

UNIVERSITY OF COLORADO  
DENVER  
ANSCHUTZ MEDICAL CAMPUS

ANNUAL STUDENT MSA CAPSTONE PRESENTATIONS

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UNIVERSITY OF COLORADO DENVER  
ANSCHUTZ MEDICAL CAMPUS  
MSA CAPSTONE PRESENTATIONS

Thursday, February 28, 2019

**Poster Sessions**

Session A: 1:00 pm – 2:00 pm

Session B: 2:15 pm – 3:15 pm

Session C: 3:30 pm – 4:30 pm

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The MSA Directors to acknowledge, with gratitude, the support for medical 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 MSA Capstone Presentations. Without their generous contribution of time and talent the forum would not be possible. Thank you!

<i>Aimee Bernard</i>	<i>Rita Lee</i>
<i>Amber Berning</i>	<i>Mark Levine</i>
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<i>Gregary Bocsí</i>	<i>Helen Macfarlane</i>
<i>Joseph Brzezinski</i>	<i>Shideh Majidi</i>
<i>Christine Chan</i>	<i>Sandy Martin</i>
<i>JJ COHEN</i>	<i>Danielle McDermott</i>
<i>Caleb Doll</i>	<i>Kristen Nadeau</i>
<i>Marisa Echaniz</i>	<i>Ram Nagaraj</i>
<i>Mark Ewalt</i>	<i>Kristen Nowak</i>
<i>Patricia Gabow</i>	<i>David Orlicky</i>
<i>Jeff Galinkin</i>	<i>Jennifer Patnaik</i>
<i>Jackie Glover</i>	<i>Cleveland Piggott</i>
<i>Daniel Goldberg</i>	<i>Miriam Post</i>
<i>Jennifer Hagman</i>	<i>Tracy Price-Johnson</i>
<i>Patricia Heyn</i>	<i>Sridharan Raghavan</i>
<i>Andrea Ho</i>	<i>Cordelia Robinson Rosenberg</i>
<i>Britta Jacobsen</i>	<i>Michael Rosenberg</i>
<i>Jill Kaar</i>	<i>Irene Schauer</i>
<i>Bethany Kwan</i>	<i>Michaela Schedel</i>
<i>Francisco La Rosa</i>	<i>Deb Seymour</i>
<i>Wladimir Labeikovskiy</i>	<i>Janet Snell-Bergeon</i>
<i>Celeste St John-Larkin</i>	<i>Junwang Xu</i>
<i>Minghua Tang</i>	<i>John Tentler</i>

Primary Presenter: **Eric Achatz**

Project Title: *A RCT to Reduce Incidence or Severity of Acute Mountain Sickness: A Failed Field Trial of Pharmacological Prevention*

Primary Mentor: Robert Roach, PhD

Thematic Area: Clinical Science

Abstract:

Abstract

**Introduction:** Acute Mountain Sickness (AMS) is a common disease state for those exposed to high altitudes without acclimatization. The effects of AMS have shown to impair physical and cognitive performance. This is pertinent to those dropped into high altitude at a moment's notice and then expected to perform demanding physical and cognitive tasks, as is the case for Special Ops Forces (SOF). Research regarding the prevention of AMS is lacking. Recent investigations have suggested novel pharmacological prevention. The purpose of this study was to investigate the hypothesis that one or more of the drug groups would reduce the incidence or severity of symptoms associated with AMS.

**Methods:** The four drug groups (1-quercetin; 2-nitrite; 3-metformin; 4-nifedipine + methazolamide) were tested in a placebo-controlled, double-blinded, matched cohort study. Participants were sea-level (SL) residents who were healthy and made the fitness criteria for SOF. 103 subjects flew from SL to high altitude Colorado to perform similar tasks as those in the SOF including demanding cognitive and physical tasks. We tracked symptoms using standardized AMS questionnaires, the Lake Louise AMS Score (LLSS) and Environmental Symptoms Questionnaire (ESQ).

**Results:** Both LLSS and ESQ scores were similar in all drug treatment groups compared to placebo. On the first night at altitude when AMS diagnosis is most prevalent, average LLSS were 2.7( $\pm$ 1.6) for placebo, 2.9( $\pm$ 1.3) for quercetin, 2.0( $\pm$ 1.6) for nifedipine + methazolamide ( $p=0.14$  compared to placebo), 3.4( $\pm$ 1.5) for metformin, and 3.7( $\pm$ 2.4) for nitrite. Of interest, SPO<sub>2</sub> values were higher in the nifedipine + methazolamide group at all time points at altitude ( $p<0.01$ ). However, this increase did not result in improved AMS incidence or severity at any time.

**Conclusions:** Although promising preliminary studies that suggested novel mechanisms of action to prevent incidence or severity of AMS, we found these drugs had a non-significant effect.

Primary Presenter: **Mikal Ahtner**

Project Title: *Suicide awareness and prevention in rural Colorado*

Primary Mentor: Mark Deutchman

Thematic Area: Public Health and Epidemiology

Abstract:

The rate of suicide in the state of Colorado has steadily increased over the past decade and ranks among the top in United States<sup>1</sup>. Furthermore, there is an increased rate of suicide in rural communities compared with urban areas.<sup>1</sup> There have been multiple studies to try and understand this discrepancy in hopes to address the crisis. In this paper we hope to provide insight and education to the problem of suicide in rural Colorado. We first introduce the prevalence of suicide attempts in rural areas, then identify high risk populations and barriers to care, provide education on prevention and available resources, discuss existing community-based solutions, and discuss novel approaches to suicide prevention.

Primary Presenter: **Justin Allsop**

Project Title: *A FAILING HEART: A NEW DIAGNOSIS OF HEART FAILURE DUE TO HYDROXYCHLOROQUINE-INDUCED CARDIOMYOPATHY*

Primary Mentor: Sridharan Raghavan

Thematic Area: Clinical Science

Abstract:

**Introduction:** Antimalarial medications such as hydroxychloroquine (HCQ) are commonly used in patients with rheumatoid arthritis, systemic lupus erythematosus, and other connective tissue diseases. Cardiotoxicity is a side effect of these medications that can be difficult to recognize because of its rarity. Here, we present a patient without prior cardiac history who developed severe heart failure after only 8 months of exposure to HCQ.

**Case Presentation:** A 43-year-old woman presented with 1-week of progressive shortness of breath, a new dry cough, and one day of intermittent chest pain lasting about 30 seconds. Significant history for seronegative inflammatory arthritis treated with meloxicam and hydroxychloroquine (HCQ) 200 mg twice daily for 8 months, and a known cystic lung disease of unclear etiology. Vitals were temperature of 97°F, pulse 128 bpm, blood pressure 132/91 mmHg, respirations 18, and oxygen saturation 89% on room air. On examination she had distant heart sounds but no murmurs or gallops, and diffuse inspiratory crackles.

