target of rapamycin (mTOR), a serine/threonine kinase that functions as a master regulator of growth and metabolism. Amongst canonical mTOR substrates, MIRO2 KD only affected the phosphorylation of S757 Unc-51-like kinase 1 (ULK1) following insulin stimulation. Phosphorylation of S757-ULK1 by mTOR inhibits the initiation of autophagy, a lysosome mediated degradation process. To this extent, we show that autophagosome formation upon nutrient starvation is increased in MIRO2 KD cells and reduction of these autophagosomes by insulin is dampened in cells without MIRO2. Taken together we show that MIRO2 regulates cell growth and cellular ROS. Furthermore, we show that MIRO2 acts as a scaffold for mTOR to mitochondria, which leads to an inhibition of global autophagy in response to insulin.

**Primary Student Presenter:** Morgan Brown

**Presenting School:** Graduate

**Degree Seeking:** PhD

**Year:** 4th

**Mentor:** Alexander Horswill

**Poster Title:** The Ubiquitous Colonizer *Staphylococcus hominis* Protects Host Skin from Opportunistic Staphylococcal Pathogens by Blocking Quorum Sensing.

**Final Category:** Microbiology and Infectious Diseases

**Abstract:**

The Ubiquitous Colonizer *Staphylococcus hominis* Protects Host Skin from Opportunistic Staphylococcal Pathogens by Blocking Quorum Sensing. M Brown (PhD, GS)<sup>1</sup>, A Shahbandi<sup>2</sup>, D Todd<sup>2</sup>, N Cech<sup>2</sup>, and A Horswill<sup>1</sup>,<sup>1</sup>Dept. of Immunology & Microbiology, University of Colorado Anschutz Medical Campus, Aurora, CO, <sup>2</sup>Dept. of Chemistry and Biochemistry, University of North Carolina at Greensboro, NC.

Commensal coagulase-negative staphylococci (CoNS) actively shape the skin barrier to resist colonization or infection by opportunistic pathogens, including *Staphylococcus aureus*, in a variety of mechanisms known as colonization resistance. The best characterized CoNS is *Staphylococcus epidermidis*, yet *S. epidermidis* is a frequent opportunistic pathogen that can actively degrade the skin barrier. We hypothesize that other commensal CoNS may have a greater protective role on the skin than previously appreciated, including the second most frequently isolated CoNS, *Staphylococcus hominis*. A potential *S. hominis* colonization resistance mechanism is the Accessory Gene Regulator (*agr*) quorum sensing system, which is ubiquitous among staphylococci. This two component system senses and responds to its auto-inducing peptide (AIP) signal. In *S. aureus*, *agr* regulates virulence factor expression and inhibiting *S. aureus agr* has been proposed as an antibiotic alternative. We found that spent media from any *S. hominis* skin isolate was sufficient to inhibit *S. aureus agr*. We sequenced a hypervariable region of the *agr* locus and found that *S. hominis* makes at least six AIP variants. Using mass spectrometry, we identified and validated the structures of 5 of these AIPs. We found that synthetic *S. hominis* AIPs inhibit *S. aureus* and *S. epidermidis agr* signaling with varying degrees of potency, but the majority with nanomolar IC<sub>50</sub>s. Together, these data suggest that *S. hominis agr* cross-talk with opportunistic staphylococcal pathogens may be one mechanism to protect the cutaneous barrier from damage.

**Primary Student Presenter:** Tiffany Callahan

**Presenting School:** Graduate

**Degree Seeking:** PhD

**Year:** 5th

**Mentor:** Michael Kahn

**Poster Title:** Ontologizing Health Systems Data At Scale: Making Translational Discovery A Reality

**Final Category:** Other

**Abstract:**

Ontologizing Health Systems Data At Scale: Making Translational Discovery A Reality. TJ Callahan, (Ph.D., GS), JM Wyrwa, NA Vasilevsky, PN Robinson, MA Haendel, LE Hunter, and MG Kahn, Computational Bioscience Program, Department of Pharmacology, Graduate School, University of Colorado Anschutz Medical Campus, Aurora, CO.

A significant promise of electronic health records (EHRs) lies in the ability to perform large-scale investigations of mechanistic drivers of complex diseases. Despite significant progress in biomarker discovery, this promise remains largely aspirational due to the disconnectedness of EHR data and biomedical knowledge. Linking molecular data to EHR data will support biologically meaningful analysis and can be achieved by integrating biomedical knowledge from multiple ontologies. Similar to clinical terminologies, computational ontologies are classification systems that provide detailed representations of a specific domain of knowledge. The usefulness of mapping clinical data to ontologies, like those in the Open Biomedical Ontology (OBO) Foundry, has been recognized as a fundamental need for the future of deep phenotyping. Existing work has largely focused on using ontologies to improve phenotyping in specific diseases and for the enhancement of specific biological and clinical domains. Until a comprehensive resource that includes mappings between multiple clinical domains and ontologies is created and validated, automatic inference between patient-level clinical observations and biological knowledge will not be possible.

**Study Purpose:** We developed OMOP2OBO, the first health system-wide integration and alignment between the Observational Medical Outcomes Partnership (OMOP) standardized clinical terminologies and eight OBO biomedical ontologies spanning diseases, phenotypes, anatomical entities, cell types, organisms, chemicals, metabolites, hormones, vaccines, and proteins. To verify the mappings, we performed extensive validation with assistance from multiple domain experts.

**Methods:** Clinical terminology concepts were extracted from the Children's Hospital Colorado EHR. Additional metadata included source codes, labels, and synonyms. Ontologies were selected under the advice of several domain experts and included diseases, phenotypes, anatomical entities, cell types, organisms, chemicals, hormones, metabolites, vaccines, and proteins. EHR use was approved by the

Colorado Multiple Institutional Review Board (#15-0445). Condition concepts were mapped at the concept level, drugs were mapped at the ingredient level, and measurements were mapped at the result level. Mappings were created using automatic and manual strategies, for each clinical concept to concepts in each applicable ontology. The automatic strategy consisted of ontology database cross-reference mapping, exact string mapping, and cosine similarity scoring. All concepts unable to be mapped automatically were manually mapped. For all mappings, evidence was generated and includes the mapping source, provenance, and validation source. A random 20% sample of the most challenging mappings for each clinical domain were verified by clinical and molecular domain experts.

Results: OMOP2OBO mappings clinical concepts included 92367 condition concepts, 8615 unique drug exposure ingredients, and 11072 measurement results. Agreement between the domain experts and the mapping annotators was 75% on drug ingredients, 82.5% on conditions, and 90.9% on measurements. Coverage analysis on clinical data obtained from 24 independent health systems revealed OMOP2OBO included 99.2% of conditions, 96% of drug exposure ingredients, and 70% of measurements.

Discussion and Conclusion: OMOP2OBO is the first health system-wide resource to provision interoperability between 105020 OMOP clinical concepts and 142249 concepts in eight OBO ontologies. Preliminary results suggest excellent coverage of clinical concepts when examined in 24 health systems.

**Primary Student Presenter:** Rita Chandki

**Additional Presenter(s):** Weng Leong

**Presenting School:** Dentistry

**Degree Seeking:** DDS

**Year:** Other

**Mentor:** Chaitanya Puranik

**Poster Title:** Bifid Mandibular Canal in Children- A Literature Review and Report of Four Cases

**Final Category:** Other

**Abstract:**

Bifid Mandibular Canal in Children- A Literature Review and Report of Four Cases.

Chandki, R\*1, Weng, L2, Puranik, CP3,4

International Student Program<sup>1</sup>, Doctoral Program<sup>2</sup>, Department of Pediatric Dentistry<sup>3</sup>, School of Dental Medicine, Children's Hospital Colorado<sup>4</sup>, University of Colorado Anschutz Medical Campus

**Purpose:** The purpose of this study was to review the literature on bifid mandibular canals (BMC) in pediatric patients and present four cases of children with BMC.

**Method:** Medical subject headings (MeSH) were generated and used to conduct PubMed®/MEDLINE literature search on BMC. After initial abstract review, articles meeting the selection criteria were reviewed. Additionally, panoramic radiographs from four children with unilateral or bilateral BMC were discussed.

**Results:** The literature search revealed BMC prevalence of 0-38.7% and 15.6-65.0% in adults using panoramic and cone beam computed tomographic (CBCT) images, respectively. The prevalence of BMC in children was 27% using CBCT images. The most common type of BMC was retromolar canal (11.1%); whereas, commonly reported clinical implication of BMC was failure to achieve adequate inferior alveolar nerve block.

**Conclusion:** Although limited, routine panoramic radiographs are diagnostic for BMC in children and such a finding should be considered during restorative-surgical care.

**Primary Student Presenter:** Lan Chen

**Presenting School:** Graduate

**Degree Seeking:** PhD

**Year:** 3rd

**Mentor:** Shaodong Dai

**Poster Title:** A novel nickel-recognizing human T cell receptor activation independent of antigen presenting cells.

**Final Category:** Immunology and Autoimmune Diseases

**Abstract:**

A novel nickel-recognizing human T cell receptor activation independent of antigen presenting cells. L Chen, Ph.D. student in the Graduate School, Y Zhang, K Pacheco and SD Dai, Skaggs school of pharmacy and pharmaceutical sciences, University of Colorado, Aurora, CO.

As a common allergen, nickel leads to a high percentage of allergy over the world. However, the structural basis of nickel recognition is still an unsolved question. Until now, very few nickel-recognizing T cell receptors (TCRs) have been identified, and only one of them has been studied in depth for the activation mechanism. In this study, we discovered two novel nickel-recognizing TCRs (CZD9.1 and CZD9.2) from a highly nickel allergic patient, and uncovered a unique nickel stimulation mechanism in CZD9.1 - CZD9.1 is restricted by promiscuous human leukocyte antigen (HLA), and can even be directly activated by NTA-nickel resin without antigen presenting cells. We also found that CZD9.1 can only be stimulated by nickel, different from CZD9.2 and all other TCRs. Our work indicates a unique structural basis for the nickel recognition of CZD9.1, which sheds light on future researches of nickel allergy.

Nickel allergy; HLA; T cell receptor

**Primary Student Presenter:** Yaswanth Chintaluru

**Presenting School:** Medicine

**Degree Seeking:** MD

**Year:** 1st

**Mentor:** Drew Kern

**Poster Title:** Outcomes of Gene therapy and Subsequent Deep Brain Stimulation in Parkinson's Disease treatment

**Final Category:** Surgery

**Abstract:**

Outcomes of Gene therapy and Subsequent Deep Brain Stimulation in Parkinson's Disease treatment

Parkinson's disease (PD) is the second most common neurodegenerative disorder, projected to afflict 700,000 individuals by 2040 (Rossi et al., 2018). Several advanced therapies for PD directly target brain function via electrical stimulation or gene infusion. In this study, we conducted a retrospective analysis of PD patients that participated in a gene therapy trial using stereotactic injection of adeno associated viral (AAV)-mediated delivery of GAD (glutamic acid dehydrogenase). We focus on the subset of patients who did not benefit adequately from GAD gene therapy and subsequently underwent DBS (deep brain stimulation). The purpose of this study is to determine the outcomes of patients who initially had GAD treatment and subsequently underwent DBS.

Methods

In total, 11 patients from the GAD gene therapy study were included in our study. Five patients who received GAD treatment later underwent DBS, while 6 did not. Data from 3-, 6-, and 12-months post GAD and DBS surgery were collected. We measure the following outcomes: Motor scores (MDS-Unified Parkinson's Disease Rating Scale) and LEDD statistics (levodopa equivalent daily dose).

Results

Preliminary data analysis presents LEDD dose values and UPDRS scores for patients receiving GAD+DBS and patients who received GAD treatment only.

Conclusion

DBS is a highly effective treatment for the motor symptoms of PD but does not address disease progression. GAD gene therapy aims to address disease progression. As DBS and GAD gene therapy have individual benefits, positive outcomes in patients who received both treatments could suggest additive effects to PD management.

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doi:10.1002/mds.27063

**Primary Student Presenter:** Shea Claflin

**Presenting School:** Medicine

**Degree Seeking:** MD

**Year:** 2nd

**Mentor:** Elizabeth Gillespie

**Poster Title:** Cardiac Sarcoidosis: A Resonating Diagnosis

**Final Category:** Cardiovascular

**Abstract:**

OBJECTIVES:

1. Develop a high index of suspicion for cardiac sarcoidosis and be able to name common presentations.
2. Describe diagnostic criteria for cardiac sarcoidosis.

BACKGROUND:

Sarcoidosis is a granulomatous disease of unknown etiology that has various clinical presentations dependent upon the extent of systemic involvement. Approximately 5% of patients diagnosed with sarcoidosis also meet clinical criteria for cardiac sarcoidosis (CS), whereas subclinical cardiac involvement is observed in 20-50% of cases. Commonly, workup for presenting signs of syncope, near-syncope, or chest pain reveals heart failure with preserved ejection fraction or a new arrhythmia – Mobitz I or II, or even third-degree heart block. CS often has non-specific findings on ECG and echocardiogram; cardiac magnetic resonance imaging (CMR) and 18F-fluorodeoxyglucose positron emission tomography (FDG-PET) are more specific. Although the gold standard finding of CS is non-caseating granulomas on endomyocardial biopsy, routine biopsies are not recommended as standard of care due to their low sensitivity and high risk for complications. Thus, CS can be challenging to diagnose, so a high index of clinical suspicion is of utmost importance.

CASE DESCRIPTION:

We report the case of a 46-yo male with a longstanding history of unexplained arrhythmias who presented with atrioventricular block and recurrent syncope. He was ultimately diagnosed with cardiac sarcoidosis and treated with an implantable ICD.

CONCLUSION:

In the setting of cardiac abnormalities such as new second or third degree AV block or restrictive heart failure, and when other diagnoses have been ruled out, there should be a high index of suspicion for cardiac sarcoidosis. Though endomyocardial biopsy is considered gold standard for histological

diagnosis, a clinical diagnosis can be made in the setting of extracardiac sarcoidosis with the presence of characteristic findings on other studies including ECG, echocardiogram, CMR, and FDG-PET.

**Primary Student Presenter:** Nicholas Cleland

**Presenting School:** Medicine

**Degree Seeking:** MD

**Year:** 2nd

**Mentor:** Kimberley Bruce

**Poster Title:** Novel Methodology For Probing Microglial Metabolism In Situ

**Final Category:** Neuroscience and Brain and Behavior - Adult

**Abstract:**

Novel Methodology For Probing Microglial Metabolism In Situ

Nicholas R W Cleland (1,2), Mikaela C Neal (2), Maoping Tang (2), Evgenia Dobrinskikh (3) Kimberley D Bruce (2)

(1)University of Colorado School of Medicine

(2)Division of Endocrinology, Metabolism, & Diabetes, Department of Medicine, University of Colorado Denver Anschutz Medical Campus, Aurora, Colorado

(3)Department of Medicine, University of Colorado Denver Anschutz Medical Campus, Aurora, Colorado

Background: Microglia play a role in the pathogenesis of multiple sclerosis (MS) and other neurodegenerative diseases (ND) by taking on adaptive and injurious phenotypes in response to their environment. Understanding these phenotypes may guide the development of novel therapeutics. Recent single-cell RNA sequencing (scRNAseq) analyses of microglia ex vivo found that genes associated with lipid and lipoprotein metabolism are tightly regulated in ND. We hypothesize that microglial activation is paired with a metabolic switch key in the development of ND. However, our current understanding of microglial metabolism draws on what is known about peripheral macrophages and invasive techniques like scRNAseq that could alter microglial phenotype and metabolism. Therefore, there is a need for methodologies that allow probing of microglial metabolism in situ, as a first step to develop metabolism-focused interventions.

Methods: We use the endogenous fluorophore NADH to probe the metabolic profile of microglia in situ via fluorescence lifetime imaging microscopy (FLIM). By exciting NAD in the sample and tracking its fluorescence lifetime (FLT), we can determine whether it is free or enzyme-bound. More free NADH suggests more glycolytic flux and presents as a longer NAD FLT, whereas bound NAD indicates more oxidative phosphorylation. We use an experimental autoimmune encephalitis (EAE) mouse as a model of MS. Mice were scored based on their MS-like symptoms. Brains were frozen and sectioned before analysis.

Results: Preliminary data suggest that a higher score is associated with a shorter NAD FLT, suggesting a higher reliance on glycolysis in an EAE mouse. This also suggests that microglia have adopted an injurious phenotype.

Conclusions: The data support our hypothesis that microglial activation in the setting of MS is paired with a metabolic switch towards more glycolysis. This study also supports FLIM being used to probe microglial metabolism in situ to better understand other NDs.

**Primary Student Presenter:** Evan Cornish

**Additional Presenter(s):** Boris Stepanyuk Rouna Mohran

**Presenting School:** Medicine

**Degree Seeking:** MD

**Year:** 2nd

**Mentor:** Madiha Abdel-Maksoud

**Poster Title:** Evaluating middle school students' understanding and emotional outlook on the COVID-19 pandemic. EC Cornish (M.D., SOM), B Stepanyuk, R Mohran, and M. Abdel-Maksoud, School of Medicine, University of Colorado Anschutz.

**Final Category:** Education

**Abstract:**

Adolescent knowledge and emotional outlook on COVID-19. EC Cornish (M.D., SOM), B Stepanyuk, R Mohran, and M. Abdel-Maksoud, School of Medicine, University of Colorado Anschutz.

**Overview:** The COVID-19 pandemic interrupted the education of nearly 94,000 students throughout Denver Public Schools, creating academic and mental health challenges. The COVID Virtual Summer Camp was created to engage middle school students in discussions about COVID-19 topics to increase understanding and decrease anxiety induced by the pandemic.

**Methods:** Eighty-five students (62.8% females) were recruited to the virtual camp. Two identical camps took place July 13th- 24th. Curriculum topics included microbiology, immunology, health disparities, recognizing and verifying credible sources, and mental health. Content was presented using short lectures, small group discussions, and Q&A sessions with medical and public health professionals. Participants completed pre- and post-camp surveys assessing their level of understanding COVID-19 topics and emotional states experienced in virtue of the pandemic. Participants described their emotions by choosing words, from a provided word bank, corresponding to positions on a pleasantness vs energy intensity axis (RULER Mood Meter).

**Results:** Comparing pre- and post-camp surveys showed a 55% increase ( $p < 0.00001$ ) in confidence discussing infectious diseases and a 40% increase ( $p < 0.00001$ ) in self-reported knowledge about the spread of infectious diseases. Pre- and post-camp surveys showed 62% and 68% of words chosen to describe emotional state were in the unpleasant, high-intensity quadrant, respectively.

**Conclusions:** The COVID Virtual Summer Camp increased self-reported knowledge and confidence in discussing infectious diseases. We demonstrated that most emotions towards the pandemic were associated with high energy and unpleasantness, regardless of level of self-reported understanding of topics pertinent to the pandemic.

**Primary Student Presenter:** Alexander Cullen

**Presenting School:** Medicine

**Degree Seeking:** MD

**Year:** 2nd

**Mentor:** Matthew Taylor

**Poster Title:** Refined Methods for Transcriptome Analysis in Cardiomyopathy

**Final Category:** Cardiovascular

**Abstract:**

Refined Methods for Transcriptome Analysis in Cardiomyopathy. A. Cullen, (MD, SOM), M. Taylor, L. Mestroni, S. Graw, D. Grine, G. Storm, S. Gao, and S. Chen, Human Medical Genetics and Genomics, Cardiovascular Institute and Adult Medical Genetics Program, Department of Cardiology, and MD Program, University of Colorado, Denver, CO.

Purpose of Study: Sweet et al. (2018) reports that severity of heart failure (HF) symptoms and left ventricular dysfunction determine current HF treatment. An approach based on underlying biology may ultimately facilitate a precision medicine approach to HF [ ], [ ]. Using the same data from this 2018 study, we developed a novel modification for bioinformatic analysis of differentially expressed genes (DEG's) between ischemic cardiomyopathy (ICM), dilated cardiomyopathy (DCM), and non-failing (NF) heart tissue. Our process also permitted easy adjustment of statistical parameters in DEG analysis of this and other datasets. Methods Used: RNA-seq from 13 ICM, 37 DCM, and 14 NF control human left ventricular samples with expression data for 57974 genes. Matlab analysis began with purging data of missing and nonsensical entries. We first aimed to replicate the analysis of Sweet et al. Initial replicate lists mostly match the list of Sweet et al., but current efforts to adjust for age and gender to create more complete matching are underway. In DEG identification, we also adjust threshold stringency for a) fold-change and b) mean absolute change between ICM, DCM, and NF gene expression levels to identify smaller, more focused DEG sets. We will also present results of bioinformatic validation testing on a newly generated human heart tissue transcriptome dataset. Summary of Results: Using the DEG cutoff conditions of the 2018 study, we largely replicated its gene lists, but are aiming for more exact matching through age and gender adjustment. With subsequent varying cutoff conditions for mean and fold-change, we produced narrower DEG lists for pathway analysis. Applying the same algorithm to a new, larger dataset will test repeatability. Conclusions: Our bioinformatic pipeline provides for flexible adjustment of DEG identification parameters, allowing for tailored generation of DEG lists. Pathway analysis, with verified repeatability across multiple datasets, enables discovery of the underlying biology of HF due to ICM and DCM.

**Primary Student Presenter:** Rachel Culp-Hill

**Presenting School:** Graduate

**Degree Seeking:** PhD

**Year:** 3rd

**Mentor:** Angelo D'Alessandro

**Poster Title:** Fatty acid metabolism and desaturation in the pathogenesis of leukemic stem cells in Acute Myeloid Leukemia

**Final Category:** Hematology and Oncology

**Abstract:**

Acute myeloid leukemia (AML) is a cancer of bone marrow-derived blood cells, where leukemic blasts build up and block proper function and development of myeloid progenitors. Conventional therapy eliminates most bulk tumor cells but disease-initiating leukemic stem cells (LSCs) survive, leading to disease progression and relapse. LSCs are uniquely reliant on oxidative phosphorylation (OXPHOS). The key metabolic drivers of OXPHOS in LSCs from relapsed patients are amino acid and fatty acid metabolism. While we have previously described successful strategies for targeting amino acid metabolism the mechanisms that control fatty acid metabolism remain to be elucidated.

LSCs in relapsed/refractory patients display increased fatty acid metabolism, driving OXPHOS and LSC survival. We also show a strong correlation between fatty acid desaturase (FADS) expression and poor prognosis in AML. As unsaturated fatty acids are oxidized more rapidly than saturated, increased FADS activity fuels OXPHOS more than overall fatty acid metabolism. This suggests pharmacological targeting of fatty acid desaturation may offer a novel approach for LSC eradication in relapsed/refractory AML patients. We have also shown similar increases in fatty acid desaturation in cases of p53 loss in AML. Successful inhibition of OXPHOS is dependent on p53-driven apoptotic pathways, and p53 is a tight regulator of lipid metabolism. Therefore, a loss of p53 in AML may result in a loss of FADS inhibition and promotion of fatty acid desaturation.

We hypothesize that relapsed/refractory LSCs upregulate fatty acid desaturation through increased FADS activity to maintain OXPHOS as a mechanism for survival. Our goal is to determine the mechanism by which relapsed/refractory LSCs maintain OXPHOS through fatty acid oxidation. We also hypothesize that loss of p53 function in relapsed/refractory LSCs results in loss of inhibition of FADS, increasing fatty acid desaturation.

**Primary Student Presenter:** Sarah Daley

**Presenting School:** Nursing

**Degree Seeking:** BS

**Year:** 4th

**Mentor:** Ryan Marker

**Poster Title:** The Effects of Exercise on Stress and Depression and Associated Quality of Life Changes in Cancer Survivors

**Final Category:** Neuroscience and Brain and Behavior - Adult

**Abstract:**

THE EFFECTS OF EXERCISE ON STRESS AND DEPRESSION AND ASSOCIATED QUALITY OF LIFE CHANGES IN CANCER SURVIVORS

**Purpose.** The purpose of this study was to investigate the effects of adherence to an exercise program on participant depressive and perceived stress ratings, and how changes in these ratings effect QoL.

**Background.** Exercise programs are increasing as adjunct to medicinal therapies for cancer survivors. Research suggests that exercise reduces symptoms of stress and depression in cancer survivors. Cancer survivors have shown QoL improvement when participating in exercise, though the effects of adherence to exercise on stress and depression and how those changes affect overall quality of life during a program are not known.

**Methods.** The BfitBwell Program is a 3-month exercise program for cancer survivors. Measures of stress, depression and quality of life collected pre-and post-program, adherence as measured by the total number of days attended, and participant characteristics including cancer diagnosis, age, and gender were extracted from the BfitBwell Research Database. Correlation coefficients were calculated between change scores for depressive and stress symptoms and adherence, and between change scores and changes in QoL.

**Results.** Change in depression was calculated in 179 participants and was not correlated with adherence. Change in perceived stress was calculated in 86 participants and was not correlated with adherence to the exercise program. Changes in stress and depression were significantly correlated with changes in QoL (N=92 and 201, respectively).

**Implications.** Attendance to an exercise program is not correlated with changes in stress and depression. There is a significant correlation between changes in stress and depression and changes in quality of life in cancer survivors. Further research is warranted to determine how exercise can improve cancer treatments and survivor QoL.

**Primary Student Presenter:** Lorraine Davis

**Presenting School:** Graduate

**Degree Seeking:** PhD

**Year:** 3rd

**Mentor:** Daniel Sherbenou

**Poster Title:** The Ikaros Axis is Heterogeneously Expressed in Multiple Myeloma Subpopulations and Does Not Drive IMiD Resistance

**Final Category:** Hematology and Oncology

**Abstract:**

The Ikaros Axis is Heterogeneously Expressed in Multiple Myeloma Subpopulations and Does Not Drive IMiD Resistance

Lorraine Davis (PhD, GS), Zachary Walker, Brett Stevens, ..., Daniel Sherbenou, Dept. of Med.

Multiple myeloma (MM) is a malignant plasma cell neoplasm that remains incurable due to the widespread prevalence of acquired drug resistance. Immunomodulatory drugs (IMiDs) are a cornerstone of MM therapy, yet the mechanisms of acquired IMiD resistance remain largely unknown. IMiDs possess direct anti-MM effects by promoting the degradation of Ikaros (IKZF1) and Aiolos (IKZF3), which in turn downregulates the expression of the critical MM transcription factor IRF4 and consequently MYC (collectively known as the Ikaros axis). Based on the known IMiD mechanism of action, we hypothesized that the Ikaros axis differentially responds to IMiD treatment in patients with IMiD resistance. We investigated how expression of these proteins responds to ex vivo IMiD treatment in IMiD-sensitive and -resistant patient MM cells (CD38+CD138dim/+) by employing flow cytometry. Our results reveal that the levels of IKZF1, IKZF3, and IRF4 are equivalently decreased in IMiD-sensitive and -resistant cell lines and patient samples (n = 6) following ex vivo IMiD exposure. However, in the subset of patients examined thus far, MYC was not downregulated in IMiD-resistant MM. We further assessed the expression of the Ikaros axis in diverse MM subpopulations via mass cytometry. Interestingly, we discovered that IKZF1, IKZF3 and IRF4 are not expressed in MM cells with a less plasma cell phenotype, whereas MYC is expressed in all MM cells. These results suggest that IMiD-resistant MM cells may be independent of IKZF1, IKZF3, and IRF4 through possessing a less plasma cell phenotype. Further, our data suggest that IMiD-resistant MM is likely still dependent on MYC through Ikaros axis-independent mechanisms and thus targeting MYC may be a promising therapeutic strategy for IMiD-refractory patients.

**Primary Student Presenter:** Stephanie DeVoe

**Presenting School:** Graduate

**Degree Seeking:** PhD

**Year:** 3rd

**Mentor:** Shaodong Dai

**Poster Title:** Computational Modeling of T Cell Receptor Interaction Geometry

**Final Category:** Immunology and Autoimmune Diseases

**Abstract:**

Computational Modeling of T Cell Receptor Interaction Geometry: SM DeVoe (Ph.D., GS) and S Dai, Department of Immunology and Microbiology, University of Colorado Anschutz, Aurora, CO.

How a T cell receptor (TCR) recognizes its antigen greatly affects the quality of signal and level activation received by the T cell, subsequently dictating the following immune response. Traditionally, the interaction geometry has been defined by two lines: a regression fit of the MHC binding groove and the line formed from the centroids of conserved disulfide bonds in the TCR alpha (TRA) and beta (TRB) chains. The current model fails to take into account several aspects of TCR structure and interaction properties with peptide-major histocompatibility complexes (pMHC). These interactions are facilitated by 3 complementary determining regions (CDR) on each TCR chain. Additionally, the TCR is a complex, dynamic structure where the alpha and beta chains can move independently of one another. We have created an extension of the conventional model to account for these shortcomings where the TCR, TRA chain, and TRB chain are represented by planes. These planes are calculated using the center of mass of the TCR (or corresponding chain) in addition to a linear regression of the coordinates of the atoms within the CDR loops. Furthermore, we have extended our model to identify the impact of CDR3 on interaction geometry by comparing to planes where only germline encoded CDRs are used to model the angle of interaction. From the known structures, an average of a -5.18 degree shift occurs when the CDR3 atoms are included in the model. Using nearest neighbor community detection clustering algorithms, we determined 4 defined clusters of TCR-pMHC interaction geometry exist among the known class I and class II structures. The rigid clustering of our plane-based modelling suggests TCR-PMHC interaction geometry is defined by certain "rules" which dictate a range of orientations that a TCR may take.

**Primary Student Presenter:** Katherine Drexelius

**Presenting School:** Medicine

**Degree Seeking:** MD

**Year:** 3rd

**Mentor:** Christopher Kleck

**Poster Title:** Analysis of radiographic parameters reveals differences in outcomes when comparing patient-specific short rod constructs to conventional rods

**Final Category:** Bone or Skeletal

**Abstract:**

Analysis of radiographic parameters reveals differences in outcomes when comparing patient-specific short rod constructs to conventional rods

Katherine Drexelius, MD Candidate; Eren Kuris, MD; Michelle Akiyama, BS; David Ou-Yang, MD; Evalina Burger, MD; CJ Kleck, MD

CU Department of Orthopedic Surgery

**Purpose:** Patient-specific spine rods (PSSRs) are pre-contoured custom rods manufactured based on preoperative spinopelvic parameters and postoperative alignment goals. Recent studies have indicated that these rods can improve surgical correction for long segment adult spinal deformity constructs. However, few studies have investigated the impact these rods have on short segment lumbar fusion for degenerative conditions. We aimed to determine how the use of PSSRs affect radiographic parameters and categorical outcomes when compared to conventional rods.

**Methods:** In this retrospective cohort study, fifty patients underwent primary lumbar fusion with PSSR and were compared to a historical cohort of patients. Using pelvic incidence (PI) and lumbar lordosis (LL), patients were divided into preserved, restored, not corrected, and worsened categories based on pre- and postoperative measurements. Statistical analysis was performed using ANOVA and t-tests.

**Results:** Patients undergoing spinal fusion with PSSRs had a more significant change in pre- to postoperative PI-LL, compared to the non-PSSR historical cohort of patients ( $p < 0.001$ ). Postoperative analysis of spinopelvic parameters in the PSSR patients placed 74% in the preserved category, 18% in the restored category, and 4% in each the not corrected and worsened categories. A greater proportion of patients in the PSSR sample were in the preserved group, more patients in the PSSR group had restored spinopelvic parameters after surgery ( $p = 0.05$ ), and fewer patients had not-corrected parameters ( $p = 0.006$ ).

**Conclusion:** PSSRs may be able to better maintain or correct spinopelvic alignment when compared to conventional rods.

**Primary Student Presenter:** Joanna Dukes

**Presenting School:** Pharmacy

**Degree Seeking:** PharmD

**Year:** 4th

**Mentor:** Meghan Jeffres

**Poster Title:** Quantification of QTc Prolongation Due to Antimicrobial Exposure

**Final Category:** Pharmacology and Physiology

**Abstract:**

QUANTIFICATION OF QTc PROLONGATION DUE TO ANTIMICROBIAL EXPOSURE. J Dukes (PharmD candidate), MN Jeffres (PharmD), University of Colorado Skaggs School of Pharmacy and Pharmaceutical Sciences, Aurora, CO.

Background: Torsade de Pointes (TdP) is a life-threatening arrhythmia associated with a long QT corrected (QTc) interval. QTc interval >500 milliseconds (ms) increases risk of TdP. Medications commonly cause QT prolongation, but clinical resources describe QTc qualitatively, not quantitatively. The imprecision hampers clinical decision making.

Objective: To quantify QTc prolongation for fourteen common antimicrobials in macrolide, fluoroquinolone, or azole antifungal classes.

Methods: A literature review of PubMed and EMBASE databases was performed in June 2020 using MeSH terms for the antimicrobials and QTc prolongation and/or Torsade de Pointes. Data was extracted for each antimicrobial and categorized by sample population. Quantification of QTc prolongation was done by calculating weighted means.

Results: There were greater changes in QTc prolongation in patient populations than in healthy volunteers. Of macrolides, erythromycin had the greatest QTc prolongation in (32.3±13.6 ms) then clarithromycin (12.5±3.8 ms) and azithromycin (4.9±6.4 ms). Of fluoroquinolones, moxifloxacin had the greatest QTc prolongation (16.4±12.0 ms, healthy volunteers) then ciprofloxacin (10±20 ms), levofloxacin (6.0±5.6 ms), delafloxacin (3.9 ms) and gemifloxacin (2.6±24.5 ms). Of azole antifungals, voriconazole had the greatest QTc prolongation (25.7±9.3 ms) then posaconazole (9.0±6.3 ms), ketoconazole (7.3±0.95 ms, healthy volunteers) and isavuconazole (-13.6±4.9 ms).

Conclusion: This analysis demonstrates significant variability in duration of QTc prolongation. How much a medication increases the QT interval is critical information for patients at risk for QTc prolongation and TdP. Quantification of QTc interval can help clinicians assess patient risk for QTc prolongation.

**Primary Student Presenter:** Kerith Earlix

**Presenting School:** Nursing

**Degree Seeking:** BS

**Year:** 2nd

**Mentor:** Heather Coats

**Poster Title:** Unpacking Characteristics of Spirituality: Through the Lens of Persons of Color Living with Serious Illness

**Final Category:** Other

**Abstract:**

Unpacking Characteristics of Spirituality: Through the Lens of Persons of Color Living with Serious Illness

The domain of Spiritual, Religious, & Existential Care is one of official domains of Palliative Nursing. There is also a NANDA-I diagnosis for spiritual distress, related to difficulty creating existential meaning. Spiritual support enhances a patient's well-being and leads to improved healing, while spiritual distress can interfere with healing. However, research and education in this domain of nursing is severely lacking. Using a secondary data set of narrative interviews, a thematic analysis was conducted on interviews with 20 patients of color with serious illness. A schema was created based on a broad definition of spirituality, including: Religion, Self, Family, Community, Nature, and Art/Music/Literature, and the research team worked to arrive at consensus on the final themes. The three primary themes expressed were Religion, Self, and Family. Patients noted three main effects on their religious life: increased faith, a stronger sense of purpose, and the importance of being prayed for. In the theme of self, statements were made about self-worth, awareness of their life in a larger context, and reflection on their personality characteristics. Serious illness increased their feeling of value in the world and influenced what they valued in their lives. Participants reflected that family added existential meaning and purpose to their lives. Minor themes expressed by participants included Community, Nature, and Art/Music. Nurses must understand the broad range of experiences encompassed by the spiritual domain in order to be effective spiritual care generalists. Nurses must address the patient's spiritual life by building on skills such as compassion and active listening in addition to learning to identify spiritual needs, notice signs of spiritual distress, and knowing when to refer to the spiritual specialist, the chaplain. Nurses must be educated to anticipate these needs, enabling their patients to have healing despite physiological illness.

**Primary Student Presenter:** Zihan Feng

**Presenting School:** Medicine

**Degree Seeking:** MD

**Year:** 2nd

**Mentor:** Matthew Stone

**Poster Title:** Open Chest Duration Following Congenital Cardiac Surgery Increases Risk for Surgical Site Infection

**Final Category:** Surgery

**Abstract:**

Open Chest Duration Following Congenital Cardiac Surgery Increases Risk for Surgical Site Infection. Z Feng, BS; S Schofield, BBA, E Downs, MD, S Newman, NP, D Campbell, MD, M Mitchell, MD, J Jagers, MD, M Stone, MD PhD, Department of Medicine, University of Colorado, Denver, CO

Surgical site infections (SSI) following congenital heart surgery (CHS) remain a significant source of morbidity. Delayed sternal closure (DSC) is often required to minimize the potential for hemodynamic instability. While repeated open chest procedures and ECMO are established risk factors for SSI following DSC, the effect of open chest duration (OCD) remains less well defined. Thus, the purpose of this study was to evaluate the incidences of SSI among patients with DSC versus primary chest closure (PCC) and the effect of OCD on SSI occurrence.

A retrospective review of our institutional Society of Thoracic Surgeons dataset was performed to identify patients undergoing CHS at our institution between 2015-2020. Patients with SSI were identified within a prospectively collected institutional dataset and matched accordingly. Incidences of SSI were compared between DSC and PCC patients utilizing bivariate analysis. DSC patients were evaluated to determine the association of OCD on the incidence of SSI.

2582 operations were performed at our institution between 2015-2020, including 195 DSC and 2387 PCC cases. The incidence of SSI within the cohort was 1.8%. DSC patients had significantly higher incidences of SSI (8.7%) than PCC patients (1.3%,  $p=0.041$ , OR:6.7). Within the DSC cohort, patients that went on to develop SSI had a longer OCD (mean=24.7 days) when compared to non-SSI DSC patients (mean=6.4 days).

The incidence of SSI is higher in DSC patients compared to PCC patients. Prolonged OCD presents a potentially modifiable risk factor for SSI predisposition. These data support dedicated, daily post-operative assessment of candidacy for chest closure to minimize the risk of SSI.

**Primary Student Presenter:** Isabel Fernandez

**Presenting School:** Medicine

**Degree Seeking:** MD/PhD

**Year:** 7th

**Mentor:** Viridiana Estrada

**Poster Title:** Triple Threat: A case of Bubonic, Septicemic, and Pneumonic Plague Through Feline Transmission

**Final Category:** Microbiology and Infectious Diseases

**Abstract:**

Triple Threat: A case of Bubonic, Septicemic, and Pneumonic Plague Through Feline Transmission

Isabel Z. Fernandez, PhD. Viridiana Estrada, MD. Amanda V. Johnson, MD. Samuel Carpentier, MD, PhD. Jason John, MD. Kellie Hawkins, MD, MPH.

Introduction: *Yersinia pestis* is a gram-negative bacterium that causes plague and is primarily transmitted to humans through flea bites or animal exposure. It can present with three main clinical forms: bubonic, septicemic, and pneumonic plague. Infection with *Y. pestis* can cause a severe and rapidly progressing disease that can be lethal in the absence of treatment (1,2).

Case Description: The patient is a 37-year-old previously healthy male who experienced fevers and nausea two days after cutaneous and respiratory secretion exposure to an infected cat in rural Colorado. He began treatment with azithromycin for presumed *Bartonella* versus *Francisella* infection. Two days after antibiotics, he continued having high fevers and new painful axillary swelling, at which time he was admitted to the hospital. Gentamicin was added after a lymph node biopsy. He subsequently developed progressive encephalopathy, respiratory failure requiring intubation, and pressors for septic shock. CT chest was notable for multifocal pneumonia. Admission blood cultures and lymph node biopsy were ultimately confirmed as *Y. pestis* by the state laboratory. Levofloxacin was added and the patient clinically improved with extubation two days later. The patient was discharged on oral levofloxacin and doxycycline after a thirteen-day stay. He presented to the hospital several days later with high-grade fevers, worsening left upper extremity swelling, and was found to have a left brachiocephalic vein deep vein thrombosis. His course of doxycycline was extended given concern for thrombophlebitis and he was initiated on anticoagulation. The patient continues to follow with Infectious Disease as an outpatient to ensure full resolution of symptoms and laboratory abnormalities.

Discussion: There are several notable features of this case, including the exposure from feline host, delayed directed antibiotic coverage, and the complex clinical course. There have been several cases of feline transmission over the last few decades in the US; these represent a fairly large proportion given its low incidence. Interestingly, most of the primary pneumonic plague exposures in the US have been

associated with exposure to feline respiratory secretions (3).

While our patient had possible respiratory exposure to a feline from an endemic area, his clinical course correlates most closely with either bubonic or septicemic plague as primary with progression to secondary pneumonic plague. Initial antibiotic coverage was targeted towards common zoonotic diseases. This may have unfortunately permitted bacterial dissemination and resulted in multiple complications (4). These rarer presentations of plague present with higher mortality than bubonic plague and in the case of pneumonic presentation can facilitate human-to-human transmission (1).

Our report highlights the importance of high clinical suspicion and prompt antibiotic coverage for *Yersinia pestis* in endemic areas for patients with concerning presentations.

#### References:

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**Primary Student Presenter:** Jennifer Fouquier

**Presenting School:** Graduate

**Degree Seeking:** PhD

**Year:** 3rd

**Mentor:** Catherine Lozupone

**Poster Title:** The Effects of an Agrarian Diet Intervention on Inflammation and Gut Microbiome Composition in HIV-Infected Individuals in Colorado

**Final Category:** Microbiology and Infectious Diseases

**Abstract:**

Individuals living with HIV often suffer from cardiovascular disease, metabolic disease, and chronic inflammation, all of which are associated with gut microbiome dysbiosis. The gut microbiome composition of HIV-infected (HIV+) and uninfected (HIV-) men who have sex with men (MSM) in the United States is predominantly Prevotella rich and Bacteroides poor (PrevR/BactP). Interestingly, this gut microbiome composition is similar to that of healthy individuals in developing nations who consume an Agrarian diet (AD) high in fiber and low in fat, sodium and sugar, implying that HIV+ and HIV- MSM may consume inadequate nutrients for their gut bacteria. Therefore, we hypothesize that an AD modification for PrevR/BactP HIV+ and HIV- MSM individuals will have beneficial health effects as demonstrated by a greater reduction in inflammatory disease markers. To test this, we performed a four-week clinical study on 90 individuals to compare the effects of an AD versus a typical Western Diet (WD) on HIV+ and HIV- individuals in Colorado. The first two weeks of meals were prepared by our nutrition core, while the last two weeks were study-participant prepared. Dietary questionnaires showed high compliance to target diet modifications. At baseline, systemic inflammation, as measured by IL6, was significantly elevated in HIV+ individuals, and HIV- MSM at high risk for HIV, compared to HIV- low risk individuals ( $p = 0.029$ ). After two weeks, HIV+ individuals on an AD had a reduction in baseline IL6 levels that was not observed in HIV- individuals and those on a WD ( $p = 0.047$ ). IL6 levels were negatively correlated with Bacteroides, suggesting a protective effect ( $p = 0.003$ ), while there was no relationship to Prevotella. There was a significant increase in Bacteroides after four weeks of diet intervention. Our results suggest that an AD can protect from HIV-associated systemic inflammation and associated health outcomes.

**Primary Student Presenter:** Joseph Fuchs

**Additional Presenter(s):** Andrew Tannous

**Presenting School:** Medicine

**Degree Seeking:** MD

**Year:** 4th

**Mentor:** Paritosh Kaul

**Poster Title:** An Innovative Approach to Teaching Cross-Cultural Communication Among Dental Students

**Final Category:** Education

**Abstract:**

AN INNOVATIVE APPROACH TO TEACHING CROSS-CULTURAL COMMUNICATION AMONG DENTAL STUDENTS. JR Fuchs, (MD, SOM), AM Tannous, G Guiton, and P Kaul, Department of Pediatrics, University of Colorado School of Medicine, Aurora, CO

Racial and ethnic minorities remain underrepresented within the healthcare workforce generally and within the dental profession. Consequentially, professional organizations including the Commission on Dental Accreditation have identified the importance of cultural competency training in dental education. One essential component of providing care for patients of diverse backgrounds is culturally-sensitive, patient-centered communication. To address this need, we implemented an interactive, two-hour Cross-Cultural Communication (CCC) educational session for Dental Students (DS). This study describes the intervention and provides data on its effectiveness. Our session employed dyad training, role playing, education about Kleinman's Explanatory Model, and introduced a new model for negotiating across cultures that can be broadly applied to various aspects of patients' culture. Learners included 51 first-year (24) and third-year (27) DS. Evaluation compared students' pre-/post-intervention responses to a modified Health Belief Attitudes Survey (HBAS), which measured four domains: Opinion, Belief, Context, and Quality. For the first-year students, the mean difference improvement between the pre- and post-intervention surveys for each domain were all statistically significant ( $P < 0.05$ ). For the third-year students, there was a similar result as compared to the first-year students, with the exception for the domain of Quality ( $P = 0.083$ ). The educational paradigm used in this study fills a curricular gap in effectively teaching CCC among DS. Moreover, the intervention can be applied across health professions education. Limitations include that the study did not explore the long-term retention of knowledge or performance in the clinical settings.

**Primary Student Presenter:** Joshua Garcia

**Presenting School:** Graduate

**Degree Seeking:** PhD

**Year:** 5th

**Mentor:** Katharine R. Smith

**Poster Title:** Investigating the mechanistic and temporal regulation of inhibitory synapse elimination during cerebral ischemia.

**Final Category:** Neuroscience and Brain and Behavior - Adult

**Abstract:**

Inhibitory synapses are crucial for maintaining correct neuronal excitability, which is important for efficient circuitry and proper brain function. Inhibitory GABAA receptors (GABAARs) mediate the majority of fast synaptic inhibition in the brain. Thus, the number of postsynaptic GABAARs influences inhibitory strength. Shifts in neuronal excitability have been implicated in a variety of neurological disorders, including ischemia. The oxygen and glucose deprivation (OGD) observed during ischemic insult in hippocampal regions leads to synaptic depression through GABAAR and gephyrin loss from synaptic sites. However, mechanisms that regulate GABAAR declustering and gephyrin elimination following an ischemic insult remain undefined. In this project, I propose that GABAAR declustering is mediated by calcineurin activity and this is the first step in facilitating synapse elimination. Furthermore, I speculate a role of the cystine protease, Calpain, in mediating gephyrin loss during OGD. Based on this, I plan to investigate (i) mechanisms of synaptic GABAAR declustering and gephyrin elimination in hippocampal pyramidal neurons following OGD (ii) probe the temporal regulation to determine the sequential flow of events promoting GABAAR and gephyrin loss and (iii) use an in vivo model of cerebral ischemia to compare cell-type specific mechanisms in the CA1 hippocampus.

**Primary Student Presenter:** Alexis Gerk

**Presenting School:** Medicine

**Degree Seeking:** MD

**Year:** 2nd

**Mentor:** Jenny Stevens

**Poster Title:** Incidence and Impact of Contrast-enhanced Fluoroscopic Studies to Evaluate Gastrostomy-button Complications in Pediatric Patients

**Final Category:** Surgery

**Abstract:**

Incidence and Impact of Contrast-enhanced Fluoroscopic Studies to Evaluate Gastrostomy-button Complications in Pediatric Patients. J Stevens MD, MPH, AL Gerk, M Reppucci MD, M Meier MS, P Ladd MD, S Moulton MD, Children's Hospital Colorado Dept. of Pediatric Surgery, Radiology; CU School of Medicine

**Purpose:** Complications associated with gastrostomy buttons (g-buttons) such as leaking or dislodgment are common and often require contrast-enhanced fluoroscopic studies. These procedures incur significant medical costs and radiation exposure. We sought to determine the incidence and costs associated with g-button-related fluoroscopic studies at our institution.

**Methods:** A retrospective review of patients who underwent a fluoroscopic g-button study at Children's Hospital Colorado from 2015-2020 was conducted. Patients were stratified based on the reason for the study and compared using frequencies, means, and Fisher's exact or Kruskal-Wallis tests. Radiation dosages and charges associated with study encounters were calculated.

**Results:** A total of 384 g-button studies were included. The most common reason was dislodgement (27%) followed by inability to tolerate feeds (22%), routine replacement (19%), and leaking (12%). Studies for dislodgment and routine replacement showed 6.3% of g-buttons were improperly replaced and 4.4% required surgery. There was a significant difference in the age of the tract (11.88 vs 44.53,  $p=0.02$ ) and hospital admission (66.7% vs 5.5%,  $p<0.001$ ) in those with improperly replaced g-buttons. The average radiation dose administered per study was 14.99 (mGy) and the median total charge was \$3,333.45.

**Conclusion:** Contrast-enhanced fluoroscopic g-button studies are commonly performed for dislodgement and other complications. Importantly, 6.3% of g-buttons were found to be malpositioned following replacement, reinforcing the importance of a fluoroscopic study after a dislodgement especially among those <6 weeks out from initial placement.

**Primary Student Presenter:** Boston Gubler

**Presenting School:** Medicine

**Degree Seeking:** MD

**Year:** 2nd

**Mentor:** Peter Pressman

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

**Final Category:** Neuroscience and Brain and Behavior - Adult

**Abstract:**

Characteristics of Electronic and Paper Questionnaire Users in an Academic Memory Clinic

Boston Gubler, Gordon Matthewson, Jessica Cline, Marissa Grande, Kaitlin Olson, Jonathan Woodcock, Peter S. Pressman

**Objective:** To describe differences between patients and caregivers who did and did not use electronic health questionnaires in an academic memory clinic.

**Background:** Patient-reported outcomes (PROs) are increasingly essential for ensuring detailed patient information is collected despite the time constraints of modern clinical care. Electronic PROs are especially promising given the rising prominence of telehealth. Electronic methods of data collection, however, may present unique challenges that risk excluding certain patients and caregivers.

**Design/Methods:** This is a descriptive, retrospective study of patients and caregivers in an academic memory clinic (N = 785). Patients and caregivers were invited to fill electronic questionnaires ahead of their visit and provided paper questionnaires at the time of their visit if an electronic survey was not filled. We investigated demographic, disease-related, and caregiver-related characteristics of those who filled electronic surveys, paper surveys, or no surveys at all, using mixed-effects logistic regression models.

**Results:** Electronic questionnaires were more likely to be filled by caregivers with advancing patient age (beta=0.04, p<0.001, CI[0.02; 0.05]). There was no effect of gender or race. Hispanic/Latino ethnicity correlated with decreased use of electronic questionnaires, likely due to lack of Spanish translation (beta=-1.3, p<0.015, CI[-2.4;-0.26]). Medicaid use was associated with less use of electronic questionnaires (beta=-1.25, p=0.001, CI[-2.0,-0.5]). Neurobehavioral symptoms correlated with increased use of electronic questionnaires by caregivers (beta=0.2, p<0.001, CI[0.1,0.2]), as did increasing patient functional disability (beta=0.1, p<0.001, CI[0.0,0.1]). Self reported caregiver burden also associated with decreased use of electronic questionnaires (beta=-2.2, p<0.001, CI[-2.8,-1.6]).

**Conclusions:** Electronic questionnaires may offer caregivers a safe means of reporting difficult symptoms, though caregivers may be more hesitant to fill electronic forms if there are many other

sources of caregiver burden. Additional considerations should be given to expand accessibility to those of lower socioeconomic status and ethnic minorities.

**Primary Student Presenter:** Karima Hamamsy

**Additional Presenter(s):** Alexandra Lauren

**Presenting School:** Medicine

**Degree Seeking:** MD

**Year:** 4th

**Mentor:** Jennifer Adams

**Poster Title:** Development of a Novel Curriculum in Motivational Interviewing for Medical Students in an Elective and Longitudinal Integrated Clerkship.

**Final Category:** Education

**Abstract:**

Development of a Novel Curriculum in Motivational Interviewing for Medical Students in an Elective and Longitudinal Integrated Clerkship.

KC Hamamsy (MD, SOM), AS Lauren (MD, SOM), JE Adams MD, DJ Seymour, PsyD, CW Morris, PsyD, C Morris, PhD, V Kulasekaran, MD, AM Frank, MD,

Department of Medicine, University of Colorado School, Denver, CO.

Motivational Interviewing (MI) is a method proven to be effective in helping patients find their intrinsic motivation towards behavioral change(1). We believe that introducing medical students to MI early in their careers will allow them to develop a more patient-centered approach to medical care. Our project started with a MI elective that took place in the Fall of 2018 for first- and second-year medical students. The elective included a combination of didactics, exercises, MI practice, and discussion. The second part of our project was a MI curriculum for the 2020-2021 Denver Health Longitudinal Integrative Clerkship (DH-LIC). The curriculum consists of a lecture on MI principles, MI-specific exercises, 1:1 coaching with experienced facilitators, and two team-based learning (TBL) cases focused on chronic disease management and application of MI skills. Our evaluation methods are quantitative and qualitative pre- and post-elective and curriculum surveys. Students who completed the elective showed an increase in confidence and comfort with MI. Our pre-curriculum survey for the DH-LIC showed that most students reported that MI is “very important” or “extremely important” for their medical education, and 42.9% (n=21) of students reported lower comfort using MI in patient encounters. Post curricular DH-LIC surveys will measure efficacy of and student satisfaction with the curriculum. An interactive, longitudinal, and multimodal curriculum has met a need in the CUSOM curriculum. We anticipate further dissemination of this curriculum to future CUSOM clerkship students and believe the structure and content is exportable.