**Workup and Management:** White blood cell count was  $12.7 \times 10^9/L$ , hemoglobin 15.2 g/dL, and platelets  $297 \times 10^9/L$ . Comprehensive metabolic panel was normal. Pro-Brain Natriuretic Peptide (pBNP) was 3539 pg/mL, and troponin peaked at 0.05 ng/mL. Infectious and autoimmune workup was negative. ECG revealed sinus tachycardia with inferior T-wave flattening and lateral T-wave inversions. Computed tomography of the chest with contrast revealed no pulmonary embolus but was notable for diffuse cystic changes (seen previously and unchanged), ground glass opacities, and moderate bilateral pleural effusions. Her respiratory status deteriorated rapidly on hospital day one and she required 35 liters per minute 70% FiO<sub>2</sub> by heated high flow nasal cannula. Thoracentesis revealed transudative fluid. Transthoracic echocardiogram revealed global systolic dysfunction without ventricular hypertrophy, an ejection fraction of 20-25%, and functional mitral regurgitation, confirming a new diagnosis of heart failure with reduced ejection fraction (HFrEF) and dilated cardiomyopathy. Cardiac magnetic resonance imaging (CMR) revealed dilated, non-ischemic cardiomyopathy, with a left ventricular ejection fraction of 18%, and no focal inflammation or edema, infarction, or regions of fibrosis. Her hydroxychloroquine was discontinued, and her oxygen requirement resolved after several days of aggressive diuresis. Subsequent coronary angiography was unremarkable, excluding ischemic cardiomyopathy. Right heart catheterization was also performed and endomyocardial biopsies taken. She was discharged in stable condition after optimization of guideline directed oral medications for HFrEF. Surgical pathology ultimately revealed patchy myocyte hypertrophy with no evidence of iron deposition, or lymphocytic or granulomatous infiltrate. Electron microscopy revealed myelinoid bodies within myocyte cytoplasm, interstitium, and endothelial cells, as well as interstitial fibrosis, without fibrillary material, inflammatory infiltrates, or granulomas, consistent with HCQ toxicity. HCQ administration was stopped and outpatient cardiology follow-up was scheduled.

Discussion: Although retinopathy and myopathy are well documented adverse effects of HCQ therapy, cardiotoxicity is exceedingly rare and challenging to recognize because of its diversity in presentation. As in our case, endomyocardial biopsy and histopathology are essential to the diagnosis, and should be undertaken in any patient receiving HCQ and presenting with new or unexplained restrictive or dilated cardiomyopathy, or cardiac conduction abnormalities. Cardiac MRI and echocardiography serve as important adjuncts and can help narrow the differential diagnosis. There is no definitive treatment for HCQ-induced cardiomyopathy, though some authors suggest a role for aggressive preload and afterload reduction. Withdrawal of HCQ remains the cornerstone of management due to potential reversibility, and underscores the importance of early diagnosis.

Primary Presenter: **Vivianne Andersen**

Project Title: *Different Growth Patterns Persist at 24 Months of Age in Formula-Fed Infants Randomized to Consume a Meat- or Dairy-Based Complementary Diet from 5 to 12 Months of Age*

Primary Mentor: Minghua Tang

Thematic Area: Clinical Science

Abstract:

Different Growth Patterns Persist at 24 Months of Age in Formula-Fed Infants Randomized to Consume a Meat- or Dairy-Based Complementary Diet from 5 to 12 Months of Age Minghua Tang, PhD , Vivianne Andersen, BS , Audrey E. Hendricks, PhD , and Nancy F. Krebs, MD

**Objective** To test the long-term effect on growth status at 24 months of age in formula-fed infants who were randomized to consume a meat- or dairy-based complementary diet from 5 to 12 months of age.

**Study design:** Observational assessments, including anthropometric, dietary, and blood biomarkers, were conducted at 24 months of age, 1 year after the intervention ended. **Results** The retention rate at 24 months of age was 84% for the meat group and 81% for the dairy group. Mean ( $\pm$ SD) protein intakes at 24 months of age were  $4.1 \pm 1.2$  and  $4.0 \pm 1.1$  g/k meat (n = 27) and dairy (n = 26) groups, respectively, and comparable with the estimates of US population intake. At 24 months of age, weight-for-age z score did not differ significantly between groups and was similar to that at 12 months. Length-for-age z score remained significantly higher in the meat group compared with the dairy group, and the average length was 1.9 cm greater in the meat group. Weight-for-length z score also did not differ significantly between groups. Insulin-like growth factor 1 significantly increased from 12 to 24 months of age in both groups, but insulin-like growth factor binding protein 3 and blood urea nitrogen did not change significantly from 12 to 24 months of age and were comparable between groups.

**Conclusions:** The protein source-induced distinctive growth patterns observed during infancy persisted at 24 months of age, suggesting a potential long-term impact of early protein quality on growth trajectories in formula-fed infants.

Primary Presenter: **Nicholas Anderson**

Project Title: *kenneth.j.hunt@ucdenver.edu*

Primary Mentor: Kenneth Hunt

Thematic Area: Clinical Science

Abstract:

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Abstract

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Background:

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Acute inversion ankle sprains are among the most common musculoskeletal injuries. Higher grade sprains, including anterior talofibular ligament (ATFL) and calcaneofibular ligament (CFL) inju

Primary Presenter: **Aya Angstadt**

Project Title: *Proposals to Improve Outside Hospital Transfers: A Medical Student-Driven Initiative*

Primary Mentor: Tyler Anstett, DO

Thematic Area: Clinical Science

Abstract:

Background: University of Colorado Hospital (UCH) is an academic, quaternary level referral center in Aurora, Colorado responsible for receiving over 400 outside hospital (OSH) transfer patients monthly to the hospitalist medicine service. A quality improvement initiative by several medical students sought to improve the interhospital transfer process for providers and patients at UCH. Methods: Several aims were established regarding 1) decreasing time to provider assessment upon patient arrival, as defined by the time to admission orders, 2) increasing the percentage of transferred patients who have timely and relevant records, as defined by inclusion of a discharge summary, and 3) increasing transfer patient engagement, as defined by patient use of the in-room whiteboard. Through performing needs assessments, reviewing patient safety events, interviewing stakeholders, performing chart review, and designing and implementing several rapid cycle improvements, the team was able to target each aim. Results: The average time for admitting provider order placement upon patient arrival decreased from an average time of 92 minutes (n = 39) to 46 minutes (n = 19) by implementing a 30-minute estimate of patient arrival. Providers responded favorably to pre-admission order sets. An educational campaign targeted provider knowledge of existing hospital services to obtain pertinent OSH transfer patient records. By using patient-centered design principles, the in-room whiteboard was redesigned to increase patient engagement by 20% (n = 10). Conclusion: The team proposes several recommendations to improve the OSH transfer process, including providing estimates of patient arrival, creating a pre-admission order set, optimizing existing resources to obtain medical records, and reframing sections of the whiteboard to engage patients.