(1)Lundahl B, Moleni T, Burke BL, Butters R, Tollefson D, Butler C, Rollnick S. Motivational interviewing in

medical care settings: a systematic review and meta-analysis of randomized controlled trials. *Patient Educ Couns* 2013;93:157–68.

**Primary Student Presenter:** Mika Hamer

**Presenting School:** Public Health

**Degree Seeking:** PhD

**Year:** 5th

**Mentor:** Marcelo Perrailon

**Poster Title:** The Effect of Medicare Prevention Benefit Expansion on Cancer Detection and Mortality

**Final Category:** Healthcare and Public Health

**Abstract:**

The Effect of Medicare Prevention Benefit Expansion on Cancer Detection and Mortality: MK Hamer (PhD, CSPH), RM Myerson, CJ Bradley, RC Lindrooth, MC Perrailon. Health Systems, Management, and Policy, Colorado School of Public Health, Aurora, CO

Breast and colorectal cancers are leading causes of death in older adults. Early detection greatly improves survival. Yet in 2010, over half of adults  $\geq 65$  were not up to date on preventive services, including cancer screening. To address this, Medicare expanded prevention benefits through the Affordable Care Act (ACA) by: (1) eliminating cost sharing for prevention services; (2) introducing the Annual Wellness Visit; and (3) providing bonus payments to PCPs in health care shortage areas. The causal effect of these policy changes on cancer detection and mortality is unknown.

We use a difference-in-differences (DID) design to estimate outcomes before and after 2011 for a Medicare-eligible population over age 65. We compare to the near elderly (i.e., age 59-64) who were not affected by the policy changes. The validity of this design relies on the arbitrariness of age 65 as the Medicare-eligibility threshold. We model outcomes using negative binomial regression, controlling for time trends, effect of aging, and county-level factors (e.g., health care supply).

Our sample included 291,666 tumors and 442,974 cancer deaths in people age 59-70 from 2008-2013. Medicare's benefit expansion was associated with an increase in breast cancer detection (11.25/100k pop.,  $p=0.002$ ) driven by early-stage cancers (11.09/100k pop.,  $p<0.001$ ). There was no change in late-stage cancers or breast cancer mortality. There was no change in colorectal cancer detection, total or by stage. There was a small decrease in colorectal cancer deaths (-1.49/100k pop.,  $p=0.026$ ).

By encouraging and improving access to preventive services, Medicare's prevention benefit expansion increased early-stage breast cancer detection and decreased colorectal cancer mortality.

**Primary Student Presenter:** Tessa Hennesy

**Presenting School:** Medicine

**Degree Seeking:** MD

**Year:** 3rd

**Mentor:** Anu Sharma

**Poster Title:** Cortical Cross-Modal Reorganization from both Visual and Somatosensory Modalities in Children with Cochlear Implants

**Final Category:** Developmental Neuroscience and Brain and Behavior - Child

**Abstract:**

Cortical Cross-Modal Reorganization from both Visual and Somatosensory Modalities in Children with Cochlear Implants. TB Hennesy (MD, CUSOM), G Cardon, J Campbell, HA Glick, D Bell-Souder, and A Sharma, Department of Speech Language and Hearing Sciences, University of Colorado, Boulder, CO.

Cross-modal reorganization, which occurs when a deprived sensory modality's cortical resources are recruited by other intact modalities, has been proposed as a source of variability underlying speech perception in hearing-impaired cochlear implant (CI) users. Visual and somatosensory cross-modal reorganization of auditory cortex has been documented separately in children with CIs, but reorganization in these modalities has not been documented within the same subject group. Thus, this study's goal was to examine cross-modal reorganization across visual and somatosensory modalities within a single group of CI children (n=10) using high-density electroencephalography. We analyzed evoked potentials in response to visual and somatosensory stimuli and performed current density reconstruction (CDR) of brain activity sources. Speech perception-in-noise testing was also performed. CDR patterns were analyzed within the entire subject group and across groups of CI children exhibiting good vs. poor speech perception. Results showed a positive correlation between visual and somatosensory cross-modal reorganization, suggesting that neuroplasticity in different sensory systems may be interrelated. Further, CI children with good speech perception did not show recruitment of frontal or auditory cortices during visual processing, while subjects with poor speech perception did. Findings reflect widespread changes in cortical networks in CI children that relate to functional performance.

**Primary Student Presenter:** Hannah Hicks

**Presenting School:** Graduate

**Degree Seeking:** PhD

**Year:** 4th

**Mentor:** Rebecca Schweppe

**Poster Title:** The Role of an Invasive Phenotype in Promoting Resistance to MAPK-Directed Therapies in Thyroid Cancer

**Final Category:** Hematology and Oncology

**Abstract:**

The Role of an Invasive Phenotype in Promoting Resistance to MAPK-Directed Therapies in Thyroid Cancer: HM Hicks, (Ph.D., GS), VL Espinoza, LR McKenna, N Pozdeyev, RE Schweppe, Department of Medicine, University of Colorado Anschutz Medical Campus, Aurora, CO.

Advanced papillary thyroid cancer (PTC) and anaplastic thyroid cancer (ATC) have limited therapeutic options and are thus the leading causes of endocrine cancer death. Mutations in the MAP kinase (MAPK) pathway are common in PTC and ATC, especially in BRAF. An emerging mechanism of resistance to targeted therapies is an invasive phenotype switch during which cells transition from a proliferative, sensitive population to an invasive, resistant population. We hypothesized that a more invasive phenotype plays a role in resistance to BRAFi in BRAF-mutant ATC and PTC. Using Matrigel-coated Boyden chamber invasion assays, we found that BRAFi increased invasion in cells resistant, but not sensitive, to BRAFi. MAPK pathway reactivation occurs following BRAFi treatment, however, combination treatment with BRAFi and SCH772984 (ERKi) prevents reactivation. Further, combined BRAFi/ERKi mitigates the increased invasion observed in response to BRAFi alone. Using reverse phase protein array, we identified an increase in fibronectin (FN1) in response to BRAFi, and found via ELISA assays that secreted FN1 increases in response to BRAFi in resistant cells but decreases in sensitive cells. Of note, addition of FN1-supplemented media phenocopies treatment with BRAFi by increasing invasion in resistant cells, which can be overcome by ERKi. Finally, treatment of sensitive cell lines with conditioned media from BRAFi-treated resistant cells increases their invasiveness, suggesting the secretome of resistant cells in response to BRAFi is pro-invasive. These data indicate that a more invasive phenotype characterized by MAPK pathway reactivation and increased FN1 plays a role in resistance to BRAF inhibition in thyroid cancer.

**Primary Student Presenter:** Erin Hirsch

**Presenting School:** Graduate

**Degree Seeking:** PhD

**Year:** 2nd

**Mentor:** Jamie Studts

**Poster Title:** Determinants associated with longitudinal adherence to annual lung cancer screening: a retrospective analysis of claims data

**Final Category:** Healthcare and Public Health

**Abstract:**

Determinants associated with longitudinal adherence to annual lung cancer screening: a retrospective analysis of claims data

EA Hirsch (Ph.D., GS), SP Malkoski, AE Baron, RC Risendal, ML New, JL Studts

**Purpose:** Lung cancer screening (LCS) efficacy is highly dependent on adherence to annual screening, but little is known about real-world adherence determinants. We used insurance claims data to examine associations between LCS annual adherence and demographic, comorbidity, healthcare usage, and geographic factors.

**Methods:** Insurance claims data for all individuals with a LCS low dose CT scan was obtained from the Colorado All Payer Claims Dataset. Adherence was defined as a second claim for a screening CT 10-18 months after the index claim. Cox proportional hazards regression was used to define the relationship between annual adherence and age, sex, insurance type, residence location, outpatient healthcare usage, and comorbidity burden.

**Results:** After exclusions, the final dataset consisted of 9,056 records with 3,072 adherent, 3,570 non-adherent, and 2,414 censored (unclassifiable) individuals. Less adherence was associated with ages 55-59 (hazard ratio (HR)=0.80, 99% confidence interval (CI)=0.67-0.94), 60-64 (HR=0.83, 99% CI=0.71-0.97) and 75-79 (HR=0.79, 99% CI=0.65-0.97), rural residence (HR=0.56, 99% CI=0.43-0.73), Medicare Fee-for-Service (HR=0.45, 99% CI=0.39-0.51), and Medicaid (HR=0.50, 99% CI=0.40-0.62). A significant interaction between outpatient healthcare usage and comorbidity was also observed ( $p < 0.0001$ ). Increased outpatient usage was predictive of increased adherence and was most pronounced for individuals without comorbidities.

**Conclusions:** This population-based description of LCS adherence determinants provides insight into populations that might benefit from specific interventions targeted toward improving adherence and maximizing LCS benefit. Quantifying population-based adherence rates and understanding factors predictive of annual adherence is critical to improving screening adherence and reducing lung cancer

death.

**Primary Student Presenter:** Clay Hoffman

**Presenting School:** Medicine

**Degree Seeking:** MD

**Year:** 2nd

**Mentor:** Donald Jacobs

**Poster Title:** Massive Pulmonary Embolism with Cardiac Arrest During Routine Tibial Bypass Surgery

**Final Category:** Surgery

**Abstract:**

Massive Pulmonary Embolism with Cardiac Arrest During Routine Tibial Bypass Surgery

CJ Hoffman, (MD, CUSOM), N Govsyeyev MD(1), SS Siada DO(2), and DL Jacobs MD(2)

1. Department of Surgery, University of Colorado, Anschutz Medical Campus, CPC Research, Aurora, CO

2. Division of Vascular Surgery, University of Colorado, Anschutz Medical Campus, Aurora, CO

Management of pulmonary embolism (PE) is a rapidly evolving topic with an increasing focus on endovascular interventions. Historically, massive PE was treated with systemic thrombolysis despite a significant risk of major bleeding, including intracranial hemorrhage. Recent evidence shows fewer complications and lower mortality for catheter-directed thrombolysis compared with systemic thrombolysis.

We report the case of a massive PE with intra-operative cardiac arrest in a 48-year-old male during routine surgical tibial bypass successfully managed by rapid diagnosis and catheter-based interventions. The patient was removed from inotropic support by the fourth postoperative day and went on to complete successful tibial bypass one week following cardiac arrest. He was discharged home two weeks post-arrest in excellent condition.

Our experience supports the trending shift in pulmonary embolism therapy guidelines to include endovascular approaches and emphasizes the need for vascular surgeons to adapt their training protocols. Vascular surgeons often use these devices in the periphery and expanding this skillset to the management of PE will increase their value as providers, position them to be leaders in the field, and improve patient care.

**Primary Student Presenter:** Alex Hoffner-Heinike

**Presenting School:** Medicine

**Degree Seeking:** MD

**Year:** 2nd

**Mentor:** Michal Schafer

**Poster Title:** Electromechanical discoordination is present in patients with Duchenne Muscular Dystrophy independent of tissue fibrosis.

**Final Category:** Cardiovascular

**Abstract:**

Electromechanical discoordination is present in patients with Duchenne Muscular Dystrophy independent of tissue fibrosis. A Hoffner-Heinike (MD, Medical School), M Schafer, BS. Frank, DD Ivy, AJ Barker, LP Browne, M Di Maria, B Fonseca, S Miyamoto, S Auerbach, Heart Institute, Children's Hospital Colorado

**Purpose:** Progressive ventricular dysfunction is a cardinal symptom in Duchenne Muscular Dystrophy (DMD). Some of the earliest signs of cardiomyopathy in DMD are myocardial fibrotic deposition and Left Ventricle (LV) strain defects. Electromechanical discoordination, as measured by Systolic Stretch Fraction (SSF) and Diastolic Relaxation Fraction (DRF), has been shown to be a sensitive marker of ventricular dysfunction. The presence of this discoordination in relation to fibrotic deposition in DMD has yet to be elucidated.

**Methods:**

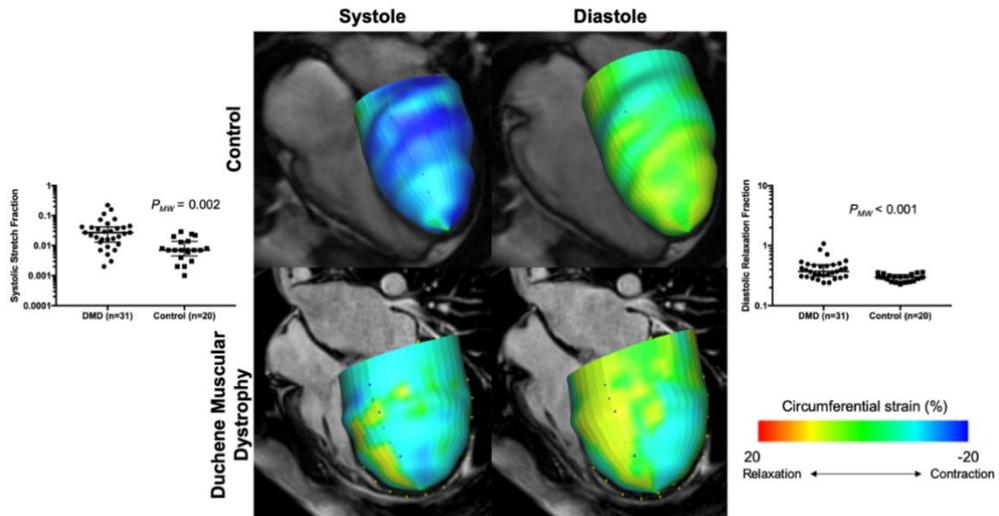
Patients with DMD (n=31)(mean age:  $14 \pm 4$  yrs) and controls (n=20) (mean age:  $15 \pm 3$  yrs) underwent CMR for volumetric and functional analysis as well as Gadolinium (Gd) enhancement to evaluate the presence of fibrosis. Circumferential strain and strain rate indices from each segment were used to calculate electromechanical discoordination. Strain rate data was used to calculate SSF and DRF.

**Results:**

Patients with DMD showed increased median LV SSF compared to controls [0.027 (IQR: 0.015-0.041) vs 0.007 (IQR:0.005-0.013),  $P = 0.002$ ] as well as increased median LV DRF [0.371 (IQR: 0.310-0.473) vs 0.300 (IQR: 0.264-0.325),  $P < 0.001$ ] (Figure). When comparing Gd(+) (n=14) vs Gd(-) (n=17) DMD patients, there was no difference between groups in either SSF [0.027 (IQR: 0.016-0.042) vs 0.026 (IQR: 0.008-0.040),  $P = 0.929$ ] or DRF [0.371 (IQR: 0.309-0.537) vs 0.379 (IQR: 0.322-0.464),  $P = 0.931$ ]. The SSF was associated with ESVi ( $R=0.71$ ,  $P<0.001$ ), EDVi ( $R=0.65$ ,  $P< 0.001$ ) and inversely associated with EF ( $R=-0.63$ ,  $P<0.001$ ).

**Conclusion:**

Patients with DMD showed increased levels of LV electromechanical discoordination independent of qualitative presence of fibrosis noted by Gd enhancement. This allows speculation that changes in electromechanical discoordination may precede visible fibrotic change in DMD.



**Primary Student Presenter:** Zachary Horwitz

**Presenting School:** Medicine

**Degree Seeking:** MD

**Year:** 3rd

**Mentor:** Aaron Powell

**Poster Title:** Sacral Level Spina Bifida Plantar Pressure Analysis

**Final Category:** Bone or Skeletal

**Abstract:**

Sacral Level Spina Bifida Plantar Pressure Analysis. Z Horwitz MD candidate 2022, A Powell (MD), A Bodkins (DPT), R Pimentel (MS), B Euker (BS), R Peterson, Y Jin, University of Colorado Anschutz Medical Campus, Children's Hospital Colorado

The objective of this study is to see if sacral level Spina Bifida (SSB) patients with myelomeningocele have equivalent to healthy control (HC) patient's feet when compared quantitatively and qualitatively using pedobarography. Quantitative measures included foot progression angle, foot start location, foot end location, lateral pressure ratio, and arch pressure ratio, continuously through center of pressure, and qualitatively for peak pressure and shape. The data was collected retrospectively from Children's Hospital Colorado's Gait Analysis Laboratory using a pedobarography mat. The quantitative data was analyzed using a Covariant T-Test comparing the 17 SSB patients to the 18 HC patients across multiple variables looking for covariation with age and BMI. Additionally analysis of the continuous center of pressure data performed. The data strongly supports that the SSB patients have statistically significant increases in the variability of their center of pressure through the gait cycle show by the higher minimum ( $p < 0.01$ ) and a lower maximum ( $p < 0.01$ ), and a higher amount of skew ( $p < 0.05$ ). The qualitative analysis was performed visually post data processing and showed increased SSB variability as well. In this small study, pedobarography was able to distinguish a significant difference between SSB and HC patients.

**Primary Student Presenter:** Clarinda Hougen

**Presenting School:** Medicine

**Degree Seeking:** MD

**Year:** 4th

**Mentor:** Ram Nagaraj

**Poster Title:** Peptain-1 blocks ischemia/reperfusion-induced retinal capillary degeneration in mice

**Final Category:** Vision Sciences

**Abstract:**

Peptain-1 blocks ischemia/reperfusion-induced retinal capillary degeneration in mice

CJ Hougen (M.D., SOM), MH Nam, RB Nahomi, and RH Nagaraj, Department of Ophthalmology, University of Colorado, Denver, CO.

**Purpose:** Diabetic retinopathy (DR) is characterized by abnormalities of retinal neuronal and capillary cells. Peptain-1 was shown to be protective against retinal ganglion cell death in animal models of glaucoma. Here we evaluate the ability of peptain-1 to block apoptosis of human retinal endothelial cells (HRECs) in vitro and retinal capillary cells in mice after retinal ischemia/reperfusion (I/R) injury.

**Methods:** HRECs were treated with peptain-1 or scrambled peptide (200 µg/ml) for 3 h and a combination of pro-inflammatory cytokines (IFN-γ 50U/ml + TNF-α 20ng/ml + IL-1β 20ng/ml) for 48 h. C57BL/6J mice (12-week-old) were subjected to I/R injury by elevating the intraocular pressure to 120 mmHg for 60 min followed by reperfusion. Peptain-1 or scrambled peptide (0.5 µg of in 1 µl of PBS) were injected intravitreally immediately after I/R injury and after one week. Contralateral eyes were used as vehicle controls and animals were euthanized on day 14 post-I/R injury. Abnormalities in the retinal capillaries were evaluated by Periodic acid-Schiff staining of elastase-digested retinal blood vessels.

**Results:** Our data suggest peptain-1 entered HRECs without any transfer reagents. Peptain-1 blocked caspase-3-mediated apoptosis in HRECs but scrambled peptides did not. Intravitreally injected peptain-1 was distributed throughout the retina after 4 h. The I/R injury caused the loss of retinal capillary cells. A similar pattern was observed in the scrambled peptide injected group. Intravitreally injected peptain-1 protected retinal cells from I/R injury.

**Conclusion:** Our study demonstrated that peptain-1 protects retinal capillary cells from I/R injury and suggests that peptain-1 could be used as a therapeutic agent to prevent the death of capillary cells in DR.

**Primary Student Presenter:** Jin Huang

**Presenting School:** Medicine

**Degree Seeking:** MD

**Year:** 2nd

**Mentor:** Timothy Amass

**Poster Title:** Stress Related Disorders in Family Members of COVID-19 Patients Admitted to the Intensive Care Unit

**Final Category:** Pulmonary and Critical Care

**Abstract:**

STRESS RELATED DISORDERS IN FAMILY MEMBERS OF COVID-19 PATIENTS ADMITTED TO THE INTENSIVE CARE UNIT. J. Huang, (MD, SOM), MD Burhani, TC Lane, T. Milinic, and TH Amass, Department of Medicine, University of Colorado, Denver, CO.

**Introduction:** To prevent the spread of coronavirus disease 2019 (COVID-19), patient isolation has become the standard of care, with hospitals reducing or eliminating visitors of all types. Post-Intensive Care Syndrome-Family (PICS-F) includes symptoms of post-traumatic stress disorder (PTSD), anxiety, and depression that persist for at least three months after Intensive Care Unit (ICU) admission. Patient isolation during the COVID-19 era may significantly increase the incidence of stress related disorders in family members.

**Methods:** As part of a national study, phone calls were made to family members of COVID-19 patients admitted to the ICU at a single university hospital from March to June of 2020. Three previously validated surveys were administered: Impact of Events Scale-6 (IES-6), Hospital Anxiety and Depression Scale (HADS), and a subset of Family Satisfaction in the ICU-27 (FS-ICU) questions thought a priori to be most impacted by restrictive visitation.

**Results:** Out of the 194 eligible, 57 family members participated in the study (29.4%). Of these, 57.9% reported symptoms of PTSD, 56.1% reported symptoms of anxiety, and 26.3% reported symptoms of depression. On the FS-ICU questions, the highest mean score (4.5/5) was given in response to the question "How well did the doctors care for the patient?" and the lowest mean score (3.5/5) was given in response to the question "Did you feel you had control over the patient's care?"

**Conclusion:** Over 57% of family members of COVID-19 patients admitted to the ICU reported symptoms of PTSD. The high incidence of stress related symptoms reported in our study suggests that interventions may be necessary to reduce the unintended consequences of necessary isolation during the COVID-19 era.

**Primary Student Presenter:** Andrew Hull

**Presenting School:** Graduate

**Degree Seeking:** MS

**Year:** 2nd

**Mentor:** Lisa Lee

**Poster Title:** The Virtual Folding Embryo: The Efficacy of Virtual Resources in Anatomy Education

**Final Category:** Education

**Abstract:**

In embryology, normal development of the body cavity is an intricate interplay of tissues folding into 3D structures. The embryo changes from a flat pancake shape around day 17 to a recognizable form at day 28. Understanding the body cavity formation is imperative to understanding multiple congenital variations. Current educational resources are sparse and do a poor job demonstrating the 3D and 4D intricacies of development. A series of models depicting embryo folding were created to demonstrate normal body cavity development called "The Virtual Folding Embryo" (VFE). The effectiveness of the VFE was tested on 155 first year medical students and 26 Modern Human Anatomy (MHA) graduate students. The students watched a pre-recorded lecture on embryology topics and then took a quiz to test their foundational knowledge. Students were then randomly divided into groups of 4-5 students. Half of the groups were given access to the VFE, while the other half were given access to a resource demonstrating a different embryonic process. After 15 minutes, all students completed a quiz and an optional short survey rating the perceived value of the resource. Scores between the pre- and post-quiz did not differ significantly. Student responses showed the perception of the VFE was very helpful for their learning. We also tested the VFE on the MHA students, following a similar testing regiment. This cohort showed a significant increase in performance between the pre and post quiz ( $n=26$ ) with an average increase of 1.4%  $p=0.0002$ . There is likely educational value to creating and incorporating the VFE and other 3D interactive resources into the medical curriculum. The large increase in post quiz score and positive feedback on the VFE indicate that it facilitated learning. These types of resources will enrich embryological education and provide a viable avenue for creating similar resources in the future.

**Primary Student Presenter:** Cydney Johnson

**Presenting School:** Graduate

**Degree Seeking:** PhD

**Year:** 4th

**Mentor:** Breck Duerkop

**Poster Title:** Plasmid carriage restricts lytic phage infection of *Enterococcus faecalis*

**Final Category:** Microbiology and Infectious Diseases

**Abstract:**

Emerging multidrug resistant (MDR) bacterial infections are outpacing the development of new antibiotics. This is specifically relevant for MDR enterococci which are major contributors to hospital-acquired infections in humans. One possible alternative for combating MDR enterococci is bacteriophage (phage) therapy. While it is widely accepted that phages hijack host cellular processes for their propagation, mechanisms used by enterococci to restrict phage infection are understudied. We previously determined that the lytic enterococcal phage 47 (phi47) exhibits an extremely narrow host range. phi47 infects MDR *E. faecalis* strain SF28073 and does not infect the prototypical MDR *E. faecalis* strain V583. Considering these two strains are genetically similar, we discovered that phi47 was capable of infecting an isogenic strain of *E. faecalis* V583 that lacked three endogenous plasmids. These plasmids include pTEF1 and pTEF2 which are conjugative plasmids that resemble pheromone responsive plasmids, and pTEF3 which belongs to the pAM $\beta$ 1 family of broad host range plasmids. Closer genomic comparison revealed that *E. faecalis* SF28073 lacks the pTEF plasmids, suggesting that an unidentified genetic feature(s) on one or more pTEF plasmid may be responsible for restricting lytic phage infection in *E. faecalis*. To investigate this hypothesis, we assessed phi47 infection of *E. faecalis* cells harboring plasmids pAD1 or pAM771, pheromone responsive plasmids that are genetically similar to pTEF1 and pTEF2, respectively. Neither plasmid successfully restricted lytic phi47 infection. However, *E. faecalis* cells harboring only pTEF2 from V583 were completely resistant to phi47 infection. There are no anti-phage mechanisms predicted to be on pTEF2. These findings provide important insight into the novel mechanisms used by enterococci to subvert phage infection. This information will be useful for the rational selection of therapeutic anti-enterococcal phages.

**Primary Student Presenter:** Austin Jolly

**Presenting School:** Graduate

**Degree Seeking:** MD/PhD

**Year:** 4th

**Mentor:** Mary Weiser-Evans

**Poster Title:** HDAC9 and Brg1 are Implicated in Pathological Vascular Remodeling

**Final Category:** Cardiovascular

**Abstract:**

HDAC9 and Brg1 are Implicated in Pathological Vascular Remodeling. AJ Jolly (MD/PhD, MSTP Program), A. Dubner, M. Mutryn, KA. Strand, K. Moulton, R. Nemenoff, S. Lu, and M. Weiser-Evans, Department of Medicine, University of Colorado Anschutz Medical Campus.

Vascular fibrosis is an irreversible consequence of pathological vascular remodeling that develops in response to many forms of cardiovascular disease including chronic hypertension and atherosclerosis. Given cardiovascular disease remains the #1 killer of Americans and people worldwide, pathological vascular remodeling emerges as an important topic of study as patients currently do not have reliable treatment options to improve quality of life. Our lab identified a unique population of multipotent smooth muscle-derived Sca1<sup>+</sup> progenitor cells that reside in the adventitia of blood vessels (AdvSca1-SM cells). In setting of vascular disease, AdvSca1-SM cells greatly expand in the adventitial region and differentiate into myofibroblasts and contribute to the development of vascular remodeling and fibrosis. The epigenetic remodeling proteins HDAC9 and Brg1 are upregulated uniquely in the AdvSca1-SM population in the setting of vascular injury, but how HDAC9 and Brg1 affect AdvSca1-SM differentiation remains unknown. Using a combination of in vitro and in vivo approaches, we aim to define the role of HDAC9 and Brg1 in progenitor cell-induced vascular remodeling. We hypothesize that HDAC9 and Brg1 remodel chromatin and preferentially drive AdvSca1-SM cell differentiation towards pathologic myofibroblasts and inhibition of HDAC9 and Brg1 will disrupt AdvSca1-SM differentiation into myofibroblasts and attenuate pathological vascular remodeling. AdvSca1-SM cells are isolated and differentiated into myofibroblasts with TGF- $\beta$  and also treated with the Brg1 bromodomain inhibitor PFI-3 to study the function of Brg1 in TGF- $\beta$  stimulated AdvSca1-SM cells. Using a highly reliable cell fate-mapping Cre-lox system, AdvSca1-SM cells are tracked with high fidelity after acute vascular injury induced by carotid ligation. The small molecule TMP195 is administered to mice with vascular injury to define the role of HDAC9 in pathological vascular remodeling. Recent results suggest Brg1 is required for TGF- $\beta$  induced myofibroblast differentiation of AdvSca1-SM cells in vitro. Further, animal studies convey that pharmacological inhibition of HDAC9 attenuates pathological vascular remodeling as compared to control animals. Ultimately, these results support the conclusion that Brg1 and HDAC9 play an essential role in facilitating the differentiation of AdvSca1-SM cells into myofibroblasts and are heavily implicated in pathological vascular remodeling.

**Primary Student Presenter:** Lawand Kamal

**Presenting School:** Pharmacy

**Degree Seeking:** PharmD

**Year:** 4th

**Mentor:** Meghan Jeffres

**Poster Title:** Third-Generation Cephalosporins Versus Carbapenems for Empiric Treatment of Enterobacter spp., Serratia spp., Citrobacter spp., or Morganella morganii Infections

**Final Category:** Microbiology and Infectious Diseases

**Abstract:**

LD Kamal (Pharm.D., SOP) C Kim, J Archer, J Dukes, MN Jeffres (Faculty Sponsor) Department of Pharmacy, University of Colorado, Denver, CO

Controversy exists on whether the use of third-generation cephalosporins to treat infections caused by aAmpCampC inducible-organisms lead to increased rates of clinical failure and resistance. The objective of this study was to examine early clinical failure rates between patients receiving empiric third-generation cephalosporins or carbapenems for treatment of Enterobacter spp., Serratia spp., Citrobacter spp., or Morganella morganii infections.

This retrospective cohort study included patients with bloodstream and/or respiratory infections caused by ESCPM pathogens resistant to first-generation cephalosporins and susceptible to third-generation cephalosporins. The primary outcome of early clinical failure was compared between patients receiving empiric third-generation cephalosporins and carbapenems. To minimize the possibility of treatment selection bias, 1:1 nearest neighbor propensity score matching was performed.

Propensity score matching yielded 30 matched pairs. Early clinical failure occurred in 8 (26.7%) patients in the third-generation cephalosporin group and 9 (30%) in the carbapenem group ( $p = 1.00$ ). Thirty-day mortality occurred in 4 (13.3%) patients in the third-generation cephalosporin group and 5 (16.7%) patients in the carbapenem group ( $p = 1.00$ ). Thirty-day readmission occurred in 4 (13.3%) patients in the third-generation cephalosporin group and 3 (10%) patients in the carbapenem group ( $p = 1.00$ ). Positive repeat cultures occurred in 3 (10.0%) patients in the third-generation cephalosporin group and 11 (36.7%) patients in the carbapenem group ( $p = .03$ ).

Empiric therapy with third-generation cephalosporin did not result in a higher rate of early clinical failure than carbapenems for patients with bloodstream and/or respiratory infections caused by ESCPM pathogens.

**Primary Student Presenter:** Meghan Kellett

**Presenting School:** Graduate

**Degree Seeking:** MD/PhD

**Year:** 4th

**Mentor:** Rebecca Schweppe

**Poster Title:** Investigating nuclear Focal Adhesion Kinase in thyroid cancer.

**Final Category:** Hematology and Oncology

**Abstract:**

Investigating nuclear Focal Adhesion Kinase in thyroid cancer. M Kellett (MD PhD, GS), V Sharma, B Kessler, and RE Schweppe; Dept. of Medicine, University of Colorado

Late stage thyroid cancers characterized by metastasis and invasion have a poor prognosis compared to those with localized disease. However, there are limited therapeutic options and few biomarkers to indicate which patients will develop aggressive disease. Our lab has identified Focal Adhesion Kinase (FAK) as a key regulator of thyroid cancer growth, invasion, and metastasis. FAK is a non-receptor tyrosine kinase that is auto-phosphorylated at tyrosine 397 (Y397) in response to integrin or growth factor receptor signaling resulting in the activation of downstream signaling pathways. FAK has also been shown to localize to the nucleus in response to cellular stress via a nuclear localization sequence to promote increased cell survival. We have found that FAK is localized to the nucleus in a subset of thyroid cancer patients, but it's unclear how FAK is localizing to the nucleus and what its function is in the nucleus. I hypothesized that cellular stress induces nuclear localization of FAK to promote a more aggressive phenotype in thyroid cancer. I first analyzed the role of hypoxia since low oxygen environments cause tumor cells to secrete pro-angiogenic cytokines in order to recruit blood vessels. I found that FAK localizes to the nucleus within 30 minutes of exposure to a hypoxic environment of 1% oxygen. Furthermore, I found that this nuclear localization is dependent on phosphorylation of Y397 FAK. Next, I found that thyroid cancer cells secrete high levels of pro-angiogenic cytokines that is reduced when FAK is excluded from the nucleus in hypoxia. Thus, hypoxia induces nuclear localization of FAK through phosphorylation of Y397 FAK to promote secretion of pro-angiogenic cytokines. Overall, nuclear FAK may serve as a biomarker of aggressive disease and novel therapeutic target in thyroid cancer.

**Primary Student Presenter:** Emmeline Kim

**Presenting School:** Medicine

**Degree Seeking:** MD

**Year:** 2nd

**Mentor:** Liron Caplan

**Poster Title:** Platelet/Lymphocyte Ratio: A Potential Biomarker for Disease Activity in Ankylosing Spondylitis.

**Final Category:** Immunology and Autoimmune Diseases

**Abstract:**

Platelet/Lymphocyte Ratio: A Potential Biomarker for Disease Activity in Ankylosing Spondylitis. EJ Kim, MD.,GS; R Sen, MD MS; ES Manning, MD; ER Anderson, MD; KD Maier, MD; E Cheng, BA; L Caplan, MD PhD, Department of Rheumatology, Rocky Mountain Regional Veterans Affairs Medical Center, Aurora, CO.

Ankylosing spondylitis (AS) is a chronic inflammatory disease involving erosions or fusion of the sacroiliac joint (SIJ) and spine which can be debilitating. The most commonly used biomarker of disease activity, c-Reactive Protein (CRP), has been shown to have low specificity and sensitivity. Prior studies have shown that the neutrophil/lymphocyte ratio (NLR) and platelet/lymphocyte ratio (PLR) are associated with inflammatory disease activity and severity. This study evaluates the utility of the NLR/PLR as biomarkers for AS disease activity and severity by examining their association with CRP and SIJ damage scores.

Data was drawn from the Program to Understand Long-Term Outcomes of Spondyloarthritis registry at the Rocky Mountain Regional VA Hospital. SIJ radiographs were scored for sacroiliitis based on the modified New York (mNY) radiographic criteria. CRP and absolute neutrophil, lymphocyte, and platelet counts were collected within 6 months of the radiograph. The relationship between NLR, PLR, CRP and mNY scores was determined using regression techniques in the STATA (v13) statistical package.

42 patients met radiologic mNY radiologic criteria for sacroiliitis. No statistically significant correlation was found between mNY radiograph scores and the NLR nor the PLR, but CRP concentration was associated with the PLR ( $R^2 = 0.3205$ ,  $p < 0.001$ ).

Though our study did not show a correlation between NLR and PLR, we did identify a relationship of PLR and CRP. Further studies are needed to validate these results in other populations, explore the relationship of PLR with patient reported outcomes, and determine if PLR is associated with findings from other imaging modalities.

**Primary Student Presenter:** Crystal Kim

**Presenting School:** Pharmacy

**Degree Seeking:** PharmD

**Year:** 4th

**Mentor:** Meghan Jeffres

**Poster Title:** Piperacillin/tazobactam versus Cefepime for Empiric Treatment of ampC Beta-lactamase Enterobacteriaceae

**Final Category:** Microbiology and Infectious Diseases

**Abstract:**

**Purpose:** The role of piperacillin/tazobactam in ampC producing bacteria remains unclear due to their instability nature in the presence of induced ampC beta-lactamase. The objective of this study was to compare clinical outcomes between piperacillin/tazobactam and cefepime in patients with bloodstream and/or respiratory infections due to *Enterobacter* spp., *Serratia* spp., *Citrobacter* spp., or *Morganella morganii* (ESCPM).

**Methods:** This single center, retrospective cohort study included patients admitted between January 2012 and June 2020. To be included, ESCPM isolates must exhibit an ampC inducible phenotype resistant to first-generation cephalosporins and susceptibility to third-generation cephalosporins, piperacillin/tazobactam, and carbapenems. The primary outcome was early clinical failure and secondary outcomes were 30-day mortality and 30-day readmission. A 1:1 nearest neighbor propensity score matching was performed to minimize differences in severity of illness and regression analysis to identify independent risk factors for early clinical failure.

**Results:** Of the 283 patients meeting inclusion criteria, a propensity score matching yielded 81 matched pairs. Early clinical failure occurred in 14 (17.3%) patients in the piperacillin/tazobactam group and 12 (14.8%) patients in the cefepime group ( $p = .83$ ). Thirty-day mortality occurred in 8 (9.9%) patients in the piperacillin/tazobactam group and 12 (14.8%) patients in the cefepime group ( $p = .47$ ). Thirty-day readmission occurred in 14 (17.3%) patients in the piperacillin/tazobactam group and 18 (22.2%) patients in the cefepime group ( $p = .55$ ).

**Conclusion:** This study suggests that piperacillin/tazobactam is an appropriate empiric treatment when used in patients with bloodstream and/or respiratory infections due to ampC inducible ESCPM bacteria. There was no statistical difference in early clinical failure, 30-day mortality, and 30-day readmission rates between piperacillin/tazobactam and cefepime.

**Primary Student Presenter:** Katherine Kissler

**Presenting School:** Nursing

**Degree Seeking:** PhD

**Year:** 6th

**Mentor:** Teri Hernandez

**Poster Title:** Hierarchical Linear Model for Uterine Activity in Women with Obesity and Augmented Labor

**Final Category:** Child-Maternal Health and Reproductive Services

**Abstract:**

**Purpose:** The research purpose is to characterize variation of uterine responsiveness to oxytocin augmentation in women with obesity and spontaneous labor onset. We evaluated patterns of uterine activity measured by Montevideo units (MVUs), oxytocin doses in augmented labor, and cervical dilation over the course of labor and their relationship to labor dystocia.

**Research Hypotheses:** We hypothesize that increased labor dystocia severity will be associated with increased oxytocin doses, decreased uterine activity, and decreased uterine responsiveness.

**Background:** Recent research indicates that poor physiologic preparedness for labor and uterine muscle fatigue both contribute to labor dystocia, slow cervical dilation leading to prolonged labor, in some women. A better understanding of the variation in the pathophysiologic causes of labor dystocia characterized by patterns in MVU, cervical dilation, and required oxytocin doses, could lead to novel techniques to manage and prevent labor dystocia and cesarean delivery.

**Methods:** We conducted a secondary data analysis of a longitudinal cohort study of (N = 87) healthy, nulliparous, women with obesity (BMI  $\geq$  30 kg/m<sup>2</sup>) who started labor spontaneously, had augmented labor, and had an intrauterine pressure catheter in place. We identified four labor phenotypes that reflected increasing levels of labor dystocia severity and analyzed factors associated with labor dystocia severity.

**Results:** While statistically non-significant, total time of exposure to oxytocin augmentation (mins), the total oxytocin dose received ( $\mu$ ), and the effective oxytocin dose (titration, hourly oxytocin dose, and cumulative oxytocin dose) all increased with increasing dystocia severity. Similarly, the mean MVU-to-hourly oxytocin dose ratio decreased with increasing dystocia severity. These patterns are consistent with an association between arrest of cervical dilation, increased oxytocin requirements and decreased uterine responsiveness to oxytocin.

**Discussion:** The consistency of the pattern across variables and the apparent dose-dependent relationship are suggestive of an association. A one-size-fits-all approach to care during labor dystocia

may be less effective than individualized titration considering BMI, dystocia phenotype, and targeted to other indicators of the cause of labor dystocia.

**Primary Student Presenter:** Elizabeth Ko

**Additional Presenter(s):** Garth Wright

**Presenting School:** Pharmacy

**Degree Seeking:** PharmD

**Year:** 4th

**Mentor:** Ashley Glode

**Poster Title:** An Evaluation of Adult Cancer-Related Neuropathic Pain Treatment at a Large Academic Medical Center

**Final Category:** Hematology and Oncology

**Abstract:**

**Background:** Cancer-related neuropathic pain (CNP) is a common comorbidity among cancer patients due to treatment and/or tumors that can cause neuronal damage. Currently, there is no proven method to prevent CNP, and no published widely followed national guideline for CNP management with a defined treatment algorithm. Further evaluation of CNP treatment is needed to help guide the development of clinical algorithms for CNP management.

**Methods:** Health Data Compass, a data mining warehouse, was used to identify adults treated at the University of Colorado Hospital (UCH) who had a new diagnosis of cancer between January 1, 2014 and May 31, 2019 in addition to neuropathy during the same time frame. Individual patient electronic medical records were then reviewed for information unable to be obtained through Health Data Compass. The primary objective of the study was to describe CNP treatment at our facility. Descriptive statistics were used to define study population demographics and the primary outcome.

**Results:** A total of 316 patients met the study inclusion criteria. Most of the patients were white (86.7%) and female (67.4%). All cancer stages were represented in the study. The most included cancer type was breast cancer (39.4%). Most patients (n=283) had a diagnosis code of neuropathy on or after the date of their cancer diagnosis. The most common CNP management strategy was: opioids alone (37.7%). Nearly half of the medications used in CNP were not prescribed prior to the patient's neuropathy diagnosis date (47.3%). Approximately one-third of the patients (33%) had no dose changes from their initial CNP treatment dose.

**Conclusions:** The study identified the most commonly used medication for CNP treatment at UCH in a wide variety of cancer types and at all stages. Opioids were the most used medication to treat CNP at UCH. Next steps will be to evaluate the efficacy of opioids compared to other treatment combinations for the management of CNP.

**Primary Student Presenter:** Carlee Kreisel

**Presenting School:** Public Health

**Degree Seeking:** MPH

**Year:** 3rd

**Mentor:** Talia Spark

**Poster Title:** Rural Veterans of Color

**Final Category:** Healthcare and Public Health

**Abstract:**

Rural Veterans of Color: CJ Kreisel (MPH, CSPH) and TL Spark, Rocky Mountain MIRECC, U.S. Department of Veterans Affairs, Aurora, CO

Research shows that Veterans of color (VOC) and people of color residing in rural areas face socioeconomic and health disparities compared to their non-Hispanic White counterparts. However, little is known about disparities faced by the intersection of these populations - rural VOC. This poster will highlight rural counties with higher populations of VOC and explore differences in socioeconomic factors compared to rural communities with lower percentage VOC.

2018 American Community Survey 5-year estimates provided county-level race and ethnicity population estimates by Veteran status. United States Department of Agriculture 2013 Rural-Urban Commuting Codes were used to identify rural counties. Counties with greater than 20% of the Veteran population being people of color (Hispanic ethnicity or non-White race) were designated as higher proportion VOC counties. ArcGIS Online was used to display counties with high percentages of rural VOC. The 2018 County Health Rankings and 2018 CDC Social Vulnerability Index datasets provide socioeconomic data used to explore sociodemographic differences in rural counties with higher proportion VOC compared to lower proportion counties.

A total of 1976 counties in the US met the criteria for rural with 457 (23%) having a higher proportion VOC. The poster will include a map showing where these populations live and results from the analysis comparing socio-demographic differences between rural counties with higher proportion VOC.

Though rural Veterans tend to be less racially diverse, numerous counties with sizable populations of rural VOC exist. Rural VOC face discrimination, historical trauma, lack of access to culturally appropriate healthcare, and a host of socioeconomic barriers. Future rural Veteran research and intervention/prevention efforts should focus on rural VOC.

**Primary Student Presenter:** Sterling Lee

**Presenting School:** Medicine

**Degree Seeking:** MD

**Year:** 2nd

**Mentor:** Melissa Masaracchia

**Poster Title:** Opioid prescribing practices for at-risk pediatric populations undergoing ambulatory surgery

**Final Category:** Surgery

**Abstract:**

Opioid prescribing practices for at-risk pediatric populations undergoing ambulatory surgery

**Introduction:** Susceptible populations for post-surgical opioid-induced respiratory depression include sleep-disordered breathing and obese pediatric patients. Guidelines for opioid dosing in these groups have not been established. We investigated our institution's pain management in these groups for ambulatory surgery.

**Methods:** Opioid prescribing data for all outpatient surgery patients (ages 0-18) between 1/1/2019 and 6/30/2020 were retrospectively reviewed. Our sample included patients with sleep disordered breathing, obstructive sleep apnea, obesity or BMI-for-age >95th percentile. We reviewed demographics, opioid prescription descriptors, and prescribing surgical subspecialty. Oxycodone was classified low (<0.05mg/kg/dose) and standard/high (>0.05mg/kg/dose). Wilcoxon rank sum tests and Pearson's chi-square/Fisher's exact tests were utilized.

**Results:** 4,674 patients generated an opioid prescription between 1/2019 and 6/2020. Approximately 173 patients had sleep disordered breathing, and 128 with obesity. Otolaryngology and orthopedics prescribed the majority of opioids. Otolaryngologists predominantly prescribed reduced doses. Obese and sleep-disordered breathing patients were mainly prescribed lower doses ( $\leq 0.05\text{mg/kg}$ , 71.4%) despite the size descriptor used for calculations. Patients with no comorbidities received standard doses (58.7%). For obese patients, 64% prescriptions were based on ideal weight; and providers primarily prescribed standard doses ( $>0.05\text{mg/kg}$ , 83.3%,  $p<.0001$ ). When providers used actual body weight, low-dose was used more often (53.7%,  $p<.0001$ ). Prescriptions for sleep-disordered breathing patients were based on actual weight (79.8%) and low-dosed (86.2%).

**Discussion:** There is minimal data on opioid prescribing practices in vulnerable pediatric populations for opioid-induced respiratory depression in the outpatient setting. Inconsistent patterns of prescribing demonstrates the need for detailed guidelines in appropriate pain management for children with comorbidities.

**Primary Student Presenter:** Alexander Linse

**Presenting School:** Medicine

**Degree Seeking:** MD

**Year:** 3rd

**Mentor:** Mark Reid

**Poster Title:** Docs on TikTok: The Benefits and Risks Physicians Experience on Social Media

**Final Category:** Healthcare and Public Health

**Abstract:**

Docs on Tik Tok: The Benefits and Risks Physicians Experience on Social Media

Alexander J Linse, MS3, University of Colorado School of Medicine, Mark B Reid MD, Denver Health Medical Center

**Background:** The social media application TikTok has quickly gained popularity, with over 800 million users worldwide after only two years. There is a growing community of physicians and other healthcare workers posting videos on the application, serving as an additional avenue to enhance medical education, improve patient care, and expand career opportunities. Given the limited literature on the physician experience creating content on social media, there is little guidance for physicians interested in developing medical social media accounts. Our objective is to gain insight into the experiences of physician “TikTok-ers,” while delineating potential risks and benefits to healthcare recognized during their own social media engagement.

**Methods:** We developed a questionnaire assessing career impact, risks, and benefits identified by DO and MD physicians with over ten thousand followers on TikTok. The questionnaire was distributed via the physicians’ social media accounts and the data was analyzed, classifying themes connecting common experiences.

**Results:** In total, 50 physicians across 19 specialties completed the questionnaire. Approximately 25% (12/50) have been posting medical content on social media for less than one year, with over 75% (39/48) for fewer than five years. The average reported benefit and risk to their careers were 3.14/5 and 2.2/5, respectively. Overall, 74% (37/50) of physicians saw TikTok having positive impacts to their practices with benefits including opportunities in education, community engagement, creative outlet discovery, and patient empowerment. With 24% reporting no impact and 2% reporting some negative impact, identified risks included potential HIPAA violations, professionalism concerns, controversial medical data, and blurred patient boundaries.

**Conclusion:** Physicians are making their presence known on social media, and TikTok provides no exception. This has created additional opportunities to beneficially engage with an online, patient-based

audience. According to surveyed physicians, the benefits provided a stronger positive impact on their careers when compared with risks, thus paving ways in which near-unanimous social media use in the community can help foster physician-patient relationships. This suggests social media platforms may provide physicians innovative ways to educate, learn, and improve the quality of medical care delivered.

**Primary Student Presenter:** Evelyn Llerena Cari

**Additional Presenter(s):** John Rushing Elise Bales

**Presenting School:** Graduate

**Degree Seeking:** PhD

**Year:** 4th

**Mentor:** Joshua Johnson

**Poster Title:** REGULATORY INTERACTIONS BETWEEN ANTIMÜLLERIAN HORMONE AND TUMOR NECROSIS FACTOR ALPHA AND THEIR IMPACT UPON OVARIAN AGING

**Final Category:** Child-Maternal Health and Reproductive Services

**Abstract:**

REGULATORY INTERACTIONS BETWEEN ANTIMÜLLERIAN HORMONE AND TUMOR NECROSIS FACTOR ALPHA AND THEIR IMPACT UPON OVARIAN AGING

E. Llerena Cari (Ph.D. Candidate, Integrated Physiology Graduate Program), J. Rushing, E. Bales, A. Polotsky, J. Johnson Division of Reproductive Sciences and Reproductive Endocrinology and Infertility, Department of Obstetrics and Gynecology, University of Colorado-Anschutz Medical Campus

The ovarian reserve, dependent on the number of ovarian primordial follicles, declines with age until women reach menopause. One percent of all women reach menopause prior to the age of 40. This is referred as primary ovarian insufficiency (POI), and significant negative consequences for overall health can accompany the loss of fertility. The process of ovarian follicle development is characterized by several morphological changes. The first step comprises the primordial follicle commitment to growth known as primordial follicle growth activation (PFGA). Binding of the cytokine Tumor necrosis factor alpha (Tnf $\alpha$ ) to its receptor Tnf receptor 2 (Tnfr2) results in activation of the Nuclear Factor Kappa-light-chain-enhancer of activated B cells (NF $\kappa$ B). Loss of function of either Tnf $\alpha$  [1] or Tnfr2 [2] in the mouse results in slowing of the rate of PFGA, and the extension of ovarian function such that primordial follicles are present much later than in wild-type (WT) controls. Tnf $\alpha$ /Tnfr2 are thus considered PFGA activators and our laboratory has published evidence that modulation of the NF $\kappa$ B pathway downstream of Tnf $\alpha$ /Tnfr2, at the level of the inhibitor of kappa B proteins, also slows the rate of PFGA.[3] Conversely, loss of function of the TGFbeta family member Antimüllerian Hormone (Amh) results in an acceleration of PFGA. Our overall hypothesis is that regulatory interactions exist between Tnf $\alpha$ /Tnfr2/NF $\kappa$ B and Amh signaling, resulting in a balance that controls the rate of PFGA and thus ovarian aging. We first tested the hypothesis that Tnf $\alpha$  treatment that accelerates PFGA does so by downregulating Amh, reducing the concentration that normally slows PFGA. We used the mouse OV3121 granulosa cell line as a model, and also evaluated ovaries from Amh receptor 2 knockout (Amhr2KO)\* mice to test this hypothesis. OV3121 cells were validated and shown to express a functional Tnf $\alpha$ /Tnfr2/NF $\kappa$ B pathway, as well as Amh and

Amhr2. First, OV3121 cells were treated with 10 ng/ml Tnf $\alpha$  and Amh was monitored every 4 hours (h) post-treatment for 24 h by western blot. Counter to our hypothesis, Amh was not downregulated by Tnf $\alpha$ . Instead, Amh levels were significantly increased at the 16, 20, and 24 h time points compared to vehicle-treated cells. We also tested whether Amh acts to regulate Tnf $\alpha$ /NF $\kappa$ B proteins downstream. Tnf $\alpha$  protein, but not NF $\kappa$ B protein p65, was significantly overexpressed in Amhr2KO ovaries compared to WT controls. These data suggest that Amh signaling normally functions to suppress Tnf $\alpha$  expression and limits PFGA in this way. The finding that Tnf $\alpha$  increases Amh expression is suggestive of a negative feedback system where the PFGA activator (Tnf $\alpha$ ) upregulates one factor that can limit its own expression (Amh). This could reduce the chances of inappropriately rapid loss of primordial follicles. Learning more of this regulatory relationship will improve our understanding of ovarian aging, and how POI may be developing in some women.

\* Richard Behringer is acknowledged for the provision of Amhr2KO mouse ovaries.

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**Primary Student Presenter:** Erin Lucas

**Presenting School:** Graduate

**Degree Seeking:** PhD

**Year:** 6th

**Mentor:** Beth Tamburini

**Poster Title:** Programmed death ligand 1 reverse signaling in dermal dendritic cells promotes dendritic cell migration required for skin immunity.