Primary Presenter: **Catherine Ard**

Project Title: *Development of a Novel Service Learning Curriculum in the Denver Health Longitudinal Integrated Clerkship*

Primary Mentor: Jennifer Adams

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

**Background:** It is estimated the Social Determinants of Health (SDoH) contribute to 80% of a health outcomes, yet most medical students receive little to no training on addressing them; instead focusing on a biomedical model of disease. Service learning is a structured experience developed in collaboration with community partners in order to fulfill a community's identified needs and enhance students' learning around specific objectives.<sup>3</sup> The Denver Health Longitudinal Integrated Clerkship (DH-LIC) is a yearlong integrated clerkship with a focus on caring for the underserved. A service learning curriculum was designed for the DH-LIC with the goal of increasing medical student community leadership, engagement, and understanding of the social determinants of health (SDoH).

**Methods:** In a needs assessment of DH-LIC students (n=16), 66% of students reported a low degree of confidence in working with communities to find solutions to their self-identified problems and 94% believed a service learning curriculum would help them better understand the SDoH of their patients. Based on these results and literature review, a multimodal curriculum was developed which included didactic sessions, written reflection with group discussion, as well as the development of a longitudinal service project in collaboration with community partners.

**Results:** Pre-curriculum surveys assessed student values and attitudes surrounding leadership, community engagement, altruism, and confidence in addressing the SDoH of their patients. Results showed students highly value community involvement, physician leadership, and altruism; with mixed results in confidence and experience in addressing SDoH. Post-curriculum surveys will be administered to students and community partners.

**Discussion:** The curriculum developed for the DH-LIC aims to be an efficacious model in involving students in communities and teaching leadership that could be scaled locally or nationally. Increased exposure to service learning will help develop leaders in medicine who are altruistic, engaged with their communities, and who work to find ways to address the SDoH of their patients.

Primary Presenter: **Kaily Baer**

Project Title: *Hyperoxia Tolerant Rats Are Less Anxious and Have Larger Hippocampi but similar HO-1 and iNOS Levels Compared to Control Rats: Possible new Model for Investigating Post-Traumatic Stress Disorder Resistance*

Primary Mentor: John Repine

Thematic Area: Basic Biomedical Science

Abstract:

Anxiety related to various factors, most notably Post-Traumatic Stress Disorder (PTSD), is a medical problem that substantially disrupts daily life. For unknown reasons, after trauma, only certain individuals develop anxiety and PTSD. Reduced brain hippocampal volume and increased brain inflammation have been implicated as possible contributors to anxiety and PTSD susceptibility but this relationship is unclear. By repeatedly breeding a single rat that unexpectedly survived breathing pure oxygen, we created a unique tolerant strain of rats that all survive indefinitely breathing pure oxygen (hyperoxia) while, in contrast, all control rats die in ~66 hours. In addition, hyperoxia tolerant rats were found to have less lung inflammation when investigating acute respiratory distress syndrome. This finding led to suspicion that tolerant rats may also resist other inflammatory conditions.

In the present investigation, we found that hyperoxia tolerant rats are less anxious than control rats when assessed using contextual fear conditioning testing. We also found that tolerant rats have larger hippocampi using MRI. Immunofluorescence staining for iNOS and HO-1 showed similar baseline level of oxidative stress in hyperoxia exposed tolerant and control rats. Hyperoxia tolerant rats could therefore be a new model for investigating anxiety, PTSD, and the many other conditions associated with increased brain inflammation and oxidative stress.

Primary Presenter: **Rima Baliga**

Project Title: *PROGRESSION OF AUTOSOMAL DOMINANT POLYCYSTIC DISEASE (ADPKD) IN CHILDREN AND YOUNG ADULTS: A METABOLOMICS STUDY*

Primary Mentor: Jelena Klawitter

Thematic Area: Clinical Science

Abstract:

**Background and objectives:** Autosomal dominant polycystic kidney disease (ADPKD) is the most commonly inherited kidney disease. Though children with ADPKD show normal renal function, rapid cyst development is already occurring. In this study, we aimed to identify plasma markers and molecular pathways of disease progression in pediatric ADPKD patients.

**Design, setting, participants, and measurements:** Plasma samples were collected through a 3-year randomized, double-blind, placebo-controlled, phase III clinical trial that was designed to test the efficacy of pravastatin on slowing ADPKD progression in pediatric patients. Samples from 58 patients were available at baseline and at the 3-year endpoint of the study. Metabolomic analysis was performed using liquid chromatography-mass spectrometry and differences in biomarkers over time and within study groups were calculated.

**Results:** While statin therapy resulted in a lower percent change in height-corrected total kidney volume (HtTKV) in ADPKD patients, it had minimal effects on metabolite changes. Pathway analysis revealed that metabolites in the kynurenine pathway, urea cycle, and arginine metabolism were significantly changed over the course of the disease independent of treatment. Furthermore, symmetric dimethylarginine (SDMA), s-adenosylhomocysteine (SAH), 1,3-bisphosphoglycerate, and  $\alpha$ -ketoglutarate were all positively correlated with percent change in HtTKV.

**Conclusions:** Metabolites from the tryptophan, arginine and urea cycles, and glucose metabolism markedly associate with the progression of ADPKD. Statin therapy had little effect on metabolic changes; metabolite changes were primarily governed by disease progression and/or angiotensin converting enzyme inhibitor treatment. Further qualification and mechanistic studies are necessary to understand the changes in the described pathways and develop targeted therapies for ADPKD.

Primary Presenter: **Nina Ball**

Project Title: *Still Seeking Emergency Contraception in the Denver Metropolitan Area*

Primary Mentor: Carol Stamm

Thematic Area: Public Health and Epidemiology

Abstract:

**Objectives:** In 2014, right after deregulation of emergency contraception (EC), research conducted in Denver showed that levonorgestrel based EC (LNG-EC) had limited availability to mystery shoppers by phone. This study examines the availability and access to LNG-EC and ulipristal acetate emergency contraception (Ella) in Denver pharmacies in 2019 and evaluates the effectiveness of an educational handout on counseling by pharmacy staff.

**Study Design:** Half of the pharmacies chosen for this study received an educational handout about EC in early January 2019. One day at the end of January 2019, three female interviewers called Denver pharmacies posing as women seeking Ella or levonorgestrel-only emergency contraception (LNG-EC) to determine the availability and cost of Ella and LNG-EC, and to record the counseling/knowledge of the pharmacy staff surrounding both forms of EC.

**Results:** Of the 131 pharmacies analyzed, 9.2% (12) were independent and 90.8% (119) were chain stores. Overall, only a small number had Ella in stock and a much larger amount had Plan B in stock. Some pharmacies still reported an age minimum or need for ID to purchase EC. There did not seem to be a significant difference in knowledge about these medications between those pharmacies who did and did not receive the educational intervention, and it is possible that the staff members did not even see the handout.

**Conclusions:** The availability of Ella is deficient in Denver and while availability of LNG-EC is much higher, it is not fully available or accessible, despite deregulation in 2014. Pharmacy staff knowledge around Ella is lacking, and may be improved through future education with a different form of delivery.

Primary Presenter: **Michaela Barbera**

Project Title: *CRISIS PLAN DEVELOPMENT FOR FAMILIES WITH CHILDREN WITH CO- OCCURRING INTELLECTUAL/DEVELOPMENTAL DISABILITY AND MENTAL HEALTH DIAGNOSIS.*

Primary Mentor: Cordelia Rosenberg

Thematic Area: Clinical Science

Abstract:

Previous research has demonstrated that patients with co-occurring intellectual/developmental disability and mental health diagnosis (known as dual-diagnosed, or DD) are more likely to have behavioral problems, including aggression. These behavioral problems often result in emergency room visits where many families do not feel their needs are met. Studies of families with concrete plans for mental health crisis show an increased ability of the family to de-escalate a crisis and a decreased likelihood of emergency room visits. A survey of families in Colorado with children who have co-occurring intellectual/developmental disability and mental health diagnosis revealed that less than 50% had such a crisis plan in place. The goal of this project was to create a written crisis plan template specific to the DD population.

In order to develop this tool, we used online research to review currently available crisis plans, listened to previously recorded interviews with family members, and met with multiple families of DD individuals, mental and behavioral health providers, and members of a variety of community mental and behavioral health resources.

Through our research we identified several features necessary for a successful crisis plan and developed a crisis plan template. It includes four sections: a quick hand-off form, a pre-work section, a step-by-step crisis plan with available crisis resources, and a reflection. We believe because this crisis plan considers both the patient's intellectual/developmental disability as well as their mental health diagnoses, it will be effective in decreasing occurrences of crises, crisis severity and emergency service utilization.

Primary Presenter: **Travis Barlock**

Project Title: *Epidemiology of burns in rural and urban Western Cape, South Africa: June-December 2015*

Primary Mentor: Lee Wallis

Thematic Area: Global Health

Abstract:

The townships of South Africa are among the most injury laden regions of the world. There is little published data on the epidemiology of burns presenting to emergency departments in the Western Cape. A retrospective review of patients in rural and urban emergency departments throughout the Western Cape was undertaken, looking at all burn patients seen from June-December 2015. This study discusses the characteristics and dispositions of the patients. Over this 7-month period, 1026 patients were seen for burns. The pediatric population was disproportionately affected with 48.9% of burn patients under 9 years of age, while 33.38% were between ages 20-54. The predominant mechanism of injury was a hot water burn (58.5%) with the legs (29.0%) and arms (30.2%) being the most common sites of injury. The average total body surface area (TBSA) of the burns was 4.62% with 44.2% of burns being superficial and 23% being partial thickness. Approximately 81.3% of patients met referral criteria and 9.4% of patients were referred. Reasons for this are explored. Recommendations are aimed at increasing prevention, which include promoting fire safety among schoolchildren in the community, parental education on pediatric risk, and legislation promoting safer stove design and water delivery systems. Further research is still needed to determine the impact of strict referral criteria adherence on patient outcomes.

Primary Presenter: **Britni Beagley**

Project Title: *Contraceptive use and sexual activity of patients with anorexia nervosa compared with patients with bulimia nervosa.*

Primary Mentor: Kristina Tocce

Thematic Area: Public Health and Epidemiology

Abstract:

Abstract

**Objective:** To determine if adolescents and young women with restrictive eating disorders such as anorexia nervosa have a similar pattern of sexual activity and contraceptive use as those with bingeing type eating disorders such as bulimia nervosa.

**Method:** Data was collected using an online survey-based study of postmenarchal women aged 14-30 years with a diagnosed eating disorder (n=31) recruited from eating disorder treatment centers and campuses around Denver, CO.

**Results:** Due to the small sample size no statistical analyses were made, however, observationally, eating disorder patients are sexually active (83.9%). Most have not been counseled on contraception by a physician involved in their treatment (74.2%), but determine the information provided by physicians not involved in their treatment to be the most important source of information to guide their contraceptive decisions (60%). Oral contraceptive pills, patch and ring methods were perceived by participants to have the most side effects, followed by the hormonal IUD. Only 25% of participants are currently using long acting reversible contraceptives (LARCs).

**Discussion:** ED patients face unique physiologic considerations during recovery. LARCs appear to be the most effective contraception for this population but more research must be done to ensure that these methods optimize the unique physiologic needs in regards to eating disorder recovery and sexual health in this population. There is a need for collaboration and consensus between physicians who are involved in patients' eating disorder treatment and those that are not.

Primary Presenter: **Katie Berenbaum**

Project Title: *HPV Vaccination in Correctional Care: Knowledge, Attitudes, and Barriers Among Incarcerated Women*

Primary Mentor: Alia Moore

Thematic Area: Public Health and Epidemiology

Abstract:

Incarcerated women are at increased risk for developing cervical cancer and have high rates of Human Papillomavirus (HPV) infection, an important cause of cervical cancer. However many correctional facilities do not offer HPV vaccination to female inmates. This pilot survey study, conducted with incarcerated women age 18-26 at a facility that does not offer the vaccine, assessed attitudes and knowledge about HPV and the HPV vaccine, acceptability of and barriers to in-prison HPV vaccination, and self-reported HPV vaccination rates. Most participants reported that they had not received the HPV vaccine, but had positive attitudes toward it and would be willing to get it in prison. Correctional facilities should consider offering this preventive service to this vulnerable population.

Primary Presenter: **Kaitlyn Biernacki**

Project Title: *CAMP: CoRHSP Attendees in Medical Professions*

Primary Mentor: Mark Deutchman

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

The Colorado Rural Health Scholars Program (CoRHSP) is a three week summer camp for 20 high school students from rural Colorado who are interested in pursuing careers in healthcare. The camp has been run for 23 consecutive years. Each year, University of Colorado School of Medicine allocates approximately \$60,000 to fund this program at no cost to the participants. The program is run by medical students with support from the School of Medicine's Office of Student Life. The goal of the program is to increase the number of health workers in rural Colorado, while providing a leadership opportunity for medical students. No longitudinal tracking of participants or leaders has been conducted to explore the impact of the experience on their future careers and educational decisions.

We conducted an online survey of past participants to assess the impact CoRHSP has had on their education and careers. We found that CoRHSP has a statically significant impact on increasing participants' interest in healthcare careers and working in a rural area. There was not a statistically significant increase in interest in attending college. Participants frequently reported that long-lasting friendships with fellow participants was the most meaningful aspect of the program.

As junior counselors of CoRHSP in 2015 and co-directors in 2016, we have gained valuable insight into the summer camp's goals and mode of operation. Our goal with this project is to demonstrate the value of the CoRHSP program and to ensure continued support for the program.