**Final Category:** Immunology and Autoimmune Diseases

**Abstract:**

While the function of extracellular region of programmed death ligand 1 (PD-L1) through its interactions with PD-1 on T cells is well studied, little is understood regarding the intracellular domain of PD-L1. Here, we outline a major role for PD-L1 intracellular signaling in the control of dendritic cell (DC) migration from the skin to the draining lymph node (dLN). Using a mutant mouse model, we identify a TSS signaling motif within the intracellular domain of PD-L1. The TSS motif proves critical for chemokine mediated DC migration to the dLN during inflammation. This loss of DC migration, in the PD-L1 TSS mutant, leads to a significant decline in T cell priming when DC trafficking is required for antigen delivery to the dLN. Finally, the TSS motif is required for chemokine receptor signaling downstream of the G $\beta$  subunit of the heterotrimeric G protein complex, ERK phosphorylation and actin polymerization in DCs.

**Primary Student Presenter:** Jacalyn Luchsinger

**Presenting School:** Nursing

**Degree Seeking:** PhD

**Year:** 4th

**Mentor:** John Welton

**Poster Title:** Readmissions and Observation Stays in the U.S. – Systematic Review of Literature

**Final Category:** Healthcare and Public Health

**Abstract:**

READMISSIONS AND OBSERVATION STAYS IN THE U.S. - SYSTEMATIC REVIEW OF LITERATURE. JS Luchsinger (Ph.D., GS) and J Welton. School of Nursing, University of Colorado Anschutz Campus.

**Purpose:** To synthesize current literature on the use of observation stays to reduce the rates of 30-day readmission rates in adults. Medicare observation stays doubled from 2006 to 2014 to nearly 1.9 million. Dedicated observation units with condition-specific care pathways can be associated with shorter lengths of stay and fewer admissions, however, many patients in observation status are not placed in dedicated unit.

**Methods:** The PRISMA guidelines were followed for this study.

**Summary of results:** Observation unit stays increased to 4.7% with no significant association between changes in observation unit stays and readmissions after the implementation of the Affordable Care Act; however, the number of observation stays within 30 days of index hospitalization increased, with one in five (20%) observation stays followed by a hospital revisit within 30 days of discharge. Readmission and mortality rates after discharge from observation closely paralleled outcomes after discharge from the emergency departments. Patients placed in observation status had 12% lower odds of 30-day readmission vs. those patients admitted for a short stay. Patients placed in observation status had 25% lower odds of dying within 30 days after discharge than those with a short length of stay in the hospital.

**Conclusions:** Observation stays increase options available to admitting physicians, allowing more time to assess the safety of discharge vs. placing the patient as an inpatient admission. Reductions nationwide in observed readmission rates in 2012 was not primarily the result of increases in post-index emergency department visits or post-index observation stays. No evidence was found to support the hypothesis that changes in observation stays account for the decrease in readmissions.

**Primary Student Presenter:** Ryan Lusk

**Presenting School:** Graduate

**Degree Seeking:** PhD

**Year:** 6th

**Mentor:** Laura Saba

**Poster Title:** Aptardi accurately incorporates expressed polyadenylation sites into sample-specific transcriptomes by combining high throughput RNA sequencing and DNA sequence

**Final Category:** Other

**Abstract:**

High throughput sequencing technologies – now standard in omics studies – gave rise to rapid advances in bioinformatics to analyze these large datasets. Transcriptome assemblers harness the power of short-read RNA sequencing to assess the expressed transcriptome on a per sample basis. Yet annotation of polyadenylation sites from short-read RNA sequencing alone is a difficult computational task. Other algorithms rooted in DNA sequence predict potential polyadenylation sites; however, in vivo expression of a particular site varies based on a myriad of conditions. Here we introduce aptardi (alternative polyadenylation transcriptome analysis from RNA-Seq data and DNA sequence information), which leverages both DNA sequence and RNA sequencing in a machine learning paradigm to predict expressed polyadenylation sites. Specifically, as input aptardi takes DNA nucleotide sequence, genome-aligned RNA-Seq data, and an initial transcriptome. The program evaluates these initial transcripts to identify expressed polyadenylation sites in the biological sample and refines transcript 3' ends accordingly. The average precision of the aptardi model is twice that of a standard transcriptome assembler. In particular, the recall of the aptardi model (the proportion of true polyadenylation sites detected by the algorithm) is improved by over three-fold. Also, the model – trained using the Human Brain Reference RNA commercial standard – performs well when applied to RNA sequencing samples from different tissues and different mammalian species. Finally, aptardi's input is simple to compile and its output is easily amenable to downstream analyses such as quantitation and differential expression.

**Primary Student Presenter:** Amber Maniates

**Presenting School:** Graduate

**Degree Seeking:** MS

**Year:** Other

**Mentor:** Harri Brackett

**Poster Title:** Completing Medical Orders for Scope of Treatment Forms in Persons with Advanced Cancer During Hospitalization

**Final Category:** Healthcare and Public Health

**Abstract:**

Completing Medical Orders for Scope of Treatment Forms in Persons with Advanced Cancer During Hospitalization

Authors: Amber Maniates, MSPAS, PA-C; Harri Brackett, RN, MS, CNS, ACHPN

Statement of the Problem: Completing Medical Orders for Scope of Treatment (MOST) forms during hospitalization allows persons with advanced cancer control over treatment and preferences before a catastrophic event.

Background: When Advance Care Planning (ACP) discussions occur, patients' values and end-of-life care preferences are not always addressed. In Colorado, the MOST form is an Advance Directive for people with serious illness that addresses preferences regarding life-sustaining interventions. Ideally, ACP would be initiated in the outpatient setting. However, persons with cancer should talk about ACP at key intervals along their illness trajectory, especially upon initial diagnosis of advanced cancer and any hospital admission.

Purpose: This quality improvement project aimed to increase the percentage of completed MOST forms by time of discharge for patients admitted to the University of Colorado Hospital (UCH) medical oncology unit.

Methods/Measures: Medical oncology providers were educated regarding how to complete MOST forms and the benefits patients receive from these discussions. Fifty-one providers were emailed a link to the narrated PowerPoint and pre-/post-education surveys asking about comfort and preparation discussing MOST forms. Eighteen providers completed a seven-item pre-education survey; 8 the post-education survey. Weekly emails reminded providers to complete MOST forms with patients. Number of MOST forms were obtained from the UCH Health Analytics Report Directory pre (March, 2019 – September, 2019) and post-education (October, 2019 – September, 2020)

Findings: Providers who participated in MOST form education felt more comfortable and prepared to discuss MOST forms. Although not statistically significant, completed MOST forms scanned into medical

records post-education increased from 13.7% to 15.5%.

Implications for Practice: Education may help increase provider comfort with MOST form discussions, though a busy inpatient setting does not necessarily translate to an increase in forms being completed. Future directions could include a formal discharge process that includes completion of MOST forms.

**Primary Student Presenter:** Geoffrey Markowitz

**Presenting School:** Medicine

**Degree Seeking:** MD

**Year:** 3rd

**Mentor:** Lara Rappaport

**Poster Title:** Medication Errors in Pediatric Patients After Implementation of a Field Guide With Volume Based Dosing

**Final Category:** Healthcare and Public Health

**Abstract:**

Medication Errors in Pediatric Patients After Implementation of a Field Guide With Volume Based Dosing. GR Markowitz (MD, SOM), G Roosevelt MD MPH, S Hulac, LD Rappaport MD MPH, University of Colorado School of Medicine, Aurora, CO; Department of Emergency Medicine, Denver Health Medical Center, Denver, CO; Denver Paramedic Division, Denver, CO.

Limited data on pediatric medication administration by EMS paramedics suggest significant error rates. Reported error rates for all medications is greater than 30%. In 2015, our hospital-based urban EMS system introduced the Handtevy field guide that provides precalculated pediatric doses in milliliters (mL) by patient age. We hypothesized that implementation of a field guide would reduce pediatric medication errors to less than 15%. We performed a single-center retrospective cohort study of our EMS electronic health reporting software from July 2017 – June 2019. All medications administered to patients  $\leq 13$  years of age were queried. Our primary outcome was medication error rate defined as administering a dose that differed from the predetermined correct dose by age by greater than 20%. We had a total of 483 drug administrations in 375 patients. Our overall rate of appropriate medication administration rate was 89.4%. 68.5% of doses were perfect doses as dictated by the guide. The 10.6% error rate consisted of 4.3% overdoses and 6.2% underdoses. The following medications had 100% appropriate dosing: epinephrine 1:10,000, adenosine, dextrose 10%, diphenhydramine IM, glucagon, and ODT ondansetron. Fentanyl was dosed correctly in 82.9% (IN) and 87.1% (IV). After implementation of a precalculated mL dose system by patient age for EMS providers, pediatric medications were more frequently administered within the appropriate dose range compared to historical data. Strategies to reduce pediatric medication dosing errors by EMS providers are essential to improving the care of critically ill and injured children.

**Primary Student Presenter:** Nicholas Mendola

**Presenting School:** Pharmacy

**Degree Seeking:** PhD

**Year:** 3rd

**Mentor:** Robert McQueen

**Poster Title:** Stakeholder Perception of Pharmaceutical Value: A Multicriteria Decision Analysis (MCDA) Educational Case Study for Value Assessment in the United States

**Final Category:** Other

**Abstract:**

Title: Stakeholder Perception of Pharmaceutical Value: A Multicriteria Decision Analysis Educational Case Study for Value Assessment in the United States

Objectives: Multi-criteria decision analysis (MCDA) has potential as a supplemental tool to traditional value assessment. However, education and training on MCDA in the United States is lacking. The objective of this work was to educate various stakeholders on MCDA approaches, in value assessment, and assess perceptions of value using hypothetical case examples. Methods: We conducted a pre-post educational session in Washington, D.C. to assess perceptions of value with and without the use of additional value elements, weighted by the use of an MCDA tool. Participants voted on their perceptions of value before and after the use of an MCDA tool, for two hypothetical treatments with similar cost-effectiveness evidence. Perceptions of value both within and between treatments before, and separately, after the use of an MCDA tool were analyzed using a Wilcoxon signed rank test. Changes in perceptions of value between treatments before and after the use of an MCDA tool were assessed using logistic regression. Results: The session included 25 participants including patient advocacy groups (44%), industry (24%), research (16%), and payer entities (8%). Perceptions of value within each treatment before and after consideration of MCDA scores was insignificant for Treatment A ( $p=0.3984$ ) and Treatment B ( $p>0.999$ ). Treatment A had a significantly higher perception of value versus Treatment B both before ( $p=0.0352$ ) and after ( $p=0.0164$ ) the consideration of MCDA scores. We did not observe a change in perception of value between Treatment A and Treatment B ( $p=0.267$ ) after the consideration of MCDA scores. Conclusions: Despite similar cost-effectiveness evidence, Treatment A and Treatment B had significantly different perceptions of value suggesting nuances in other clinical evidence may have played a part in these value judgements.

**Primary Student Presenter:** William Mundo

**Presenting School:** Medicine

**Degree Seeking:** MD

**Year:** 3rd

**Mentor:** Andres Henao-Martinez

**Poster Title:** Lower mortality associated with adjuvant corticosteroid therapy in non-HIV infected patients with pneumocystis jirovecii pneumonia: a single US cohort study and a proposed novel mechanism of corticosteroid benefit

**Final Category:** Microbiology and Infectious Diseases

**Abstract:**

Lower mortality associated with adjuvant corticosteroid therapy in non-HIV infected patients with pneumocystis jirovecii pneumonia: a single US cohort study and a proposed novel mechanism of corticosteroid benefit

W Mundo, (MD., SOM), S. Tewahade, E. Wagner, S. Archuleta, M. Bandali, S. Chadalawada, SC, Johnson, C Franco-Paredes, L Shapiro, AF Henao-Martínez, Department of Medicine, Division of Infectious Diseases, University of Colorado Anschutz Medical Campus

Pneumocystis jirovecii pneumonia (PJP) remains a cause of mortality in HIV-negative patients. The clinical benefit of adjuvant corticosteroid therapy in these patients is uncertain. This study aimed to determine if corticosteroids reduced mortality in a cohort of HIV-negative PJP patients, and to propose a novel mechanism explaining corticosteroid benefit in patients regardless of HIV status. We examined a retrospective case series of patients diagnosed with PJP at the University of Colorado Hospital between 1995-2019. Data were collected in 71 PJP-infected patients. Twenty-eight patients were HIV-negative, and 43 were infected with HIV (HIV-positive). We performed bivariate and forward, stepwise multivariable logistic regressions to identify predictors of mortality. Underlying conditions in HIV-negative patients were hematologic malignancies (28.6%), autoimmune disorders (25.9%), or solid organ transplantation (10.7%). Compared to HIV-positive patients, HIV-negative patients had higher rates and duration of mechanical ventilation and ICU stay. Survival was significantly increased in HIV-negative patients receiving adjunct corticosteroids, with 100% mortality in patients not receiving corticosteroids vs 60% mortality in patients receiving corticosteroids ( $p=0.034$ ). In an adjusted multivariable model, corticosteroids were associated with lower mortality (OR 13.5, 95% CI: 1.1-158.5,  $p=0.039$ ) regardless of HIV status. We found substantial mortality among HIV-negative patients with PJP and adjunct corticosteroid use was associated with decreased mortality. Adjunct corticosteroid mortality-lowering effect is best explained by suppressing pneumocystis lysis. This reduces surfactant disruption resulting from pneumocystis internal substances.

**Primary Student Presenter:** Jason Nadeau

**Presenting School:** Medicine

**Degree Seeking:** DPT

**Year:** 2nd

**Mentor:** Cyril Mauffrey

**Poster Title:** Analysis of Postoperative Gait, Hip Strength, and Patient Reported Outcomes Following Unstable Pelvic Ring Fractures

**Final Category:** Bone or Skeletal

**Abstract:**

Analysis of Postoperative Gait, Hip Strength, and Patient Reported Outcomes Following Unstable Pelvic Ring Fractures. J Nadeau, (DPT, SOM), C Dean, L Chambers, K Worster, D Rojas, J Parry, K Hunt, and C Mauffrey, Department of Orthopedics, Denver Health, Denver, CO.

The aim of this study was to examine gait, hip strength, pelvic function, psychological outcomes, and history of post-acute (PAC) physical therapy (PT) following rotationally unstable (Tile B) and rotationally/vertically unstable (Tile C) pelvic ring fractures. Nine adults who had definitive fixation of isolated Tile B (n=4) or Tile C (n=5) fractures at least one year prior received lower extremity instrumented gait analysis and strength testing with digital dynamometry. Peak values of kinetic, kinematic, and spatial-temporal variables were calculated at the pelvis and hip. Patient reported pelvic function (Majeed), general function (SF36), and anxiety/depressive symptoms were collected. The amount of PAC PT (inpatient rehabilitation, skilled nursing, and home health) was recorded and grouped by  $\geq 5$  days versus  $< 5$  days. Group medians were compared between fracture types and amount of PAC PT. The Tile C group had lower left hip abduction strength and higher injury severity score, left peak hip flexion moment, right peak hip abduction moment, right mean hip rotation angle, and SF36 physical function score compared to the Tile B group. There were no differences in walking speed or other outcomes between fractures. Patients who completed  $\geq 5$  days of PAC PT had higher left peak hip power and adduction moment, and better scores on Majeed Sitting, Majeed Standing – Gait Unaided, and SF36 Pain compared to  $< 5$  days. PAC PT did not improve walking speed, hip strength, or pelvis and hip kinematics. Patients with Tile C pelvic ring fractures may benefit from more aggressive hip abductor strengthening. PAC PT may positively impact hip kinetics and patient reported outcomes following unstable pelvic fractures.

**Primary Student Presenter:** Michael Nash

**Presenting School:** Graduate

**Degree Seeking:** MD/PhD

**Year:** 5th

**Mentor:** Stephanie Wesolowski

**Poster Title:** Maternal Western-style Diet Exposure Increases Oxidative Stress in the Absence of Inflammation and Triggers Persistent Collagen Formation in Non-human Primate Fetal Livers.

**Final Category:** Child-Maternal Health and Reproductive Services

**Abstract:**

Maternal Western-style Diet Exposure Increases Oxidative Stress in the Absence of Inflammation and Triggers Persistent Collagen Formation in Non-human Primate Fetal Livers. Michael J. Nash (M.D./Ph.D, CU Anschutz GS, SOM), Evgenia Dobrinskikh, Jacob E. Friedman, and Stephanie R. Wesolowski, CU Anschutz.

**Purpose:** Maternal diet and obesity can impact development of metabolic systems across the lifespan. 1 in 3 obese youth suffer from pediatric non-alcoholic fatty liver disease (NAFLD), which may begin in the perinatal period. However, little is known about the early origins of NAFLD and treatment options are limited. **Methods:** Here, we used a non-human primate (NHP) model of chronic maternal Western-Style Diet (WSD) feeding to investigate how WSD exposure impacts the early origins of NAFLD.

**Results:** In the early 3rd trimester, fetuses from WSD mothers had increased hepatic triglycerides, a 22% increase in periportal collagen deposition, and increased expression of collagen synthesis genes. WSD livers also showed increases in protein expression of MnSOD and other markers indicating oxidative stress. There was an increase in dendritic cell subsets and a decrease in CD4 T-cell maturation in fetal WSD livers, but we found no evidence for increases in pro-inflammatory cytokines in serum or livers of WSD fetuses. Switching obese mothers to a control diet or treatment of WSD mothers with antioxidant Resveratrol reversed fetal hepatic collagen deposition and liver triglycerides back to levels of controls. Finally, maternal WSD-driven hepatic collagen deposition in offspring persisted at 1 year of age despite weaning to a control diet, indicating a need for in utero intervention.

**Conclusions:** Our results suggest that maternal WSD triggers early stages of pediatric NAFLD including steatosis and fibrosis that may persist postnatally, and that alleviating diet-driven fetal oxidative stress may hold promise for halting developmental programming of pediatric NAFLD.

**Primary Student Presenter:** Ani Oganesyanyan

**Presenting School:** Medicine

**Degree Seeking:** MD

**Year:** 2nd

**Mentor:** Susan Boackle

**Poster Title:** The Minor Protective Allele at rs1876453 is Associated with Increased Age of Onset of Systemic Lupus Erythematosus

**Final Category:** Immunology and Autoimmune Diseases

**Abstract:**

The Minor Protective Allele at rs1876453 is Associated with Increased Age of Onset of Systemic Lupus Erythematosus

Ani Oganesyanyan, MD Candidate at the University of Colorado School of Medicine, J. Kelly, S. Glenn (MD), A. Adler (MD), A. Williams, K. Jones (Ph.D), Susan A Boackle (MD)

**Background:** Systemic lupus erythematosus (SLE) is a clinically heterogeneous autoimmune disease characterized by autoantibody- and complement-mediated inflammatory damage to multiple organ systems. We previously showed that the single-nucleotide polymorphism (SNP) rs1876453, located in the first intron of complement receptor 2 (CR2/CD21), is associated with decreased risk of lupus, with a preferential effect on anti-double stranded (ds) DNA antibodies. Since anti-dsDNA antibodies develop prior to clinically apparent disease, we hypothesized that the minor A allele at rs1876453 would delay lupus onset.

**Methods:** DNA from individuals recruited from multiple sites was processed with institutional review board approval. All patients with SLE met the 1997 American College of Rheumatology revised classification criteria. Age of onset was collected by chart review. Genotyping was performed on the OMRF Illumina iSelect platform. Global ancestry was estimated based on the genotype of ancestry informative markers (AIMs), using principal components analysis and ADMIXMAP, and genetic outliers removed. Final clean data were from European Americans (EA), African Americans (AA; 7.5% Gullahs), Asians (AS; 74.6% Koreans, 16.1% Chinese, 9.3% Japanese and Singaporeans) and Hispanics (HS) enriched for Amerindian-European admixture. Kruskal-Wallis and Mann-Whitney tests were used to detect differences between groups. A p value of <0.05 was considered significant. Statistics and graphs were generated using GraphPad Prism software.

**Results:** The median age of lupus onset for subjects with AG or AA at rs1876453 was significantly higher than subjects with GG [median (interquartile range[IQR]) 40 (21) for AA (n=31), 32 (17) for AG (n=488), and 30 (19) for GG (n=5175), p < 0.0001]. When stratified based on sex, both females and males with the protective allele had significantly delayed disease onset [median (IQR) 40 (21.75) for AA (n=30), 32

(17) for AG (n=439), and 30 (18) for GG (n=4775) for females,  $p = 0.0006$ ; median (IQR) 37.5 (21) for AA + AG (n=50) and 30 (23.75) for GG (n=400) for males,  $p = 0.0083$ ].

Conclusion: The minor allele at rs1876453 delays lupus onset by 2-10 years. These data provide further support for a protective role for this SNP in lupus pathogenesis and suggest that novel therapies designed to mimic its mechanisms may prevent disease development in at-risk individuals.

**Primary Student Presenter:** Matt Paulson

**Presenting School:** Medicine

**Degree Seeking:** MD

**Year:** 2nd

**Mentor:** Vik Bebart

**Poster Title:** A descriptive analysis of battlefield first responder and combat lifesaver interventions during the Role 1 phase of care

**Final Category:** Other

**Abstract:**

**Background:** Battlefield first responders (BFR) are the first non-medical personnel to render critical lifesaving interventions for combat casualties, especially massive hemorrhage where rapid control will improve survival. Soldiers receive medical instruction during initial entry training (IET) and unit-dependent medical training, and by attending the Combat Lifesaver (CLS) course. We seek to describe the interventions performed by BFRs on casualties with only BFRs listed in their chain of care within the Prehospital Trauma Registry (PHTR).

**Methods:** This is a secondary analysis of a dataset from the PHTR from 2003-2019. We excluded encounters with a documented medical officer, medic, or unknown prehospital provider at any time in their chain of care during the Role 1 phase to isolate only casualties with BFR medical care.

**Results:** Of the 1357 encounters in our initial dataset, we identified 29 casualties that met inclusion criteria. Pressure dressing was the most common intervention (n=12), followed by limb tourniquets (n=4), IV fluids (n=3), hemostatic gauze (n=2), and wound packing (n=2). Bag-valve-masks, chest seals, extremity splints, and nasopharyngeal airways (NPA) were also used (n=1 each). Notably absent were backboards, blizzard blankets, cervical collars, eye shields, pelvic splints, hypothermia kits, chest tubes, supraglottic airways (SGA), intraosseous (I/O) lines, and needle decompression (NDC).

**Conclusions:** Despite limited training, BFRs employ vital medical skills in the prehospital setting. Our data show that BFRs largely perform medical interventions within the scope of their medical knowledge and training. Better datasets with efficacy and complication data are needed.

**Primary Student Presenter:** Katherine Pemberton

**Presenting School:** Medicine

**Degree Seeking:** MD

**Year:** 4th

**Mentor:** Meghan Treitz

**Poster Title:** The Med/Mid Writing Project: Medical students and middle school students document experiences of the COVID-19 pandemic

**Final Category:** Humanities and Bioethics

**Abstract:**

The Med/Mid Writing Project: Medical students and middle school students document experiences of the COVID-19 pandemic

Katherine Pemberton, B.S.; Melanie Sutton, M.A.; Liliana Treitz, n/a; Sheilah Jimenez, B.S.; Meghan Treitz, M.D.

**Background:** Globally, students have been affected by the COVID pandemic, and many have chosen to write about their experiences. At the University of Colorado, medical students joined with eighth grade students to document their experiences in The Med/Mid Writing Project. Over two weeks in May 2020, both groups of students wrote reflective pieces and shared in "open-mic" sessions via teleconferencing.

**Purpose of Study:** To better understand the student perspective during a pandemic through reflective writing, and learn from interactions between two groups of students representing different generations.

**Methods Used:** Students were given a writing prompt each week. No formatting or content requirements were specified. All writers participated in virtual open-mic sessions, during which students volunteered to read pieces aloud and receive feedback. After the last session, students completed a survey and focus groups were conducted to elicit details of student experiences. A qualitative approach using iterative coding techniques was used to analyze student writings, focus groups, and survey comments. Survey data was analyzed using descriptive statistics.

**Summary of Results:** Seven medical students and five middle school students participated in the project. Themes common to the writings of both groups of students included: feeling enhanced external pressure to succeed and perform, friendship, family, hobbies, memories, and hope for the future. Representative comments from middle school students include: "I am self-conscious about my writing, but I improve my writing when sharing" and "Everyone was so supportive!". Representative comments from the medical students include: "They had just as much to bring to the table as the medical students" and "I was surprised at the emotional maturity the younger students showed." The survey revealed that 80% of middle schoolers reported they agree or strongly agree that the project helped them gain

confidence working with older students. 100% medical school students and 80% of the middle school students reported that they would participate in the project again.

Conclusions Reached: Despite differences in age and experience, both groups of students wrote about similar themes, feelings and archetypes. By working with one another to create, share and discuss reflective writing about the pandemic, students gained self-confidence, perspective and empathy. Both groups gained understanding of the other group, as well as themselves, through participation. Next steps include a writing group with medical school and middle school students over a longer timeframe to evaluate changes in writing and development of near-peer relationships and mentoring.

The author(s) declare(s) that there is no conflict of interest. COMIRB # 20-1120 PI: Meghan Treitz

**Primary Student Presenter:** Haylie Petrick

**Presenting School:** Medicine

**Degree Seeking:** MD

**Year:** 4th

**Mentor:** Mark Deutchman

**Poster Title:** Comparison of Maternity Care Outcomes Among Rural Colorado Hospitals Using Birth Certificate Data

**Final Category:** Child-Maternal Health and Reproductive Services

**Abstract:**

Comparison of Maternity Care Outcomes Among Rural Colorado Hospitals Using Birth Certificate Data. H Petrick (M.D., SOM), M Deutchman M.D., and BM Kwan Ph.D., Department of Family Medicine, University of Colorado, Denver, CO.

**Purpose:** The purpose of this study was to determine whether there was a difference among maternity care outcomes between urban, rural, and frontier facilities, if there were differences in maternity care outcomes among the rural/frontier facilities, and if there were population, facility, or differences in clinical care interventions that could account for these differences among the rural/frontier hospitals.

**Methods:** Colorado Birth Certificate Data from 2016-2018 was used to compare average percentages of adverse maternity care outcomes at urban, rural, and frontier facilities. A heat map of outcomes at rural and frontier facilities was used to identify high and low performing quartiles of facilities. Facility, population, and clinical care intervention differences were compared between high and low performing rural facilities.