Primary Presenter: **Sarah Black**

Project Title: *HEPARIN INDUCED LIPOLYSIS: A POSSIBLE MODULATOR OF SERUM GONADOTROPINS*

Primary Mentor: Nanette Santoro

Thematic Area: Clinical Science

Abstract:

S. A. Black, K. Kuhn, K. Jones, A. P. Bradford, I. Schauer, N. Santoro

Obstetrics & Gynecology, University of Colorado School of Medicine, Aurora, CO

**OBJECTIVE:** Heparin induces lipoprotein lipase and causes elevation in circulating free fatty acids (FFAs). We have previously shown that a lipid + heparin infusion results in a small increase in FSH in women, compared to a saline control, and that the combination of lipid + heparin infusion with added insulin reduced both luteinizing hormone (LH) and follicle-stimulating hormone (FSH) (1). We sought to determine whether a saline + heparin infusion, in the absence of exogenous lipid or insulin would result in altered gonadotropin secretion or circulating FFAs compared to saline alone.

**DESIGN:** A comparison study was performed of LH, FSH and FFAs among 18 regularly cycling, normal-weight women (NWW) in the early follicular phase of the menstrual cycle, who received a 4 hour infusion of either 0.9% normal saline or saline with heparin.

**MATERIALS AND METHODS:** Serum non-esterified fatty acids (NEFA) were determined by the University of Colorado CTCRC laboratory (2). LH and FSH were determined by immunoassay (ADVIA Centaur; Siemens). Levels and mean fold-change in LH, FSH and FFAs for each study were computed and compared across groups using unpaired, two group testing. Values are shown as mean  $\pm$  SEM for fold changes or  $\pm$  SD for absolute values.

**RESULTS:** Women who received saline with heparin (N=9) had significantly higher absolute levels of circulating FFAs at T=120 min ( $p < 0.0001$ ) and T=240 min ( $p < 0.0001$ ) as compared to women who received saline alone (N=9; data has been previously reported [1]). The FFA fold change was significantly greater in the women who received saline plus heparin compared to women who received saline alone (fold change of  $1.26 \pm 0.06$  versus  $0.76 \pm 0.04$ ,  $p = 0.0351$ ). Absolute LH and FSH levels at T=120 min and T=240 min did not differ significantly between women receiving saline or saline with heparin (LH:  $4.5 \pm 1.8$  versus  $5.0 \pm 3.3$  U/L at T=120 min and  $4.9 \pm 3.3$  versus  $4.7 \pm 1.5$  U/L at T=240 min; FSH:  $4.1 \pm 1.2$  versus  $10.2 \pm 8.5$  U/L at T=120 min and  $4.3 \pm 0.9$  versus  $10.9 \pm 10.3$  U/L at T=240 min). In addition, the fold change of LH and FSH from T=0 min compared to subsequent time points did not differ significantly with the addition of heparin (LH:  $0.8 \pm 0.1$  versus  $1.0 \pm 0.1$ ; FSH:  $1.0 \pm 0.1$  versus  $1.0 \pm 0.1$ ).

**CONCLUSION:** When given at the low levels required to maintain patency of an intravenous line, heparin significantly increases circulating free fatty acids in normal individuals undergoing short-term experimental infusion. This increase in free fatty acids was not sufficient to alter gonadotropins.

**SUPPORT:** Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHD): grant number RO1 HD 087314 (to NS), University of Colorado School of Medicine Research Track (for SB)

References:

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Primary Presenter: **Kara Blaisdell**

Project Title: *Endocarditis: Patient Vignettes and Literature Review*

Primary Mentor: Jaime Baker

Thematic Area: Clinical Science

Abstract:

Case Description:

Patient was a 73 yo female with a past medical history of breast cancer, hypertension, anxiety, and a seizure disorder on lamotrigine who presented to the Emergency Department with altered mental status. Her family reported that she had an increase in seizures in the past month wherein she became glossy eyed, lethargic, and was not acting herself; in addition to having a headache and shortness of breath. Upon presentation she had blood pressure readings in the 60s, blood glucose of 30, pH of 6.95, bicarbonate of 5, a lactate of 12.5, and a troponin of 6.34. Shortly after presentation she was intubated for a GCS of 3, started on broad spectrum antibiotics, dextrose, bicarbonate, and vasopressors. Workup revealed an EEG that showed cerebral dysfunction but no seizure activity, an unremarkable head CT, and CSF (obtained after antibiotics were started) with 47 nucleated cells, a glucose of 90, and no organisms on smear. A CT scan of her abdomen/pelvis showed incidental pulmonary nodules initially concerning for a metastatic process versus emboli. Initial blood cultures grew staphylococcus aureus in two out of two blood samples, but subsequent transthoracic echocardiography and transesophageal echocardiography showed no evidence of endocarditis. An MRI obtained a couple days into her stay revealed diffuse acute and subacute small vessel infarcts concerning for micro-emboli.

Despite appropriate antibiotic therapy, her neurologic status had only minimal improvement, and she failed an extubation attempt. After enough time had passed for a tracheostomy to be placed, her family decided that she would not have wanted this life-prolonging intervention and opted for comfort care only.

Discussion:

Our patient was diagnosed with definitive endocarditis by modified Duke criteria by having major and four minor clinical criteria (only three needed for diagnosis). Her blood cultures growing staph aureus fulfilled the major criteria, and her minor criteria were fevers >38 degrees, chart review revealing a prior echo with evidence of moderate mitral stenosis, vascular phenomenon by having microemboli present in both the brain and lungs, and immunologic phenomenon with a positive RF. Her CSF pleocytosis was thought most likely due to a para-meningeal foci of endocarditis.

Even after being partially treated with antibiotics, CSF findings in bacterial meningitis should reveal markedly elevated WBC count. Thus, alternative explanations such as para-meningeal foci, should be

considered for type "C" CSF findings with a modestly elevated level of WBCs (5-1,000 WBCs). Furthermore, TTE and even TEEs are not 100% sensitive for endocarditis, and definitive diagnosis can be made without ultrasound findings according to modified Duke criteria. Though TEEs are far more sensitive than TTEs, vegetations may be missed if they are too small to be visualized or if they have already dislodged from the valve.

Primary Presenter: **Elizabeth Bloemen**

Project Title: *Lesbian, Gay, Bisexual, and Transgender (LGBT) Older Adults'™ Experiences with Elder Abuse and Neglect*

Primary Mentor: Skotti Church

Thematic Area: Public Health and Epidemiology

Abstract:

**Background/Objectives:** Little is known about elder abuse and neglect among LGBT older adults, but it is likely that this population faces a greater risk of mistreatment, experiences abuse differently, and face challenges in accessing resources. Our goal was to use focus groups to investigate LGBT older adults'™ perspectives on and experience with elder mistreatment, focusing on understanding how medical and service providers can improve outreach to and support for this community.

**Methods:** We conducted 3 focus groups with 26 participants recruited from senior centers which provide services and programs to LGBT elders. We developed a semi-structured questionnaire which was revised iteratively. Focus groups were audio recorded, professionally transcribed, and themes were identified using grounded theory.

**Results:** Participants defined elder abuse in multiple ways including more traditional forms of abuse such as physical and financial abuse, abuse in institutions; as well as abuse from systems, such as by law enforcement, and medical providers. Commonly reported causes of abuse included: social isolation due to discrimination, internalization of stigma due to LGBT identity, intersection of discrimination from multiple minority identities, and an abuser'™s desire for power and control. Participants reported mixed feelings about reporting abuse to the police, however most felt strongly that they would not report abuse to their medical provider. Most participants reported that they would feel compelled to report if they knew someone was being abused, however they did not know who to report to. Strategies participants suggested to improve outreach included: increasing awareness about available resources, researchers engaging with the LGBT community directly, providers interviewing patients alone and believing reports of abuse.