**Results:** Rural facilities in Colorado reported worse average percentages of adverse maternity care outcomes compared to urban facilities. Variation in adverse maternity care outcomes among rural facilities also existed. Providers at low performing rural hospitals on average augmented less labors, used vaginal forceps more, and had more clinical chorioamnionitis, unplanned hysterectomies, admissions of the mother to the intensive care unit, meconium aspiration, and hypoglycemia in the infant than high performing rural hospitals. Mothers who delivered babies at low performing rural hospitals tended to live at higher elevations, more often identified as non-white race, reported consuming more alcohol during the 2nd and 3rd trimesters, and were more often diagnosed with eclampsia and HELLP Syndrome than mothers at high performing rural hospitals.

**Conclusions:** This hypothesis-generating study suggests there were worse maternity care outcomes at rural facilities compared to urban facilities in Colorado and some rural Colorado hospitals may perform better than others. However, due to numerous limitations this cannot be definitively concluded without additional research.

**Primary Student Presenter:** Andrea Prinzi

**Presenting School:** Graduate

**Degree Seeking:** PhD

**Year:** 2nd

**Mentor:** Donna Curtis

**Poster Title:** The Pediatric Endotracheal Aspirate Culture Survey (PETACS): Examining Practice Variability Across Pediatric Microbiology Laboratories in the United States

**Final Category:** Microbiology and Infectious Diseases

**Abstract:**

The Pediatric Endotracheal Aspirate Culture Survey: Examining Practice Variability Across Pediatric Microbiology Laboratories in the United States

Andrea M Prinzi SM(ASCP) MPH, Ph.D student in the graduate school, Sarah K Parker MD, Donna J Curtis MD, Sonja I Ziniel Ph.D

**Introduction:** In the absence of evidence-based laboratory guidelines, the workup and interpretation of tracheal aspirate (TA) cultures remains controversial and confusing within the fields of clinical microbiology, infectious diseases, and critical care.

**Methods:** Between January 22 and February 24, 2020, we conducted a national, web-based survey of microbiology laboratory personnel in free-standing pediatric hospitals and adult hospitals containing pediatric facilities regarding the laboratory practices used for TA specimens. We hypothesized that there would be substantial center-level variability in laboratory processes of TA cultures.

**Results:** The response rate for the survey was 48% (73/153). There was a high level of variability in the criteria used for all processes including specimen receipt, Gram staining and culture reporting. Most respondents (77%) reported that they do not reject TA specimens based on Gram stain criteria. Overall, non-academic hospital laboratories and pediatric-only laboratories are more likely to identify, report and perform susceptibility testing on organisms from TA cultures, regardless of organism quantity or predominance.

**Conclusion:** There is a substantial amount of process variability among pediatric microbiology laboratories that affects TA culture reporting, which guides treatment decisions. This variation within and among labs makes clinical outcome studies related to TA cultures difficult to interpret. This study serves as a pragmatic step in informing the development of robust clinical guidelines. Clinical outcome and implementation studies are necessary to determine the effectiveness of guidelines for TA cultures.

**Primary Student Presenter:** Caitlin Ritz

**Presenting School:** Medicine

**Degree Seeking:** MD

**Year:** 2nd

**Mentor:** Rajeev Vibhakar

**Poster Title:** CDK8-Mediator complex plays positive transcriptional role in MYC-amplified medulloblastoma

**Final Category:** Hematology and Oncology

**Abstract:**

CDK8-MEDIATOR COMPLEX PLAYS POSITIVE TRANSCRIPTIONAL ROLE IN MYC-AMPLIFIED MEDULLOBLASTOMA

Ritz CE (MD, CUSOM), Madhavan K, Venkataraman S, Vibhakar R, Dept of Pediatrics, University of Colorado, Aurora, CO

**Purpose:** Medulloblastoma (MB) is the most common malignant pediatric brain tumor. Group 3 MB, characterized by MYC amplification, carries a 50-60% 5-year survival expectancy. Current molecular therapies fail to outperform the standard therapy of surgical resection, CSI, and chemotherapy. Treatment can result in long-term therapy induced morbidity so there is a need to identify novel therapeutic targets. We investigate cyclin dependent kinase 8 (CDK8), a mediator complex-associated transcriptional regulator identified in a CRISPR druggable target screen in MYC-amplified MB.

**Methods:** Group 3 MB cells grown in supplemented DMEM. Protein expression analysis done with western blots (4-20% SDS-PAGE). Spheroid live cell imaging used to observe cell growth with titrated CDK8 chemical inhibitors Senexin B (10-2000nM) and BI-1347 (0.25-50nM).

**Results:** We demonstrated the role of CDK8 in survival and proliferation of MB. We found in MB subtypes, cells express CDK8 at levels 20 to 30-fold higher than normal cerebellum. CDK8 chemical inhibition revealed reduction in cell growth with IC50 in the nanomolar range (Sen B IC50 = 218.6 nM; BI-1347 IC50 = 2.591 nM). We are investigating the role of CDK8 in giving growth advantage to MYC expressing tumor cells and the impact of CDK8 depletion on mediator-complex stability.

**Conclusions:** Our results suggest that CDK8 plays a positive transcriptional role in MYC-amplified MB. We hypothesize this occurs through loss of kinase phosphorylation at the CTD of RNA polymerase II, an interaction well characterized in yeast. While CDK8 has been implicated in other cancers, its role in MB is not yet known. The mechanistic elucidation of CDK8 in MYC-amplified MB could provide insight into its potential role as a clinical therapeutic target.

**Primary Student Presenter:** Lexie Ross

**Presenting School:** Medicine

**Degree Seeking:** MD

**Year:** 2nd

**Mentor:** Kenneth Hunt, MD

**Poster Title:** Epidemiology of Lower Extremity Injuries in Collegiate Student-Athletes: Insights from the Pac-12 Health Analytics Program.

**Final Category:** Bone or Skeletal

**Abstract:**

Epidemiology of Lower Extremity Injuries in Collegiate Student-Athletes: Insights from the Pac-12 Health Analytics Program. LK Ross (MD, SOM), K Robell, and KJ Hunt.

Sports injury surveillance, the collection of data characterizing factors associated with athletic injuries, provides the ability to monitor and identify risk factors related to sport participation. While sports injury surveillance systems are currently utilized by populations ranging from youth sports programs to professional athletics organizations, surveillance systems at the NCAA collegiate level have thus far been limited by a lack of standardization, scale, and access. By standardizing metrics across all 12 Pac-12 institutions, the Pac-12 Health Analytics Program (HAP) addresses this need and now stands as the largest scale sports injury database within the varsity student-athlete population. Additionally, the HAP is the first conference-wide sports injury surveillance system made available for sports medicine research. This study aims to demonstrate the vital role the HAP has in identifying trends in sports injuries and how systematic analysis of these trends can provide the foundation to design injury prevention strategies. This epidemiological study utilizes a HAP dataset to provide a proof-of-concept assessment of lower extremity injuries at each of the 12 Pac-12 Athletic Conference institutions. The HAP gathered data characterizing 16908 lower extremity injuries sustained by 9444 NCAA Division I student-athletes between 2017 and 2020. Each injury record was assessed for completeness by institutional sports medicine staff and deidentified before being sent to the HAP. Injury record characteristics analyzed by the research team included the number of days from date of injury to date of exam, body part injured, type of injury, onset of symptoms, general mechanism of injury, season, event order of occurrence, and injury outcome. Results and conclusions to come as data is currently being analyzed.

**Primary Student Presenter:** Jessica Saiffee

**Presenting School:** Medicine

**Degree Seeking:** MD

**Year:** 2nd

**Mentor:** Stacy Dixon

**Poster Title:** An Ethical Case Study Concerning a Patient with Spinal Muscular Atrophy

Enrolling in an Expanded Access Program

**Final Category:** Humanities and Bioethics

**Abstract:**

We report the case of a 28-year old man with Spinal Muscular Atrophy (SMA) Type II (0 copies of SMN1 and 3 copies of SMN2). He reports worsening symptoms of weakness and muscle fatigue associated with his SMA diagnosis making him a candidate for a compassionate use drug program for Risdiplam run by Genentech. Risdiplam is an SMN modifying agent currently undergoing FDA review for treatment of SMA. Risdiplam would be the first orally administered SMA disease modifying agent if approved. The patient was accepted to be screened for this program. Prior to his screening visit, he experienced an acute medical problem which could potentially disqualify him. We will discuss the ethical issues regarding his participation in the program.

**Primary Student Presenter:** Omar Samara

**Presenting School:** Medicine

**Degree Seeking:** MD

**Year:** 2nd

**Mentor:** Andres Martinez

**Poster Title:** Cytokine and Cytokine Antagonist Levels in Healthy Individuals and in Sepsis: An Etiology and Risk Systematic Review Protocol

**Final Category:** Microbiology and Infectious Diseases

**Abstract:**

Title: CYTOKINE AND CYTOKINE ANTAGONIST LEVELS IN HEALTHY INDIVIDUALS AND IN SEPSIS: AN ETIOLOGY AND RISK SYSTEMATIC REVIEW PROTOCOL. Amal A. Gharamti, M.D., Omar Samara, MD Candidate in the School of Medicine, Anthony Monzon, Andrés Henao-Martínez, M.D., Department of Infectious Disease, university of Colorado, Denver, CO.

Objective: The main aim of this review is to characterize levels of key cytokines and cytokine antagonists in the circulation in healthy individuals and patients with sepsis.

Introduction: Research hypothesis has implicated multiple cytokines in the pathogenesis of sepsis. The levels of key cytokines, mainly TNF- $\alpha$ , IL-1 $\beta$  and IFN- $\gamma$  and antagonistic (anti-cytokine) molecules TNF soluble receptors (TNFRp55 and TNFRp75) and IL-1 receptor antagonist (IL-1ra) are poorly characterized during sepsis or in healthy volunteers. A systematic review of this topic will contribute to a better understanding of the pathophysiology of sepsis and inform therapeutic approaches to anticytokine therapy in patients with sepsis.

Inclusion criteria: Clinical trials and prospective cohort studies that measure relevant cytokine or cytokine antagonists will be included. We would include reports of any design with key information for healthy individuals as well as patients with sepsis. Sepsis patients will comprise those with a diagnosis of sepsis, severe sepsis, or septic shock. The primary outcome is levels of pro-inflammatory and anti-inflammatory cytokines (6 molecules total, see above). Studies will be restricted to the English language. We will limit to studies published from 1985 forward.

Methods: Medline, Embase, Cochrane Library, and Web of Science Core Collection will be searched for eligible studies. Two reviewers will independently screen and select studies, assess methodological quality, and extract data. A meta-analysis will be performed, if possible, and the Grading of Recommendations Assessment Development and Evaluation (GRADE) Summary of

Findings presented.

What is left: We are at the stage of statistical analysis of the entire data set. After completing the

statistical analysis, we will move on to write up the conclusion and report out results before submitting to a journal.

**Primary Student Presenter:** Brionna Sandridge

**Presenting School:** Medicine

**Degree Seeking:** MD

**Year:** 2nd

**Mentor:** Jay Albright

**Poster Title:** Outcomes of Initial Conservative Treatment in Adolescent Patients with Stable Osteochondritis Dissecans of the Elbow

**Final Category:** Bone or Skeletal

**Abstract:**

Outcomes of Initial Conservative Treatment in Adolescent Patients with Stable Osteochondritis Dissecans of the Elbow. Brionna M Sandridge BS, David R Howell PhD, Jay C Albright MD, Department of Orthopedics, Children's Hospital Colorado, Aurora, CO.

**Purpose of Study:** Osteochondritis dissecans (OCD) is a disorder characterized by separation of subchondral bone and articular cartilage from underlying bone due to lack of blood supply. Effective treatment of elbow OCD is still debated. The purpose of this study is to compare the characteristics and clinical outcomes of adolescent patients diagnosed with stable OCD of the elbow who either progressed to surgery or did not after initial conservative treatment.

**Methods Used:** We performed a retrospective chart review of patients 5-18 years of age who were diagnosed with stable OCD of the elbow and initially underwent conservative treatment. Demographic, radiologic, and clinical outcome variables were collected. Statistical analysis was performed with Stata version 15.

**Summary of Results:** We identified 18 patients to meet inclusion criteria; 11 progressed to surgery and 7 did not. There were no significant differences between groups regarding demographic variables or clinical outcomes. Loss of range of motion was seen in 64% of patients who progressed to surgery and in 29% of those who did not ( $p = 0.34$ ). While there were no significant differences in radiographic measurements between groups, those who progressed to surgery had greater average lesion sizes than those who did not ( $p=0.22$ ).

**Conclusions:** Overall, there were no significant differences between patients who progressed to surgery versus those who did not regarding patient characteristics or clinical outcomes. However, it may be clinically useful to consider loss of range of motion and size of lesion when treating these patients. Factors associated with healing of stable OCD lesions and the benefits of conservative treatment should be further investigated.

**Primary Student Presenter:** Gabriela Santos

**Presenting School:** Public Health

**Degree Seeking:** MPH

**Year:** 3rd

**Mentor:** Angela Sauaia

**Poster Title:** Evaluation of the Medical Legal Partnership Colorado

**Final Category:** Healthcare and Public Health

**Abstract:**

Evaluation of the Medical Legal Partnership Colorado

**Background:** Medical-legal partnerships provide legal support within medical settings, addressing social determinants of health with civil legal remedies. The Medical Legal Partnership – Colorado (MLP\_CO) integrated into the Salud Family Health Centers in 2014. This project assessed MLP\_CO's impact on legal case resolution, satisfaction with legal care, health outcomes, and healthcare utilization among clients.

**Methods:** The researchers surveyed 49 randomly selected clients that  $\geq$  six months past case closure. The survey addressed mental and physical health, satisfaction with legal care, legal outcomes, and healthcare utilization. I attempted to contact each client at least three times at various times and days. Language line interpreters supported when clients had limited English proficiency. MLP\_CO provided additional patient and case data. Data analysis included descriptive statistics and paired comparisons between follow-up surveys and intake surveys.

**Results:** MLP\_CO resolved 82% of the cases. The most common legal issue was immigration (60%), followed by public benefits (21%). Health outcomes and the satisfaction response rate was 59%. Most clients ( $\geq$ 86%) reported positive interactions with the lawyers. All health outcomes showed improvement with significance achieved days with 1) poor mental health, 2) poor physical health, 3) stress, and 4) worry. Additionally, healthcare utilization reduced, albeit non-significantly. Qualitative analysis revealed the impact of COVID19 and difficulties with communication, especially when needing interpretation.

**Conclusions:** The MLP-CO legal intervention was associated with improved health outcomes, reduced healthcare utilization, and overall satisfaction. These data support MLP and healthcare integration as a promising intervention to reduce the impact of social determinants of health.

**Primary Student Presenter:** Michal Schäfer

**Presenting School:** Medicine

**Degree Seeking:** MD

**Year:** 2nd

**Mentor:** Kristen Nadeau

**Poster Title:** Bromocriptine Improves Central Aortic Stiffness in Adolescents with Type 1 Diabetes Mellitus: Arterial Health Results from the BCQR-T1D Study

**Final Category:** Cardiovascular

**Abstract:**

**Purpose of study:** The presence of global vascular dysfunction and central aortic stiffness is a well-recognized feature in youth with type 1 diabetes (T1D). This predisposes young patients to the life-long exposure to elevated ventricular afterload and increased incidence of cardiovascular events. Therapeutic strategies to mitigate vascular dysfunction are urgently needed. We hypothesized that bromocriptine quick release (BCQR) therapy would improve vascular health in youth with T1D.

**Methods:** This was a placebo-controlled, random-order, double-blinded, cross-over study investigating BCQR as adjunct therapy on central aortic stiffness as measured by phase-contrast MRI. Participants also underwent flow mediated dilation test and brachial distensibility evaluation using tonometry. Adolescents with T1D were randomized 1:1 to phase-1 of 4-week BCQR (minimum dose 1.6 mg daily) or placebo therapy after which all vascular measurements were performed. Following a 4-week washout period, phase 2 was performed in identical fashion with the alternate treatment.

**Summary of Results:** Forty-two adolescents (mean age 15.9 yrs, HbA1c 8.6%, BMI %ile 71.4, TD duration 5.8 yrs) with T1D were enrolled. BCQR therapy decreased systolic ( $\Delta = -5$  mmHg,  $p < 0.001$ ) and diastolic blood pressure ( $\Delta = -2$  mmHg,  $p = 0.039$ ). BCQR therapy reduced ascending aortic pulse wave velocity (PWV) ( $\Delta = -0.4$  m/s,  $p = 0.005$ ), and increased relative area change (RAC) ( $\Delta = -2.6\%$ ,  $p = 0.022$ ), and distensibility ( $\Delta = 0.08$  %/mmHg,  $p = 0.010$ ). In the thoraco-abdominal aorta, BCQR decreased PWV ( $\Delta = -0.2$  m/s,  $p = 0.013$ ) and increased distensibility ( $\Delta = 0.05$  %/mmHg,  $P = 0.032$ ) (FIGURE). In contrast, BCQR decreased reactive hyperemia index (RHI) ( $\Delta = -0.34$ ,  $p = 0.006$ ).

**Conclusions:** BCQR therapy improved central aortic stiffness and pressure hemodynamics in adolescents with T1D over 4 weeks. However, BCQR decreased peripheral RHI. BCQR therapy might serve as a potential clinical intervention to attenuate accelerated aortic stiffness in youth with T1D supporting future longer-term studies.

**Primary Student Presenter:** Laura Schubert

**Presenting School:** Medicine

**Degree Seeking:** MD

**Year:** 2nd

**Mentor:** Robert Doebele

**Poster Title:** EGFR, ERBB2 and ERBB4 fusions are recurrent alterations in multiple cancer types

**Final Category:** Hematology and Oncology

**Abstract:**

*EGFR*, *ERBB2* and *ERBB4* fusions are recurrent alterations in multiple cancer types

L Schubert (MD, SOM) and RC Doebele

Division of Medical Oncology, Department of Medicine, University of Colorado School of Medicine, Aurora, Colorado

Gene fusions involving the HER family of genes, *EGFR*, *ERBB2* and *ERBB4* are rare, but potentially amenable to treatment with targeted therapies. The incidence of these fusions across cancers has not yet been comprehensively described. We sought to assess the frequency and characteristics of fusions involving the HER family of genes. We utilized publicly available next generation sequencing data to assess the frequency of gene rearrangements involving *EGFR*, *ERBB2* and *ERBB4*. We queried the TCGA PanCancer Analyses, MSK IMPACT and AACR GENIE data bases through cBioPortal (accession dates 6/18/20, 8/8/20, 8/8/20 respectively). The overall frequency of each type of fusion by data set is displayed in Table 1. We found that *EGFR* fusions were most frequent in glioblastoma multiforme, oligoastrocytoma and astrocytoma. *ERBB2* fusions were found most often in breast cancer, stomach adenocarcinoma and cervical adenocarcinoma. *ERBB4* fusions were the least common overall, but most frequently found in breast cancer and non-small cell lung cancer. We assessed fusion partners in each category and the most common *EGFR* and *ERBB2* fusions were *EGFR-SEPT14* and *ERBB2-PPP1R1B*, respectively. We evaluated these fusions for co-occurrence of mutations in tumor suppressor genes within the TCGA datasets. Interestingly, we found that *TP53* mutations cooccurred with *ERBB2* fusions more often than in samples without *ERBB2* fusions (74% in *ERBB2* fusions vs. 36% of non-*ERBB2* fusion samples). *EGFR*, *HER2* and *HER4* fusions are individually rare events but collectively represent up to 1% of all cancers, a significant number of patients with potentially actionable genomic alterations.

Table 1. Frequency of *EGFR*, *ERBB2* and *ERBB4* fusions.

Fusion	Overall Frequency	TCGA PanCancer (N= 10,967)	MSK IMPACT (N= 10,945)	AACR GENIE (N=96,324)
EGFR	0.6% (752)	0.3% (27)	0.8% (88)	0.6% (637)
ERBB2	0.1% (173)	0.5% (50)	<0.1% (10)	0.1% (113)
ERBB4	<0.1% (45)	<0.1% (7)	<0.1% (4)	<0.1% (34)

**Primary Student Presenter:** John Schutz

**Presenting School:** Medicine

**Degree Seeking:** MD

**Year:** 1st

**Mentor:** Sarah Sibbel

**Poster Title:** Pediatric Proximal Phalanx Base Fractures in Fingers: Identifying the Need for Surgical Management

**Final Category:** Bone or Skeletal

**Abstract:**

Pediatric Proximal Phalanx Base Fractures in Fingers: Identifying the Need for Surgical Management

J. Schutz; N. Look; A. Lalka; H. Korrell; M. Sinclair; J. Nance; S. Sibbel

Children's Hospital Colorado

Fractures of the base of the proximal phalanx are among the most common fractures in children. Immobilization with or without a closed reduction can lead to good results. This retrospective study aims to evaluate change in angular deformity of proximal phalanx base fractures at final follow up.

A multi-institutional retrospective review of pediatric patients treated for a proximal phalanx base fracture from 2002-2019 was conducted. Variables collected included: demographics, initial and final angulation and displacement, treatment, malunions, Salter Harris classification, and time to union. Patients with <3-week follow up, inadequate details, or missing radiographs were excluded.

644 subjects met inclusion criteria and were categorized into non-operative, closed reduction, and operative groups. Average age was 10.8 years. Salter Harris II fractures were the most common (85.2%,  $P=0.082$ ). There were 6 malrotations for a 0.93% malrotation rate. Non-operative, closed reduction, and operative groups initial and final median coronal deformity ( $2^\circ$  vs  $16^\circ$  vs  $15.1^\circ$ ,  $P=0.0001$ ) and ( $2^\circ$  vs  $4^\circ$  vs  $1.5^\circ$ ,  $P=0.0001$ ) differed significantly between and within groups. Initial and final median sagittal angular deformity ( $2^\circ$  vs  $8^\circ$  vs  $11^\circ$ ,  $P=0.0001$ ) and ( $2^\circ$  vs  $3^\circ$  vs  $3^\circ$ ,  $P=0.0022$ ) differed significantly between and within groups. Initial median AP displacement ( $0$  vs  $0.85$  vs  $1.6$ ,  $P=0.0001$ ) was significantly different between and within groups.

A few proximal phalanx base fractures require surgical management. The vast majority can be treated with closed reduction in the clinical setting without sedation, resulting in equivalent outcomes of minimal angular deformity. Current treatment methods have led to good results with correction of angular deformity in both the sagittal and coronal planes.

**Primary Student Presenter:** Stefanie Schwab

**Presenting School:** University of Colorado Denver

**Degree Seeking:** PharmD

**Year:** 4th

**Mentor:** Kristofer Fritz

**Poster Title:** Characterizing Altered Protein Acetylation in Diabetic Nephropathy

**Final Category:** Metabolism and Endocrinology

**Abstract:**

Diabetes is currently the seventh leading cause of death in the United States. According to the Center for Disease Control (CDC), approximately 30.3 million people have diabetes. An astounding 84.1 million adults are believed to have prediabetes, where 90% of those individuals remain undiagnosed. Numerous health complications arise from diabetes, including nephropathy. Diabetic nephropathy (DN) is defined by both structural and functional changes of the kidneys; including mesangial expansion, glomerular basement membrane thickening, and podocyte injury. Progression of DN can ultimately lead to chronic kidney disease (CKD), end-stage renal disease, and kidney failure. Although there are well-known structural changes of DN at the glomerulus, alterations occurring at the proximal tubule are often overlooked. Recent findings suggest that persistent damage at the proximal tubule contributes to the progression of CKD. A potential mechanism underlying proximal tubule dysfunction is the result of aberrant post-translational modifications (PTM). One such PTM of particular interest is lysine acetylation, which has been linked to cellular metabolic flux. Dysregulated acetylation can result in altered protein function. To better understand how protein acetylation is distorted during DN, whole cell lysates were prepared from kidney tissue isolated from mice that were injected with streptozotocin (STZ) to induce diabetic hyperglycemia. Mice were sacrificed at 1, 3 or 32 weeks of life post-STZ injection. Western blots, immunohistochemistry (IHC), and activity assays were employed to examine the acetylation pattern of proteins, including SOD2. Our data demonstrates that protein acetylation is increased in diabetic mice, with increased SOD2 acetylation at lysine residue 68 (ack68). This corresponded with decreased SOD2 activity after 32 weeks of diabetic hyperglycemia. Increased acetylation also corresponds with elevated glycated hemoglobin (HbA1c), a known marker of diabetic hyperglycemia. Furthermore, these results corroborate our findings from human kidney tissue biopsies from patients with moderate to severe diabetes. Total acetyllysine and SOD2 ack68 were increased at the proximal and distal tubules in patients with moderate diabetes. The correlation between this STZ mouse model and human data represents a translational link that supports the need for further investigation to determine if hyperacetylation may play a role in the pathogenesis of DN.

**Primary Student Presenter:** Violette Simon

**Presenting School:** Medicine

**Degree Seeking:** MD

**Year:** 2nd

**Mentor:** Joshua Parry

**Poster Title:** Validation of Orthopedic Hip Fracture Data from the National Surgical Quality Improvement Program (NSQIP) Database

**Final Category:** Bone or Skeletal

**Abstract:**

The use of clinical registry data is integral to patient care and predicting outcomes, but is dependent on the accuracy of the data. This study examined the validity of the National Surgical Quality Improvement Program (NSQIP) database collected on all adult hip fracture patients at a single level one trauma institution. A retrospective study of adult patients who underwent surgery for hip fracture at a single level one trauma center between April 2016 and April 2018 was performed. CPT coding and 30-day complications reported in the NSQIP database were validated for accuracy against the medical records. 156 patients were identified in the NSQIP database that underwent surgery for femoral neck fractures, including hemiarthroplasty, plate/screw type implants, and intramedullary implants. 29.5% of these procedures were incorrectly coded (Table 1). Additionally, 31 (19.9%) of NSQIP cases had missing complications. In total, there were 36 missing complications - 9 bleeding complications requiring transfusions, 14 renal complications, 7 UTIs, 3 infections, 2 respiratory complications, and 1 death. Validation of the NSQIP database for adult hip fractures at a single institution detected improper coding for 29.5% of cases and missing complications for 19.9% of cases. These discrepancies suggest a need to improve NSQIP data reporting and account for erroneous information when utilizing the database.

**Primary Student Presenter:** Anne Strong

**Presenting School:** Medicine

**Degree Seeking:** MD

**Year:** 4th

**Mentor:** Jasleen Singh

**Poster Title:** Risk of Refractive Error after Cataract Surgery in Thyroid Eye Disease. AD Strong (BA), JL Patnaik (PhD), M Ackerman (MPH), K Christopher (MD), A Lynch (MD, MSPH), JK Singh (MD).