**Conclusion:** LGBT older adults conceptualize elder abuse differently than the general population, and have different experiences with law enforcement and medical providers. Improved outreach to this potentially vulnerable population is critical to ensuring their safety.

Primary Presenter: **Emily Bressan**

Project Title: *Reflective Writing in Medicine*

Primary Mentor: Bethany Kwan

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

#### ABSTRACT

**Objective:** Empathy is a key characteristic for a successful physician that decreases as the medical professional goes through their career. The medical professional must also develop their professional identity, career goal, and cope with stressors during four years of medical school. Reflective writing can be a means for students to navigate their development and use mechanisms of empathy in the process to practice quality patient care and avoid burnout.

**Methods:** Two investigators reviewed students' reflective writing throughout four years of medical school using qualitative analysis, developing codes and themes and identifying how those related to mechanisms of empathy and physician experience.

**Results:** Multiple themes relating to mechanisms of empathy, desensitization, identity, successful and difficult patient encounters, self-perspective, and professionalism emerged from the data.

**Conclusion:** Students who wrote reflectively throughout their medical school career used mechanisms of empathy; cognitive, automatic, personal distress, and counterfactual thinking. This suggests that students may benefit from reflective writing in their curriculum to promote empathy and professional development that will have a positive impact in patient care.

Primary Presenter: **Kyle Buchwalder**

Project Title: *Needs Assessment of a Pediatric HIV Clinic in Guatemala City, Guatemala*

Primary Mentor: Lisa Abuogi

Thematic Area: Global Health

Abstract:

HIV-infected children in Guatemala are a vulnerable group whose care and treatment have not been extensively evaluated. Our team utilized 2016 World Health Organization HIV treatment guidelines and a Kenyan Ministry of Health antiretroviral therapy (ART) decentralization guideline to create a needs assessment survey for use in low and middle-income Latin American countries such as Guatemala. The needs assessment survey created by our team was piloted with the multidisciplinary staff of the Pediatric Infectious Disease Clinic at Hospital Roosevelt in Guatemala City, Guatemala in July of 2016. Responses were compiled to provide an overview of HIV care at the clinic. At the time of survey completion, the Pediatric Infectious Disease Clinic at Hospital Roosevelt served 334 HIV-infected children as well as 147 uninfected children with perinatal exposure. The clinic demonstrated great execution and capacity in areas of Policy (4/5), Human Resource Capability (4/4), Psychosocial Support (4/4), Laboratory and Clinical Monitoring (6/6), Treatment Retention (4/4), and Supply Management (4/4). Areas for improvement included Pediatric ART and Decentralization (9/13), Financial Support (0/2), Data Storage and Analysis (0/3), and Community Involvement (0/3). Based on our results, an adapted needs assessment survey can successfully evaluate the capacity for pediatric HIV care in low and middle-income Latin American countries. In the future, similar needs assessments should be conducted at decentralized clinics to determine additional areas for improvement and collaborative support.

Primary Presenter: **Christine Burton**

Project Title: *Ligation of Common Carotid Artery after Penetrating Neck Trauma*

Primary Mentor: Lauren Steward

Thematic Area: Clinical Science

Abstract:

We present the case of a 32-year-old woman who suffered gunshot wounds to the head and right neck. She had a delayed presentation with neurologic deficits upon arrival. Upon investigation of her right common carotid artery (CCA), she was found to have an intraluminal foreign body with associated thrombus. The decision was made to proceed with CCA ligation, a damage control procedure rarely utilized today due to associated mortality and morbidity. In this report, we describe a patient with penetrating neck and intracranial trauma who underwent a carotid artery ligation with acceptable outcomes.

Primary Presenter: **Jennifer Butler**

Project Title: *Outcomes of Elective Outpatient Hysteroscopic Sterilization in Undocumented Women: A Retrospective Analysis*

Primary Mentor: Kristina Tocce

Thematic Area: Clinical Science

Abstract:

**Objective:** To determine the feasibility of hysteroscopic sterilization in low-income and unauthorized immigrant women when financial barriers to care are removed.

**Methods:** Outpatient hysteroscopic sterilization for low-income women at an urban clinic was made possible by grant funding. All procedures were performed by obstetrician/gynecologist attending physicians or supervised trainees. Electronic records were reviewed for cases performed from June 2010 to December 11, 2013. Outcome incidences and complications were determined. Subgroup analyses using demographic and clinical factors were performed.

**Results:** Hysteroscopic sterilization was attempted in 197 patients. Most were Hispanic (93%) and undocumented immigrants (83%). Bilateral placement was achieved on first attempt in 92% (181/197). Successful placement was ultimately achieved in 96% (190/197), and 88% (168/190) returned for hysterosalpingogram (HSG). Appropriate tubal occlusion was documented on 96% (161/168) of HSGs with mean time of 3.5 +/- 1.3 months. Repeat HSG at 6 months showed 100% occlusion (7/7). Of the initial cohort, 85% (168/197) could ultimately rely on Essure for contraception. One pregnancy was self-reported 9 months after the procedure; the patient had not followed up for HSG. There were no pregnancies among those who completed follow-up. There were no cases of procedural complications. Successful Essure placement was not associated with age, parity, immigration status, or clinical characteristics (analgesics administered, history of cesarean section, vaginal delivery, cervical surgery, ectopic, fibroids, or pelvic inflammatory disease). The only

factor positively associated with HSG follow-up was age 35 years or younger (53% vs. 47%;  $p = 0.03$ ).

**Conclusions:** Successful hysteroscopic sterilization can be achieved in an undocumented, low-income population. Rates of confirmatory HSG follow-up were found to be higher than the general population. Public funding of programs could decrease unintended pregnancies and pregnancy-related costs.

Primary Presenter: **Adlei Carlson**

Project Title: *Benzodiazepine use among US adults, a scoping review*

Primary Mentor: Karsten Bartels

Thematic Area: Clinical Science

Abstract:

Background: According to Lembke et al, increased prescription use of benzodiazepines parallels early patterns of the opioid epidemic [1]. This is concerning, due to the frequency benzodiazepines are used with other medications of abuse [2]. The use of prescription benzodiazepines among chronic opioid users nearly doubles the likelihood of an emergency room visit for unintentional overdose [3]. Concurrent use of benzodiazepines and opioids, defined by at least 7 days of use overlap; remains highest among long-term opioid users, those using opioids for greater than 90 days [4-6]. Recent work by Bartels et al. highlighted exposure to opioids in the perioperative setting served as an initiating event for previously opioid naïve patients to begin chronic opioid therapy [7].

Hypothesis: Within the perioperative setting, initiation of long-term benzodiazepine use among previous non-users is highest among those with a history of long-term (greater than 90-day) opioid use.

Objective: Identify the current state of general benzodiazepine use, concurrent use with opioids, and use within the perioperative setting among US adults.

Methods: Conducted Scoping Review of PubMed literature database to identify studies related to the objective. Utilizing PubMed Mesh terms to identify related studies, separate literature searches were conducted for General Benzodiazepine use, Benzodiazepine use concurrent with opioid use, and Benzodiazepine use within the perioperative setting. The scoping review conducted in accordance with guidelines by Arksey and O'Malley [8]

Results: According to Bachhuber et al, Olfson et al, and Yang et al, benzodiazepine use among US adults is 5.6%, 5.2% and 13.7% for patients filling at least one benzodiazepine prescription. Rates of concurrent use of benzodiazepines and opioids ranged from 80% to 11%.

Conclusion: Our scoping review identified a lack of research surrounding benzodiazepine use within the perioperative period. Additionally, the wide range of reported concurrent use between benzodiazepines and opioids reveals variation in the definition of concurrent use and reporting methods. While rates of benzodiazepine use and concurrent use with opioids remains high, there is limited data on how this affects the surgical patient.

Primary Presenter: **Matthew Cataldo**

Project Title: *Improving Knowledge, Skills, and Attitudes of Future Health Care Professionals Toward Caring for Resource-Limited Patients: Four years of the Poverty Immersion in Colorado Springs (PICOS)*

Primary Mentor: Erik Wallace

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

The Poverty Immersion in Colorado Springs (PICOS) is an experiential immersion program that engages health professional students and community stakeholders to describe and analyze the social determinants of health in the community, demonstrate knowledge and skills while experiencing poverty, identify their own attitudes toward resource-limited people, and recognize the relationship between adverse childhood experiences (ACEs) and health outcomes. Health professional students learn from and care for patients from varied socioeconomic backgrounds. However, most future health professionals may have few personal experiences with poverty. Therefore, students may have difficulty empathizing with and caring for resource-limited patients based on few shared life experiences. Participants were invited to attend lectures, a classroom poverty simulation, an overnight stay at a homeless shelter, and complete experiential case scenarios over two days. In 2018, participants also aided in a foot care clinic and needs assessments for people staying at a homeless shelter. Quantitative pre- and post-test data on PICOS objectives were analyzed by paired t-test. Seventy-nine participants (49 medical students, 18 health sciences graduate students, and 12 community stakeholders) completed PICOS. Knowledge of social determinants of health, ACEs, and skills necessary to obtain and utilize basic resources improved in all 79 participants ( $p < 0.05$ ). Seven of twelve attitude statements toward resource-limited people improved in all 79 participants. Six of twelve attitude statements improved in the 49 medical students ( $p < 0.05$ ). A two-day experiential program focused on poverty can improve the knowledge, skills, and attitudes of health professional students toward patients with limited resources. Results are limited as participants self-selected for the program. Programs like PICOS should solicit participation by additional health professional providers and students in order to better understand and empathize with the resource-limited patients they will serve. The relatively low cost (<\$200 per participant) and continued financial and in-kind contributions to support PICOS from community partners demonstrate feasibility for continuing this program and for developing similar programs with other campuses and communities.

Primary Presenter: **Heather Caulkins**

Project Title: *Ultrasmall Super-Paramagnetic Iron Oxide Nanoparticles to Image Radiation-Induced Inflammation in Tumor-Bearing Mice with Diverse Immune Phenotypes*

Primary Mentor: Natalie Serkova

Thematic Area: Basic Biomedical Science

Abstract:

Many patients experience inflammation after radiation therapy (RT). This study aims to develop quantitative T2-MRI to measure RT-induced inflammation in tumor-bearing mice with varying degrees of immunodeficiency. We hypothesize that macrophage iron metabolism will allow us to assess inflammation using ultra-small superparamagnetic iron oxide nanoparticle (USPION) T2 contrast. NOD.SCID (non-obese diabetic/severe combined immunodeficiency), nu/nu athymic, and wild-type mice (C57BL/65) were implanted with tumor cells in the flank. Quantitative T2-weighted MRI was performed before USPION and 24 hours after USPION. Mice underwent RT of the tumor, followed by MRI. Tumors were harvested for ex vivo correlates. No drop in T2 was seen at baseline in any model except U251 glioblastoma in nu/nu mice. SCID mice failed to accumulate iron. All nu/nu mice xenografts revealed reduced T2 relaxation times after RT. All nu/nu models developed moderate macrophage inflammation and SCID models developed none. Macrophage levels correlated strongly with iron levels. Previously, we have shown that highly inflamed immunocompetent models showed significant drops in T2 after USPION due to macrophage uptake. Here we demonstrate that RT-induced inflammation is absent in SCID mice, and athymic nu/nu mice produce macrophages after RT. SCID mice are inappropriate for studying inflammatory microenvironments of cancer.

Primary Presenter: **Olivia Charlier**

Project Title: *Engaging Teens in Weight Management Conversations*

Primary Mentor: Janet Meredith

Thematic Area: Clinical Science

Abstract:

Background: In Aurora, CO, childhood obesity rates are higher (36-41%) than both Colorado (21.9%) and national (30%) averages.<sup>1</sup> To address this disparity, we conducted a community-based participatory research project to explore and compare the perspectives of teenage patients and healthcare providers about interactions regarding obesity and weight-related issues. Methods: Teenagers (n=47) participated in gender-separated focus groups about weight-related conversations with providers. Sessions were recorded and transcribed. Data were analyzed by open coding. A subsequent survey investigated providers' perspectives on weight management conversations with teens. Local teenagers formed an advisory board and were actively involved throughout the project. Results: From focus groups, four themes arose: (1) get to know the teen before talking about weight and then avoid using Body Mass Index (BMI) to start this conversation; (2) ask about the teen's motivations in health; (3) provide specific, personalized goals; and (4) include frequent follow-up and encouragement. Meanwhile, provider survey findings included that most providers: (1) were comfortable starting the weight management conversation; (2) used BMI to open the conversation; (3) felt ineffective in achieving positive weight change; and (4) saw a need to improve communication. Conclusion: A teen-approved methodology for weight management counseling can inform providers on how to better approach these conversations.

Primary Presenter: **Alexander Clinkenbeard**

Project Title: *Genetics in Prostate Cancer: Current Understanding of Germ Line Mutations and Future Implications*

Primary Mentor: Salvatore Catariniccia

Thematic Area: Clinical Science

Abstract:

Germ line associated prostate cancers are a rare entity, but have powerful implications in terms of screening and targeted treatment options. Here, we assess the genetics of germ line prostate cancer, as well as specific genes associated with prostate cancer. We also discuss potential screening tests that can be used in practice. We discuss future aims and implications for research associated with germ line prostate cancer.