Department of Ophthalmology, University of Colorado School of Medicine

**Final Category:** Vision Sciences

**Abstract:**

Risk of Refractive Error after Cataract Surgery in Thyroid Eye Disease. AD Strong (BA), JL Patnaik (PhD), M Ackerman (MPH), K Christopher (MD), A Lynch (MD, MSPH), JK Singh (MD). Department of Ophthalmology, University of Colorado School of Medicine

**Purpose:** To investigate the risk of unexpected refractive error after cataract surgery in patients with thyroid eye disease (TED).

**Methods:** We examined the records of patients who underwent cataract surgery (2014 to 2018) included in a Cataract Surgery Outcomes database. Any patient with documentation of thyroid eye disease (TED) in the medical record was classified as TED. Post-operative refraction error greater than or equal to  $\pm 1.0$  diopter from the target refraction was the main outcome of this study. Eyes with history of refractive surgery, ocular trauma, retinal detachment, non-Graves' disease thyroid conditions or Graves' disease without TED, and eyes without refractive error at follow-up were excluded.

**Results:** A total of 5,716 eyes from 3,692 patients who underwent cataract surgery were analyzed. Sixty-five eyes of thirty-nine patients (1.1%) had TED. Three hundred and forty-nine eyes (6.1%), including 9 eyes (13.8%) in patients with TED, had refraction error greater than  $\pm 1.0$  diopter following surgery (univariate OR = 2.5, 95% CI: 1.1-5.7,  $p=0.0274$ ). After multivariate analysis controlling for race, tobacco use, combined surgery, and axial length, TED was associated with an increased risk of refractive error greater than  $\pm 1.0$  diopter (OR = 2.4, 95% CI: 1.0-5.7,  $p = 0.0506$ ).

**Conclusions:** Patients with TED are at increased risk for refractive error following cataract surgery. Discussion with patients regarding their risk and possible need for glasses following surgery is important for setting realistic patient expectations.

**Primary Student Presenter:** Anne Strong

**Presenting School:** Medicine

**Degree Seeking:** MD

**Year:** 4th

**Mentor:** Jennifer Jung

**Poster Title:** Clinical utility of electroretinograms for evaluating vigabatrin toxicity in children

**Final Category:** Vision Sciences

**Abstract:**

Clinical utility of electroretinograms for evaluating vigabatrin toxicity in children. AD Strong (BA), A Sturdy (MD), EA McCourt (MD), RS Braverman (MD), JK Singh (MD), RW Enzenauer (MD, MPH), JL Jung (MD). Department of Ophthalmology, University of Colorado School of Medicine, Children's Hospital of Colorado

**Purpose:** To determine changes in clinical management in pediatric patients taking vigabatrin for seizure control in response to electroretinogram (ERG) results performed for retinal toxicity screening.

**Methods:** We retrospectively reviewed the medical records of patients who received ERGs at Children's Hospital of Colorado from 2009 to 2012. Age, indication for ERG, ERG data, and clinical management of vigabatrin were extracted from the records. ERGs were interpreted according to LKC Technologies normative values. A physician trained in ERG analysis interpreted each ERG.

**Results:** One hundred and seventy ERGs were performed during the study period, and 147 ERGs were available for analysis. Every patient received general anesthesia for the procedure. Thirty-three ERGs were performed in 29 patients specifically as screening for retinal toxicity due to vigabatrin use, and 30 were available for analysis. Within this cohort, only 2 ERGs were normal (6.6%), and 28 were abnormal (93.3%). In patients who received abnormal results, 1 patient discontinued vigabatrin in response to the screening.

**Conclusions:** In our study cohort, clinical management generally did not change in response to an abnormal screening result. Given the need for general anesthesia in the pediatric population receiving ERG testing, and minimal change in clinical decision making in the face of abnormal results, ERG screening for retinal toxicity due to vigabatrin in the pediatric cohort should be reconsidered.

**Primary Student Presenter:** Karli Swenson

**Presenting School:** Graduate

**Degree Seeking:** PhD

**Year:** 2nd

**Mentor:** Emily Bates

**Poster Title:** Kir2.1 Potassium Channels and Bone Morphogenic Protein in Craniofacial Development.

**Final Category:** Bone or Skeletal

**Abstract:**

It is well known that craniofacial development relies on signaling molecules such as Bone Morphogenic Protein (BMP). More recently, it has become apparent that ion channels are also critical for craniofacial development. However, how ion channels contribute to canonical developmental signaling remains mysterious. Loss of the K<sup>+</sup> Inwardly Rectifying Channel Kir2.1 (Kir2.1KO/KO ) phenocopies loss of BMP2/4 signaling from the cranial neural crest cells (cNCCs) of mice. Kir2.1 is also required in the CNCCs for secondary palate closure. Furthermore, BMP signaling is reduced in the developing palate of Kir2.1KO/KO mice. To understand how Kir2.1 contributes to BMP signaling, we knocked out one copy of Kir2.1 and turned on a constitutively active BMP receptor in the cranial neural crest. We then quantified changes in craniofacial development. In Kir2.1KO/+ mice that express a constitutively active BMP receptor (caBMPR1a/+) in the cNCC, we found an exacerbation of phenotypes including a shortened premaxilla, shortened nasal bones, widened fontanelle, and decreased mandible height and length. Mice lacking one copy of Kir2.1 (Kir2.1fl/+) and one copy of the BMP4 ligand (BMP4fl/+) in the cNCC showed a tendency towards rescuing the craniofacial defects of the BMP4fl/+ in the cNCC alone. BMP4fl/+ alone show craniofacial defects at embryonic day 18.5, as noted by increased fontanelle area, decreased mandible length, and decreased mandible height. While the Kir2.1fl/+; BMP4fl/+ also showed craniofacial phenotypes, they are less severe. Data from our lab shows that depolarization can induce BMP4 release. Loss of Kir2.1 should depolarize cells and could lead to a constant release of BMP4. Together, these results suggest a negative feedback loop in BMP4 signaling in which constant release of BMP4 is detrimental to the efficiency of BMP4 signaling.

**Primary Student Presenter:** Quy Tat

**Presenting School:** Medicine

**Degree Seeking:** MD

**Year:** 2nd

**Mentor:** Jasleen Singh

**Poster Title:** Glucocorticoid Use to Prevent the Progression of Thyroid Eye Disease during Radioactive Iodine Treatment in a Pediatric Cohort

**Final Category:** Vision Sciences

**Abstract:**

Glucocorticoid Use to Prevent the Progression of Thyroid Eye Disease during Radioactive Iodine Treatment in a Pediatric Cohort. QL Tat, (M.D.,SOM), E Hink, and J Singh, Ophthalmology Department, University of Colorado-Denver, Aurora, CO.

**Purpose:** To analyze the effect of glucocorticoid prophylaxis during radioactive iodine treatment (RAI) for thyroid eye disease (TED) in order to prevent progression of ocular disease.

**Methods:** This is a retrospective chart review conducted at Children's Hospital of Colorado from 2007-2017 analyzing 61 pediatric patients with Graves' disease who received RAI treatment. Patients were identified by a procedure code for RAI and diagnosis of TED. All charts were reviewed and looked for basic demographics, TED diagnostic criteria, clinical activity score at each visit, the presence or absence of glucocorticoid treatment, patients' subjective assessment, and physicians' clinical assessment. Simple, comparative statistical analysis was performed.

**Results:** Twelve out of sixty-one patients had office visit due to TED. Of those, five patients had only RAI and seven patients had combination of RAI and oral prednisone. Without prednisone, two patients developed de-novo TED and one patient worsened TED condition. Most of patient with prednisone had their eye condition improving or no change.

**Conclusions:** Radioactive iodine treatment is associated with new development of TED and worsening TED conditions in pediatric population. Starting oral glucocorticoid treatment (such as prednisone at 0.5 mg/kg daily) at the time of RAI can help reduce the progression of TED in children with this preexisting condition.

**Primary Student Presenter:** Kisha Thayapran

**Presenting School:** Medicine

**Degree Seeking:** MD

**Year:** 2nd

**Mentor:** Steven Abman

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

**Final Category:** Pulmonary and Critical Care

**Abstract:**

Prostacyclin Analog Treprostinil Enhances Neonatal Rat Lung Endothelial Cell Growth And Angiogenesis In Vitro. KG Thayapran (MD, SOM), G Seedorf, SH Abman. Pediatric Heart Lung Center, Department of Pediatrics, University of Colorado School of Medicine, Aurora CO.

**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 Student Presenter:** Alexandra Theis

**Presenting School:** Graduate

**Degree Seeking:** PhD

**Year:** 5th

**Mentor:** Lori Sussel

**Poster Title:** Groucho co-repressor proteins regulate  $\beta$  cell development and proliferation by repressing Foxa1 in the developing pancreas

**Final Category:** Metabolism and Endocrinology

**Abstract:**

Groucho co-repressor proteins regulate  $\beta$  cell development and proliferation by repressing Foxa1 in the developing pancreas

Alexandra Theis<sup>1</sup>, Ruth A Singer<sup>2</sup>, Diana Garofalo<sup>2</sup>, Lori Sussel<sup>1,2</sup>

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Loss of insulin-producing  $\beta$  cell numbers and/or function represent the defining characteristics of Type 1 and Type 2 diabetes. Research on the cellular mechanisms that lead to these diseases is focused on understanding the development and function of  $\beta$  cells. Much of the work within this field has described the critical role of transcription factors in controlling the process of pancreas development and function. PDX1, NKX2.2, NGN3 and other transcription factors are known to be vital at the different stages of pancreas development; however, genetic regulation by cell-specific transcription factors often depends on their interactions with co-activators/-repressors. One such group of proteins is the Groucho-related gene (GRG) family of co-repressors. GRGs interact with an array of transcription factors that recruit GRGs to their respective target genes. GRGs subsequently recruit epigenetic modifiers, such as HDACs, resulting in closed chromatin that is inaccessible to transcriptional machinery. Grgs are expressed early in pancreas development and are maintained throughout adulthood. They have also been shown in other systems to interact with several important endocrine cell transcription factors, including NKX2.2, PAX6, and FOXA2, yet the molecular mechanisms behind GRG function in pancreas and islet development has only been partially characterized in an ex vivo system. Here, we used complex mouse genetics and transcriptomic analyses to determine that GRG3 is essential for  $\beta$  cell development, and that in the absence of Grg3, there is compensatory upregulation of Grg4. Grg3/4 double mutant mice are extremely hyperglycemic at birth with early lethality occurring in the majority of pups. Using bulk RNA-sequencing on pancreata from e18.5 mice, we found severe dysregulation of the pancreas development and  $\beta$  cell functional genes. Surprisingly, canonical liver genes are ectopically expressed in

mutant pancreata, along with an 8-fold increase in expression of Foxa1, a master regulator of the liver program. Additionally, Neurod1, an essential  $\beta$  cell transcription factor and predicted target of Foxa1, becomes downregulated in Grg3/4 mutants. Loss of Neurod1 in  $\beta$  cells inhibits the proliferative expansion of the  $\beta$  cell population, which is phenocopied in Grg3/4 mutant mice displaying a significant decrease in the percentage of proliferating  $\beta$  cells perinatally. These results implicate GRGs as critical cofactors in the transcriptional network controlling pancreas gene expression during  $\beta$  cell development. Future studies are underway to determine the molecular function of GRG-mediated repression specifically in  $\beta$  cells. Ultimately, further insight into the mechanisms that promote tissue-specific gene programs while maintaining repression of other tissue identities will enable us to improve therapeutic options for diabetic patients.

These studies are supported by NIH F31 DK122634-01 (AT) and NIH R01 DK082590.

**Primary Student Presenter:** Scott Tilden

**Presenting School:** Graduate

**Degree Seeking:** PhD

**Year:** 3rd

**Mentor:** Tom Anchordoquy

**Poster Title:** Induction of Endothelial Tightening to Limit Off-Target Deposition of Nanomedicines. SG Tilden, (Ph.D., GS) TJ Anchordoquy, Department of Pharmaceutical Sciences, University of Colorado – Anschutz Medical Campus.

**Final Category:** Hematology and Oncology

**Abstract:**

Induction of Endothelial Tightening to Limit Off-Target Deposition of Nanomedicines. SG Tilden, (Ph.D., GS) TJ Anchordoquy, Department of Pharmaceutical Sciences, University of Colorado – Anschutz Medical Campus.

The overall goal of the project is to decrease off-target accumulation and toxicity of intravenously administered chemotherapeutic nanomedicines. Over the past several decades the field of “tumor-targeted” nanomedicines has failed to make significant strides toward increasing tumor drug accumulation. We propose a novel approach to “targeting” nanomedicines by focusing on decreasing off-target accumulation rather than directly increasing tumor delivery. Recent studies in the field of virology have revealed a novel anti-viral phenotype in epithelial cells that limits the spread of viruses. Changes induced by an anti-viral type III interferon (IFN- $\lambda$ ) lead to tightening of endothelial/epithelial junctions that limits the ability of viral particles to diffuse into tissues. We were able to induce this tightening event, in a murine cancer model, by formulating and injecting a viral-like nanoparticle. Our data shows that injecting this viral-like nanoparticle 24 hours before an injection of FITC-labeled dextran significantly limited off-target deposition of the dextran. Additionally, tumor accumulation of the dextran was dramatically increased. In conclusion, we have demonstrated that a viral-like nanoparticle injection can initiate an endothelial tightening event that limits off-target deposition and increases tumor accumulation of a subsequently administered nanoparticle.

**Primary Student Presenter:** Wesley Tran

**Presenting School:** Medicine

**Degree Seeking:** MD

**Year:** 2nd

**Mentor:** Jeffrey Druck

**Poster Title:** The Personal and Financial Wellbeing of Withdrawn Medical Students who obtain a Master of Medical Science

**Final Category:** Other

**Abstract:**

Medical school attrition, though not common, has profound implications for the students involved. Whether the decision to drop out is for academic, professional, and/or personal reasons, there is a need for a so-called “compassionate off-ramp” in which the option to do so is without compromise to one’s self-esteem or acquiring significant debt. One recommended avenue is through the attainment of a certificate or a master’s degree, though the value of this has not yet been analyzed for this particular circumstance. This project aims to do so and hypothesizes that medical students who have withdrawn and decided to obtain a master’s in medical science will have higher personal and financial well-being scores than similar students who decide against doing so. The study will include all students who have withdrawn from the following medical schools: University of Colorado School of Medicine, Medical University of South Carolina, Lewis Katz School of Medicine at Temple University, Michigan State University College of Human Medicine, Donald and Barbara Zucker School of Medicine at Hofstra/Northwell, Midwestern University Chicago College of Osteopathic Medicine, University of Illinois College of Medicine, and University of California, Irvine, School of Medicine. The online survey will assess demographic information as well as the key variables that consist of the 7-item Personal Well-being index and the 10-item Financial Well-being scale adapted from the International Wellbeing Group and the Consumer Finance Protection Bureau, respectively. The survey itself will take approximately 20 minutes to complete and will be emailed to all students deemed most appropriate. Once data collection is complete, the scores of the two scales from various groups of interest will be analyzed via a t-test and/or one-way ANOVA, depending on the number of groups compared. As of now, the study is awaiting IRB approval.

**Primary Student Presenter:** Richard Tran

**Presenting School:** Medicine

**Degree Seeking:** MD

**Year:** 2nd

**Mentor:** Jeffrey Olson

**Poster Title:** Ascorbic Acid Attenuates Hydrogen Peroxide Induced Oxidative Stress and Osteoblasts Demonstrate Antioxidant Recycling Potential

**Final Category:** Vision Sciences

**Abstract:**

Oxidative stress is strongly implicated in progression of age-related macular degeneration. Oral ascorbic acid (AA) targets this oxidative etiology, yet efficacy is limited by insufficient ocular distribution. A possible avenue is restoring the antioxidant potential of the vitreous by improving recycling of the inactive oxidized form of AA, dehydroascorbic acid (DHA), back to its active reduced form. Here, we demonstrate the antioxidant potential of AA to improve common retinal pigment epithelium (ARPE-19) cell viability in the setting of H<sub>2</sub>O<sub>2</sub> induced oxidative stress and evaluate osteoblasts as a potential source of antioxidant recycling.

In vitro evaluation was performed by incubating ARPE-19 in culture media containing .2mM H<sub>2</sub>O<sub>2</sub> with and without 100uM AA. MTT assay was performed to assess for cell viability. Osteoblast antioxidant recycling potential was tested by exposing MG-63 osteosarcoma cells to culture media containing 100uM DHA. At set time points, media was collected and concentrations of DHA and AA were assessed using HPLC. Statistical comparisons were performed using a student's t-test.

AA successfully attenuated the toxic effects of H<sub>2</sub>O<sub>2</sub>, with 88% of ARPE-19 cells remaining viable after exposure to both H<sub>2</sub>O<sub>2</sub> and AA, compared to 61% viable after incubation with H<sub>2</sub>O<sub>2</sub> alone (P < .001). Osteoblast antioxidant recycling of DHA was observed with an increase of AA concentration and a concomitant decrease in DHA levels over time. At 80 minutes, the concentration of AA had a 2-fold increase with a paired 2-fold decrease in DHA levels.

These experiments demonstrate the antioxidant potential of AA to attenuate the effects of oxidative stress and its physiologic importance in managing cellular exposure to reactive oxygen species. Osteoblasts exhibited the potential for antioxidant regeneration of AA. While preliminary, these results demonstrate the promise of an implantable device that continuously recycles antioxidant, eliminating the need for constant injections.

**Primary Student Presenter:** Anastasiya Trizno

**Presenting School:** Medicine

**Degree Seeking:** MD

**Year:** 3rd

**Mentor:** Jason Stoneback

**Poster Title:** The Effect of Nail Diameter to Medullary Canal Ratio in Pediatric Forearm Fractures Treated with Intramedullary Nailing

**Final Category:** Surgery

**Abstract:**

**INTRODUCTION:** Intramedullary nailing is one of the preferred operative fixation methods for pediatric diaphyseal forearm fractures. The aim of our study was to assess the impact of nail diameter to medullary canal diameter (ND/MCD) ratio on postoperative outcomes in these patients.

**METHODS:** 301 pediatric patients that underwent intramedullary fixation of diaphyseal forearm fractures (OTA 22A and 22B) at a level I pediatric trauma center between January 2004 and September 2014 were retrospectively reviewed. Patients who sustained pathologic or radial neck fractures, and those with inadequate follow-up (<6 months) were excluded. The ND/MCD ratio was calculated using the nail diameter and the intramedullary canal isthmus measured radiographically. Univariate regression analysis was performed to test the association between the ND/MCD ratios and outcomes. One-way analysis of variance, t-tests, and chi-square tests were used to compare the differences between fractures with ND/MCD ratios of <40%, 40-49%, 50-59%, and  $\geq$ 60% in terms of demographic and clinical characteristics.

**RESULTS:** The average age among the 73 patients included in the study was 9.6 years (range: 2.0-18 years). Average ND/MCD ratio was 52.2% (range: 27.3-77.6%) and 65 patients (89%) had a ND/MCD ratio of greater than 40%. There was a trend towards shorter times to union with an increased ND/MCD ratio, but it failed to reach statistical significance. There was no statistically significant difference in the ND/MCD ratios between patients who experienced complications and the ones who did not. Univariate regression analysis revealed that the ND/MCD ratio was not associated with time to union, complications, or time to hardware removal.

**DISCUSSION AND CONCLUSION:** ND/MCD ratio is not associated with complications, time to union, or time to hardware removal in pediatric diaphyseal forearm fractures.

**Primary Student Presenter:** Tara Trujillo

**Presenting School:** Medicine

**Degree Seeking:** MD

**Year:** 2nd

**Mentor:** Joel Stoddard

**Poster Title:** Learning Types during Interpretation Bias Training to Treat Irritability

**Final Category:** Developmental Neuroscience and Brain and Behavior - Child

**Abstract:**

LEARNING TYPES DURING INTERPRETATION BIAS TRAINING TO TREAT IRRITABILITY. TH Trujillo (MD, SOM), J Stoddard, SP Haller, MA Brotman, M Jones, Children's Hospital Colorado, Anschutz Medical Campus.

A potential treatment target for chronic irritability is hostile interpretation bias, a tendency to interpret ambiguous stimuli as threatening, which may be targeted and changed via a computer-based interpretation bias training (IBT). The goal of this study was to apply a principled, model-based analysis of categorical learning to identify learning types during IBT. A session of IBT learning was assessed in 63 transdiagnostic youth with irritability and anxiety. Participants judge a continuum of facial expressions and train in IBT towards less angry and more happy judgments of ambiguous faces. A computational model of categorical learning, ALCOVE, was applied to each person's training data. We assessed two model parameters: 1) learning rate with higher values representing a greater speed at which individuals change their associations to faces, and 2) generalization with higher values reflecting a lower precision of applying feedback to a specific face on the morph continuum. We assessed associations with anxiety and irritability and then empirically assessed for types of learners. In multivariate linear modeling, individuals with higher generalization tended towards anxiety ( $b=1.7$  (0.9),  $p=.05$ ) and were younger ( $b=-0.5$  (0.2),  $p=0.02$ ). Learning rate was reduced with both anxiety and irritability ( $b=-0.11$  (0.04),  $p=0.01$ ). Generalized mixture modeling identified two learning types, those with very high generalization and those with lower generalization. Younger individuals were more likely to be in the high generalization group (Cohen's  $d=0.66$ ,  $p=0.01$ ). The model-based analysis empirically detected distinctive pathology and age associated learning styles. Understanding learning will improve the ability to identify learning types, improving precise prescription of IBT.

**Primary Student Presenter:** Shilpa Tummala

**Presenting School:** Medicine

**Degree Seeking:** MD

**Year:** 2nd

**Mentor:** Sarah Gitomer

**Poster Title:** Bacterial Meningitis and Pediatric Sensorineural Hearing Loss in the PCV13 Era

**Final Category:** Microbiology and Infectious Diseases

**Abstract:**

**INTRODUCTION:** Bacterial meningitis is the most common cause of postnatally-acquired sensorineural hearing loss (SNHL). Prognostic associations are lacking for pediatric SNHL due to *Streptococcus pneumoniae* bacterial meningitis after the introduction of updated pneumococcal vaccine (PCV13) in 2010.

**OBJECTIVES:** To assess clinical presentation of meningitis based on bacterial etiology in children and identify associations with post-meningitic SNHL in children after 2010. To describe rates of *S. pneumoniae*-associated post-meningitic SNHL based on three time periods: pre-PCV, post-PCV7 and post-PCV13.

**METHODS:** A retrospective review was performed for patients 18 years and younger diagnosed with meningitis after January 1, 2010. Patients were identified by history of positive CSF bacterial culture or FilmArray Meningitis/Encephalitis Panel (MEP) assay. Clinical data were stratified by bacterial etiology, analyzed for clinically relevant characteristics, and compared with previously reported rates of post-meningitic SNHL.

**RESULTS:** In a cohort of 147 patients with positive CSF cultures, 91 (61.9%) met inclusion criteria. Sixty-eight (age 23 months, 59% male) had audiograms after diagnosis and were divided into four subgroups based on bacterial etiology: *S. pneumoniae* (n=17), Group B streptococcus (GBS, n=25), *Haemophilus influenzae* (n=10), and Other (n=16). Of those with hearing evaluations, SNHL was reported in 14 patients (20.6%), most frequently in the *H. influenzae* population (n=4/10, 40%). Five (29.4%) *S. pneumoniae* patients and one (4%) GBS patient were found to have SNHL. Children in the PCV13 vaccination era had a similar rate of post-meningitic SNHL (20.6%) as historical pediatric cohorts in the pre-PCV vaccination time period (23.8%), and the PCV7 vaccination time period (35%) (p=0.34).

**CONCLUSION:** Despite advances in vaccine development for *S. pneumoniae*, SNHL remains a common long-term complication of this disease. Further research into predicting and preventing this outcome is necessary.

**Primary Student Presenter:** Ivana Vasic

**Presenting School:** Medicine

**Degree Seeking:** MD

**Year:** 2nd

**Mentor:** Christene Huang

**Poster Title:** Galectin-3 as a Potential Biomarker for Liver Regeneration and Transplant Outcomes

**Final Category:** Surgery

**Abstract:**

Galectin-3 as a Potential Biomarker for Liver Regeneration and Transplant Outcomes

Ivana Vasic<sup>1</sup> (M.D. Program, SOM), Nathaly Limon-de la Rosa<sup>2</sup>, Eduardo Cervantes<sup>2</sup>, Nalu Navarro-Alvarez<sup>1,2</sup>, Christene A. Huang<sup>1</sup>

<sup>1</sup>University of Colorado Anschutz Medical Campus, Department of Surgery, Division of Plastic & Reconstructive Surgery and Division of Transplant Surgery, Aurora, Colorado

<sup>2</sup> Instituto Nacional de Ciencias Médicas y Nutrición Salvador Zubirán, Mexico City, Mexico.

Purpose of this study was to compare plasma Galectin-3 levels between deceased liver donors and healthy subjects, and investigate the co-expression of Galectin-3 and cell cycle markers in liver tissues from patients with liver cirrhosis.

Methods: Invitrogen Human Galectin-3 ELISA kit was used to analyze circulating levels of Galectin-3 in sera of healthy donors (n = 10) and deceased liver donors (n = 64) collected immediately prior to graft procurement. Unpaired t-test was performed and a p-value <0.05 was considered to be of statistical significance.

Liver tissue samples from patients with liver cirrhosis were stained for DAPI, Galectin3, Ki67, CyclinD1, EPCAM, p21, and p53 and analyzed using inForm<sup>®</sup> software.

Results: Deceased donors had significantly higher levels of serum Galectin-3 (mean 17.1659 ng/ml, standard deviation 7.525991) in comparison to healthy controls (mean 11.4919 ng/ml, standard deviation 4.480911). Preliminary data shows that in a cirrhotic liver galectin 3 co-localizes with known cell cycle suppressors including p53 and p21. At the same time, regenerative nodules that express EPCAM, a marker of pluripotency, show low levels of Galectin-3.

Conclusion: Galectin-3 is a known inflammatory marker. Here, we are showing that it could also be involved in the regulation of cell cycle in the regenerative liver nodules. This, along with its pro-inflammatory effects could significantly contribute to the outcomes in liver transplant recipients and

liver regeneration in patients with liver pathologies.

**Primary Student Presenter:** Corey Walsh

**Additional Presenter(s):** Carley Little

**Presenting School:** Medicine

**Degree Seeking:** MD

**Year:** 4th

**Mentor:** Rita Lee

**Poster Title:** Qualitative Definitions of LGBTQIA+ Inclusivity in the Colorado Healthcare Environment

**Final Category:** Humanities and Bioethics

**Abstract:**

Despite national improvements in LGBTQIA+ inclusivity, local governmental policy and public attitudes continue to influence the health of this community. This study emphasizes perspectives among rural and non-urban LGBTQIA+ patients to further define attributes of inclusive healthcare provision through a thematic, qualitative approach. Participants (n = 28) joined semi-structured focus groups in Denver, Ft. Collins, Colorado Springs, and Grand Junction. They were more likely to identify as white (70.4%) and transgender or gender diverse (71.4%), and a majority of patients (85.7%) lived in rural or non-urban areas other than Denver. Focus group themes were identified, such as inclusive language use, comfort with sexual history taking and exams, advanced communication skills, cohesion among all team members, LGBT training credentials, provider connection to community, ability to provide specialized and preventive care, importance of LGBTQIA+ symbolism, and value for the individual. Specific examples of each were provided in detail, including notable direct quotations. This study identifies what a more inclusive healthcare environment looks, feels, and sounds like for those traditionally under-represented in LGBTQIA+ medical literature. Patients discussed tangible solutions to meet these identified needs, which should be a call to action for providers to continue to strive for more patient-centered care. These findings were also used to produce provider education and patient empowerment tools.

**Primary Student Presenter:** Corey Walsh

**Presenting School:** Medicine

**Degree Seeking:** MD

**Year:** 4th

**Mentor:** Elizabeth Kvach

**Poster Title:** Patterns of Healthcare Access and Utilization Among Non-Urban Transgender and Nonbinary Patients at a Large Safety Net Health System in Colorado

**Final Category:** Healthcare and Public Health

**Abstract:**

Patterns of Healthcare Access and Utilization Among Non-Urban Transgender and Nonbinary Patients at a Large Safety Net Health System in Colorado. CF Walsh, (MD, SOM), RP O'Connell, EJ Kvach, Department of Family Medicine, University of Colorado, Denver, CO.

Research characterizing transgender and nonbinary (TNB) communities focuses on coastal, urban centers and fails to recognize intersections of geography and gender identity. We systematically evaluated a cohort of TNB patients traveling from throughout Colorado to access care at the Denver County safety net hospital. We used electronic medical record (EMR) data to evaluate this cohort of urban and non-urban TNB patients (n=1,230). Characteristics of age, race/ethnicity, sex assigned at birth, gender identity, insurance, residence ZIP code, alcohol use, tobacco use, marijuana use, depression, and anxiety were extracted. Chart review characterized utilization patterns among non-Denver TNB patients (n=232). Denver TNB patients were more likely to have the following characteristics: black or Hispanic identity, marijuana use, private commercial insurance, depression, anxiety; comparatively, non-Denver TNB patients were more likely to be white and have public coverage (Medicaid). The non-Denver cohort traveled an average one-way distance of 82.5 miles (SD 54.4) compared to 11.4 miles (SD 9.1) for Denver TNB patients. Non-Denver patients accessed gender-affirming (99%), hormone-related (81%), preventive (78%), primary (69%), and surgical transition (23%) care. The number of non-Denver TNB traveling for healthcare likely reflects a lack of accessibility to local gender-affirming care. The study site's decentralized model of access to this care embedded within primary care allowed TNB patients to engage in chronic disease management and preventive care at their visits, as seen in a majority of patients. This study should serve as a call for medical educators to improve teaching on gender-affirming healthcare.

**Primary Student Presenter:** Emily Wang

**Presenting School:** Medicine

**Degree Seeking:** MD

**Year:** 2nd

**Mentor:** Rajeev Vibhakar

**Poster Title:** Histone Demethylase KDM4B: A Novel Epigenetic Target in Atypical Teratoid/Rhabdoid Tumor (ATRT)

**Final Category:** Hematology and Oncology

**Abstract:**

Lysine Demethylase 4B: A Novel Epigenetic Target in Atypical Teratoid/Rhabdoid Tumor. EJ Wang (M.D., SOM), I Alimova, S Venkataraman, R Vibhakar, Department of Pediatrics, University of Colorado School of Medicine, Aurora, CO

Purpose of study: Atypical teratoid/rhabdoid tumor (ATRT) is a highly aggressive childhood brain tumor. Current treatment options often create therapy-related toxicity that is especially critical in this young patient population. Previous studies reported the loss of SMARCB1, a member of the SWI/SNF chromatin remodeling complex, as a molecular feature of ATRT, creating an overall epigenetic dysregulation of the genome. This marks a potential avenue in the search for novel targeted therapy.

Methods: We utilized an unbiased epigenome-wide RNAi screen and identified lysine demethylase 4B (KDM4B) as a top epigenetic regulator critical for ATRT growth. Cell lines and patient tumor samples were used to validate the screen through both genetic perturbation and pharmacologic inhibition.

Summary of Results: Genetic depletion of KDM4B in ATRT has decreased cell viability by 79% and impaired the ability of tumor cells to form colonies. The suppression of KDM4B leads to a global increase in protein expression H3K9Me3, which has been shown to promote compaction in promotor regions. This suggests a hindrance of overall transcriptional activation which is currently being explored using integrated CHIP and RNA-sequencing. Importantly, KDM4B protein is highly expressed in ATRT cell lines and patient tumor samples, with minimal expression in normal cerebellum tissue. Small molecule inhibition of KDM4B shows preferential suppression of ATRT cells in comparison to normal human astrocytes.

Conclusions: We anticipate a promising translatable potential of KDM4B as a new target with a favorable therapeutic window. It additionally furthers our understanding of ATRT epigenetic biology and is a starting point to develop better, clinically translatable targeted therapies.

**Primary Student Presenter:** Emily Wolverton

**Presenting School:** Medicine

**Degree Seeking:** MD

**Year:** 3rd

**Mentor:** Emily Gottenborg

**Poster Title:** HIPAA-Compliant Group Messaging Use Guidelines In Large Academic Medical Centers

**Final Category:** Healthcare and Public Health

**Abstract:**

HIPAA-Compliant Group Messaging Use Guidelines In Large Academic Medical Centers. E Wolverton (MD, SOM), S Arogyamswamy (MD, SOM), A Marin (MD, SOM), D Rodriguez (MD, SOM), D Thompson (MD, SOM), A Ragusa (MD, SOM), R Kondapally (MD, SOM), T Ansett, DO, M Diaz, MD, E Gottenborg, MD. Department of Internal Medicine, University of Colorado Hospital

**Purpose:** To identify best practices for the use of HIPAA-Compliant Group Messaging (HCGM) in the context of a large academic medical center.

**Methods:** We surveyed 102 members of inpatient healthcare teams at University of Colorado Hospital, a large academic medical center, about the use of HCGM for various communication topics. Survey participants included nurses, medical students, advanced practice providers, residents, attendings, pharmacists, physical and occupational therapists, case managers, and social workers. Survey respondents were given a list of conversation topics and asked to select those that they felt were appropriate for HCGM. Free response answers were also permitted.

**Results:** Our results show that 75% or more healthcare providers believe HCGM is appropriate for the following conversation topics: non-urgent lab value updates, non-urgent orders or clarifications, non-urgent procedure schedule updates, non-urgent clinical status updates, and non-urgent provider-to-provider communication. Additionally, more than 66% of healthcare team members believe discharge status updates and nutrition recommendations should be sent through HCGM, while critical lab values and social conversations should not. Limitations of our study include response bias, which is inherent to any optional survey, as well as convenience bias favoring residents and attendings within the Department of Medicine.

**Conclusions:** Our findings indicate that HCGM is appropriate for low acuity information and non-urgent questions. However, urgent messages and social conversations should not be communicated on an HCGM service.

**Primary Student Presenter:** Jeffrey Wong

**Presenting School:** Medicine

**Degree Seeking:** MD

**Year:** 1st

**Mentor:** Nicole Rosendale

**Poster Title:** Neurologic Health of Sexual and Gender Minorities: A Scoping Review

**Final Category:** Neuroscience and Brain and Behavior - Adult

**Abstract:**

Neurologic Health of Sexual and Gender Minorities: A Scoping Review. JO Wong, (M.D., SOM), N Rosendale, MD (faculty sponsor), JD Flatt, PhD, and E Whitaker, MD, MLIS, Department of Neurology, University of California San Francisco Medical Center, San Francisco, CA.

Only a scarce number of studies have looked into the neurologic health needs of sexual and gender minorities (SGM). This scoping review describes the current state of science in SGM neurology and identifies gaps in knowledge to guide future research. The authors searched PubMed, Embase, Web of Science, PsycINFO, CINAHL, and Biosis Previews including all articles published before April 12, 2020 using a search string encompassing SGM descriptors and neurologic disorders. A total of 8359 items were found and entered into EndNote, with 2921 duplicates removed. The authors performed blinded abstract review followed by full text review in duplicate, with conflicts settled through consensus, to identify 348 articles eligible for data abstraction. Articles presenting primary data about an identified adult SGM population addressing a clinical neurology topic were included. The largest proportion of articles were case reports/series (58.9%). Most (72.4%) included gay/bisexual cisgender men, and 71.0% assessed HIV neurology. Studies suggested an association between autism spectrum disorder and gender dysphoria and higher risk of ischemic stroke in transwomen. Qualitative studies suggested that SGM people have unique needs in dementia care. Literature in neuroinfectious disease, the most common topic, primarily focused on HIV. More rigorous research in a broader range of neurologic topics that includes more sociodemographic diversity is deeply needed. Systematic collection of sexual orientation and gender identity in the electronic health record and population health surveys would advance neurologic health equity for the SGM community.

**Primary Student Presenter:** Dana Yabroudi

**Presenting School:** Medicine

**Degree Seeking:** MD

**Year:** 2nd

**Mentor:** Nanette Santoro

**Poster Title:** Effect Of One Month Exposure To Components Of The Reprometabolic Syndrome On Physical Activity And Body Composition In Lean Women

Authors: Dana F. Yabroudi, MD Candidate. SOM, Katherine Kuhn, Amanda Allshouse, Andrew Bradford, Irene Schauer, Wendy Kohrt,

**Final Category:** Metabolism and Endocrinology

**Abstract:**

EFFECT OF ONE MONTH EXPOSURE TO COMPONENTS OF THE REPROMETABOLIC SYNDROME ON PHYSICAL ACTIVITY AND BODY COMPOSITION IN LEAN WOMEN

Authors: Dana F. Yabroudi, MD Candidate. SOM, Katherine Kuhn, Amanda Allshouse, Andrew Bradford, Irene Schauer, Wendy Kohrt, Angela J. Fought, Shannon Pretzel, Nanette F. Santoro. University of Colorado School of Medicine, Aurora, CO.

Background: Subfertility in obese women is associated with chronic pituitary suppression, reduced sensitivity to GnRH and decreased sex steroid production. We have found evidence for a combined effect of hyperinsulinemia and high circulating fatty acids to acutely (4h infusion) suppress pituitary gonadotropin secretion and are currently investigating the effects of one-month exposure to a eucaloric high-fat diet (HFD) on gonadotropin levels in lean women. The aim of this study is to examine the effect of the one-month HFD on physical activity and body composition.

Methods: 12 normal weight (BMI < 25 kg/m<sup>2</sup>), normally cycling female participants of reproductive age were given a one-month eucaloric HFD, from the onset of menses in one cycle through the next, with 48% calories from fat. A Fitbit was provided to monitor changes in daily activity and sleep throughout the study. Measurement of gonadotropin pulsatility and reproductive hormones were done using frequent blood sampling and daily urine excretion, respectively. These measurements were obtained for a total of 4 menstrual cycles: 1 pre-diet cycle, the HFD cycle, and 2 post-diet cycles. DEXA body composition was measured at baseline and at the end of the 2nd post diet cycle. Pre and post diet comparisons were done using linear mixed model testing and reported as estimated means ± standard error.

Results: Mean number of daily steps were (9,226 ± 1,140) pre diet, (9,132 ± 1,140) during the diet and (7,533 ± 1,140) post diet. Daily active calories were (1,982 ± 99) pre diet, (1,975 ± 99) during the diet and

(1,856  $\pm$  99) post diet. Means in the HFD cycle did not differ from the pre-diet cycle. Daily sleeping minutes pre diet were (443  $\pm$  19), (451  $\pm$  20) during the diet and (412  $\pm$  19) post diet, with no statistical difference between the 3 time points. BMI did not differ between pre-diet (21.84  $\pm$  0.52) and post-diet (21.77  $\pm$  0.52). DEXA body composition measurements indicated a statistically significant decrease in total fat percentage, (32.26  $\pm$  1.53) pre diet and (31.31  $\pm$  1.53) post diet, which does not appear clinically significant as the difference of less than 1% falls within the anticipated measurement error of the method. Visceral fat volume (cm<sup>3</sup>) did not differ between pre diet (299.51  $\pm$  27.76) and post diet (295.53  $\pm$  27.76).

Conclusions: The complete cohort has not yet been fully recruited and analyzed. These preliminary findings indicate that women consuming a one-month, HFD maintain their usual level of physical activity and sleep patterns, and do not appear to sustain change in visceral fat. Further accrual of participants should clarify the small decrease in total body fat observed without a change in BMI.

Supported by HD087314 ROI to NS UL1TR002535 to the Colorado Clinical and Translational Sciences Institute.

**Primary Student Presenter:** Jerry Yang

**Presenting School:** Medicine

**Degree Seeking:** MD

**Year:** 4th

**Mentor:** Sarah Tevis

**Poster Title:** Choosing Between Mastectomy and Breast Conserving Therapy: Is Patient Distress an Influencing Factor?

**Final Category:** Surgery

**Abstract:**

**Project Title:** Choosing Between Mastectomy and Breast Conserving Therapy: Is Patient Distress an Influencing Factor?

**Authors:** Jerry Yang BS, Victoria Huynh MD, Michael Bronsert PhD MS, Abigail Ludwigson, Gretchen Ahrendt MD, Karen Hampanda PhD MPH, Sarah Tevis MD

**Background/Objective:** Breast conserving therapy (BCT) offers similar oncologic outcomes when compared to mastectomy. Additionally, patients undergoing BCT have reported improved postoperative satisfaction and cosmetic outcomes. Yet, when presented with BCT or mastectomy, many patients will still opt to undergo mastectomy. Distress at the time of diagnosis has broad impacts – including quality of life and treatment adherence – and may be related to patients’ surgical decision making. We sought (1) to evaluate the relationship between patient-reported distress at the time of diagnosis and surgical treatment pursued in those who were eligible for BCT and (2) to determine sociodemographic and clinicopathologic factors predictive of choosing BCT versus mastectomy.

**Method:** Newly diagnosed breast cancer patients who completed a distress screening tool at their initial clinic visit at an academic institution and were deemed candidates for BCT were retrospectively evaluated between 2016 and 2019. The screening tool captured self-reported distress levels in emotional, social, health, and practical domains on a scale of 0-10, with 10 being high distress. Overall distress was calculated by adding all domains (0-40). Relevant sociodemographic and clinicopathologic details, along with surgery performed, were reviewed. Clinical presentation (palpable lump, nipple discharge, screen-detected) and consultation as a second opinion were also noted. Distress scores were compared against surgical decisions using nonparametric Wilcoxon rank sums test. Remaining categorical variables were analyzed by either Chi-square or Fisher’s exact tests and continuous variables by Student’s t-test. A two-sided p-value < 0.05 was considered significant.

**Results:** Of 459 patients who were candidates for BCT, 71(15.5%) elected to have mastectomy and 388(84.5%) pursued BCT. There were no significant differences in overall distress or the separate domains of distress in patients undergoing BCT versus mastectomy (Table 1). Patients who opted to undergo mastectomy were on average significantly younger (50.7 years vs 60.4 years,  $P<0.0001$ ), more likely to have sought a second opinion (19.7% vs 8.6%,  $P=0.0032$ ), and more often presented with a

palpable mass (59.2% vs 34.7%,  $P < 0.0001$ ). Clinical anatomic stage was also significantly associated with surgical decision, with stage 0 and II patients more frequently pursued mastectomy, while stage I, and III favored lumpectomy. There was no association between family history of breast cancer in a first degree relative and the choice of lumpectomy or mastectomy ( $P = 0.55$ ).

Table 1. Relationship between Distress and Surgical Decision Distress Domain	Breast Conserving Therapy Median (IQR)	Mastectomy Median (IQR)	P-value
Emotional	5 (3-7)	5 (3-7)	0.1844

**Primary Student Presenter:** Heami Yi

**Presenting School:** Medicine

**Degree Seeking:** MD

**Year:** 1st

**Mentor:** Carol Stamm

**Poster Title:** Emergency Contraception Access in a Historic Southern City: Mystery Caller Study in Birmingham, Alabama

**Final Category:** Healthcare and Public Health

**Abstract:**

Emergency Contraception Access in a Historic Southern City: Mystery Caller Study in Birmingham, Alabama

H Yi, (MS1, SOM), CA Stamm (MD), L Borgelt (PharmD, MBA), WS Mondie (DO), L Rupp (LCSW), Division of General Internal Medicine, University of Colorado, Aurora, CO.

**PURPOSE:** Emergency contraception pills (ECPs) may be taken after unprotected intercourse or contraceptive failure. There are two widely available types in the United States: levonorgestrel (LNG) and ulipristal acetate (UPA) pills. We explored ECP access in Birmingham, Alabama, because Alabama has recently introduced legislation (HB314) that may severely restrict abortion access. It is, therefore, essential to understand if ECP access is adequate in this geographic region in the case that there would be greater reliance on them for pregnancy prevention in emergency situations.

**METHODS:** A list of independent, chain, and 24-hour retail pharmacies was generated, and a standardized, mystery-caller telephone script was developed to call 69 pharmacies that met inclusion criteria to understand the accessibility of ECPs.

**RESULTS:** Of the surveyed pharmacies, 41 (59%) pharmacies had LNG ECP and 0 (0%) had UPA ECP in stock. Chain pharmacies were more likely than independent pharmacies to have LNG ECP in stock (80% v. 31%). While age requirements to purchase LNG ECPs have been removed nationally, 16% of chain pharmacy and 44% of independent pharmacy employees said that ID verifications would necessary.

**CONCLUSION:** There are still barriers to ECP access in Alabama as of 2020, which is concerning given the legislation regarding abortion access. People could find it difficult to access ECPs at retail pharmacies.

**Primary Student Presenter:** Alla Yousif

**Presenting School:** Medicine

**Degree Seeking:** MD

**Year:** 2nd

**Mentor:** Erik Wallace

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

**Final Category:** Healthcare and Public Health

**Abstract:**

Assessing Barriers Among HIV, Substance Use Disorders, and Trans Patients During the COVID-19 Pandemic. AE Yousif, (MD, CUSOM), C Akpala, (MD, MUSOM), L Patten, (M.S. CoSPH), E Wallace, Department of Medicine University of Colorado, JP Bettencourt, Harvard Medical School, Boston, MA.

COVID-19's effects on the health of vulnerable populations are still emerging; however, current data suggest a disproportionate burden of illness and death among groups with substance use disorders (SUD), HIV, and transgender patients. Widening of healthcare disparities during COVID-19 justifies the exploration of barriers faced by vulnerable populations. We explored socioeconomic barriers by surveying healthcare providers about the impacts of COVID-19 on their patient's healthcare access and investigated ways to mitigate barriers widening the health disparities for vulnerable patients. 74 providers completed a cross-sectional survey administered in July 2020 at Fenway Health, a large multi-site community health center. Fisher's exact tests were used to compare outcomes. The frequency of outcomes reported are associated with whether providers were asked about before versus during COVID-19. Providers reported that, during COVID-19, mental health concerns for patients were higher ( $p < 0.001$ ) and more patients lacked access to transportation ( $p < 0.001$ ). Most providers (88%) reported their patients were not informed of the resources available to them through the CARES Act, where providers identified financial barriers (66%) to be the most common and language barriers (22%) to be the least common. Evidence suggests that improvements can be made to better facilitate efficient transportation and provide mental health services. Most providers identified a lack of education and understanding of the CARES Act among their patients to access available resources. This indicates a need for providing an outreach and education department to ensure patients are aware of their resources. Financial barriers were the most common, which may require institutional and governmental resources to curb this disparity.

**Primary Student Presenter:** Caterina Zagona-Prizio

**Presenting School:** Medicine

**Degree Seeking:** MD

**Year:** 3rd

**Mentor:** James Maloney

**Poster Title:** Emergent Cricothyrotomy Training for Non-Surgeons

Zagona-Prizio C (MD candidate at CUSOM), Maloney JP, Pascoe MA, Mayer K, Mann S

**Final Category:** Pulmonary and Critical Care

**Abstract:**

**Purpose:** Cricothyrotomies are performed in critical care (CC) settings when oral endotracheal (ET) intubation isn't possible. Training are usually performed on synthetic materials or pig tracheas, however cadaveric training is superior due to tissue fidelity.

**Methods:** We implemented a program to train CC fellows and attendings on cadaveric donors. All participants practiced scalpel and Seldinger kit methods. The program was enhanced by endoscopic visualization of the trachea that allowed them to review their technique and by a training video that we produced.

Participants responded to a pre-survey regarding their experience and anxiety with the procedure, and we assessed for changes in their confidence after the video and training. We also reviewed the endoscope recordings for any excursions of instruments beyond the tracheal midline and recorded procedure duration and puncture-to-tube time (PTTT) from entry to tube placement.

**Results:** Response rate for the first session of 10 participants was 100% and showed that the session was helpful to all participants. 20 endoscopic recordings were analyzed (10 from each method), which revealed that 1 trocar needle hit the posterior tracheal wall and 2 scalpels passed the tracheal midline. PTTT ranged from 15-83 seconds (s), with the mean PTTT without the outlier was  $29.2 \pm 12.7$ s. During the training 1 bougie was placed parallel to the trachea which was made immediately clear via the endoscope and feedback allowed the participant to successfully intubate.

**Conclusions:** Endoscopic enhancement of the emergent cadaveric cricothyrotomy training was valued by trainees. It helped detect 3 complications in 20 attempts which was important in refining trainee technique to avoid real-life complications and improve confidence. Adoption of ET endoscopy may enhance cadaveric cricothyrotomy training programs.

**Primary Student Presenter:** Tessa Zangara

**Presenting School:** Medicine

**Degree Seeking:** MD

**Year:** 4th

**Mentor:** Tyler Anstett

**Poster Title:** Thinking Outside the Cardiac Box: Anchoring in an Elderly Patient with Multiple Visits for Orthopnea

**Final Category:** Other

**Abstract:**

TK Zangara (MD, SOM), A Hudler, W Silkworth, T Anstett, Department of Medicine, University of Colorado, Denver, CO.

Thinking Outside the Cardiac Box: Anchoring in an Elderly Patient with Multiple Visits for Orthopnea

Case information: A 77-year-old male presented four times over four months for evaluation of progressive shortness of breath worse with lying down and associated with fatigue. His pmhx included HTN and prostate cancer. During his first visit, he was discharged from the ED with dyspnea of unknown etiology. On his next visit, he was admitted to the hospital where cardiac workup was unrevealing. On the third visit, the patient was discharged from the ED with a diagnosis of pneumonia but returned six hours later for worsening cough and dyspnea. Oxygen saturation by pulse-ox during this presentation revealed mild hypoxia of 90% on room air while seated upright and 79% while supine. The patient was admitted to the hospital where workup was negative for pneumonia, COPD, heart failure, pulmonary shunting, and dysphagia. Detailed physical examination revealed fasciculations and weakness of the upper extremities and hyperreflexia in the upper and lower extremities. Further discussion revealed four months of progressive weakness and several years of worsening tremors. Pulmonary function testing revealed reduced inspiratory strength and electromyography confirmed the diagnosis of amyotrophic lateral sclerosis (ALS).

Discussion: Dyspnea and fatigue are frequent complaints in outpatient settings. Though often due to cardiac dysfunction, the differential diagnosis for true orthopnea is limited and includes neuromuscular disease. This case illustrates the importance of maintaining a broad differential and considering a neurologic etiology for dyspnea. Although ALS has no cure to date, misdiagnosis can lead to delayed treatment, over-testing, reduced quality of life, and emotional distress for patients and their families.

**Primary Student Presenter:** Tessa Zangara

**Presenting School:** Medicine

**Degree Seeking:** MD

**Year:** 4th

**Mentor:** Lisa Ferrigno

**Poster Title:** Epidemiology and Outcomes of NSTI: A Population-Based Incidence Study of California Hospitalizations in 2016

**Final Category:** Surgery

**Abstract:**

TK Zangara (MD, SOM), C Witt, P Hosokawa, L Ferrigno, Department of Surgery, University of Colorado, Denver, CO.

Epidemiology and Outcomes of NSTI: A Population-Based Incidence Study of California Hospitalizations in 2016

**Purpose:** Soft tissue infections (STI) encompass a wide spectrum of disease, ranging from cellulitis to necrotizing soft tissue infections (NSTI) which have a mortality rate as high as 20-40%. Diagnosis of NSTI is hampered by a lack of characterization. More research is needed to determine the epidemiology of NSTI, the spectrum of disease over time, and risks for severe disease.

**Methods used:** Retrospective analysis of the California Office of Statewide Health Planning and Development Patient Discharge Database for the year 2016 was used. Patients were selected using ICD-10 codes representative of the spectrum of STI and NSTI as the principal diagnosis code. Population-based incidence for was calculated using the census-obtained population.

**Summary of results:** 1925 patients were included. The incidence of NSTI within this population is 4.9/100,000. 68% are male and 49% are white with a median age of 55. Common comorbidities include HTN (61%), DM (60%), and IVDU (39%). Common anatomic locations include the lower extremity (37%) and perineum (27%). 32% of patients experienced severe sepsis with 15% going into septic shock. 24% were placed on mechanical ventilation. The mortality rate was 15%. Of those that survived, 52% were discharged home.

**Conclusions:** The prevalence of NSTI is higher than previously reported, especially among 50-59-year-old white males. Common comorbidities include DM, HTN, and IVDU. Many, but not the majority, required advanced ICU care, with 50% being discharged home and approximately 15% succumbing to the disease. This study increases the availability of epidemiological data for this disease process. Future goals include characterizing NSTI in diabetic patients for earlier prevention, diagnosis, and management.