Primary Presenter: **Meryl Colton**

Project Title: *Assessing Bias in Problem-Based Learning Curriculum Through a Community Lens*

Primary Mentor: Rita Lee

Thematic Area: Public Health and Epidemiology

Abstract:

**Background:** Identity-based bias in medical education contributes to discrimination in healthcare and health inequities. Community and Students Together Against Healthcare Racism (C-STAHR) was developed in 2010 to combat healthcare racism using community-based participatory research. The aim of this analysis was to evaluate the problem-based learning (PBL) curriculum at a US medical school for identity-based bias through a community lens.

**Methods:** Evaluation tool developed from prior C-STAHR focus group data and Sadker Foundation's Seven Forms of Bias. Community participants were recruited via snowball sampling. Participants evaluated PBL cases through a quantitative survey and a qualitative discussion. Survey responses assigned value based on ideal answer (0=least bias, 3=most bias). Questions were summed and divided by total possible points to create a percentage referred to as the Bias Score. Bias Scores corresponding to a particular case were averaged. Multivariate mixed effects linear regression model used to associate patient-character identity with Bias Score. Three evaluators (two per transcript) coded transcripts via initial codebook developed from data and iterative code generation. Thematic model developed from emergent themes.

**Results:** Six focus groups with a total of 41 participants were recruited. Each focus group evaluated five of 15 unique cases—each case was reviewed by two focus groups. The average case Bias Score was 40% (sd: 20%). In multivariate mixed effects linear regression models, Latinx and transgender-man identities resulted in the largest increase in Bias Score [9.1% (p-value=0.047) and 11.4% (p-value=0.069), respectively]. Emergent themes from community participants include: discriminatory care, assumptions based on identity, and missed opportunities to address important patient needs.

**Conclusion:** Community members may be valuable assets to identify identity-based bias in medical school curriculum. PBL cases included incidences of identity-based bias that may perpetuate harmful stereotypes and implicit bias of future physicians. These findings represent a larger need to evaluate and address issues around bias and representation in medical education curricula.

Primary Presenter: **Jess Coulter**

Project Title: *The Youth Community Health Awareness Partnership: A community-based initiative to address problematic alcohol use within the community of refugees from Burma*

Primary Mentor: Janet Meredith

Thematic Area: Public Health and Epidemiology

Abstract:

**BACKGROUND:** Since the installation of a military junta in 1962, minorities in Burma have fled their homeland to escape killings, torture, rape, landmines and forced labor. Many settle in East Denver and Aurora where they struggle to adjust to life in a foreign culture. Personal and community health are crucial priorities to address with refugees that must face the complexity of the American healthcare system during transition.

**METHODS:** Beginning with the work completed by Hoerauf, Holtstaul, and Ovrutsky (CUSOM Class of 2017), we developed a multi-phase community based participatory research (CBPR) project in collaboration with the refugee community from Burma residing in Aurora/Denver. Phase 1, Community Assessment and Issue Identification, involved solidifying a community partnership, identifying priority health issues, and conducting a formative needs assessment. Monthly meetings with the Youth Advisory Board (YAB), a group of young adults and teenagers from Burma, have guided this project. The YAB selected risky alcohol use as the priority health issue facing their community. The project is currently in Phase 2, Intervention Mapping, which involves conducting a formal, publishable needs assessment. We will be conducting semi-structured interviews of roughly 30 community members. Participants will be recruited using a snowball sampling technique, and interviews will be conducted by one medical student and one translator (a community member that has gone through training). The interview data will be analyzed using Immersion Crystallization methodology i.e. inductive category development. Phase 3, Intervention Development and Evaluation, will consist of using the information gathered in Phase 1 and 2 to create, implement and evaluate a sustainable, culturally appropriate intervention to address risky alcohol use in this disadvantaged community.

**RESULTS:** To date, we have held 24 meetings with the YAB and over 20 meetings with local organizations. 19 formative community surveys were collected and 3 key informant interviews were held. Formal interviews for needs assessment are currently being conducted; with 4 completed to date. Initial results point to the vulnerability of the refugee population, the scarcity of culturally appropriate resources for alcohol abuse, and the urgency of addressing problematic alcohol use.

**CONCLUSIONS:** This project has already made significant progress in developing meaningful relationships with members of a local community that is incredibly underserved. Challenges faced include intense time commitment, multiple submissions for IRB approval in order to best acquire

information from a unique community that communicates in person and with trusted individuals. Because of the equal partnership model of CBPR and the investment made on both ends, this partnership will result in a sustainable, longitudinal project that will affect meaningful and culturally effective change for the refugee community from Burma.

Primary Presenter: **Ross Crandall**

Project Title: *Assessing Acceptability of Acceptance and Commitment Therapy Methods in Diabetes-Related Distress*

Primary Mentor: Bethany Kwan

Thematic Area: Clinical Science

Abstract:

**Background:** Diabetes distress is a clinically relevant behavioral health consequence of living with diabetes, and it is associated with adverse health outcomes related to diabetes. Research has demonstrated that certain mindfulness practices can help mitigate diabetes distress and improve A1c. Mobile app technology is also showing promise as a means of facilitating self-care behaviors for patients with diabetes and other chronic diseases. It is currently unclear how acceptable a mindfulness practice aimed at mitigating diabetes distress would be for a patient population with diabetes, and it is unclear how autonomy support and dissemination method (mobile app vs. in-person) influence this acceptability.

**Methods:** This is a randomized experiment in which participants with diabetes and smartphones are given a survey containing vignettes about how a mindfulness practice would be utilized to alleviate diabetes distress. Participants are randomized to autonomy-supported or non-supported surveys and are asked to indicate Likert-like acceptability of a mobile app and in-person therapy. Diabetes distress and background characteristic data are also collected. T-statistics are used to compare acceptability against each variable.

**Results:** Thirty-eight participants (n=38) completed acceptability assessments of each vignette, and thirty-six of those (n=36) completed the entire survey. This is less than half of the recruitment goal of 100. Twenty-three were randomized to no autonomy support (n=23), and fifteen were randomized to autonomy support (n=15). In this interim analysis, there was a statistically significant correlation between acceptability - irrespective of dissemination method - and severe diabetes distress (non-severe distress acceptance mean 2.78, SD 1.39; severe distress acceptance mean 3.83, SD 1.24;  $p < 0.05$ ). Any correlations between acceptability and autonomy support or dissemination method could not be made with statistical significance in the interim.

**Conclusion:** There appears to be a correlation between severe diabetes distress and acceptability of mindfulness. In this interim analysis, it is too early to come to any other conclusions regarding influence of autonomy support and dissemination method on mindfulness modality acceptability.

Primary Presenter: **Kelly Crane**

Project Title: *Adenine Dose Study Modeling Chronic Kidney Disease for One Month in Older Male and Female BALB/c Mice*

Primary Mentor: Karen King

Thematic Area: Basic Biomedical Science

Abstract:

**Purpose:** Chronic kidney disease (CKD) alters mineral metabolism (mineral loss in bone but gain in cardiovascular and renal tissues) and may cause early death. Our target patient population is the mature adult; therefore, we desire a method suitable for modeling CKD in older mice. Bone changes occur slowly; therefore, we desire a model in which animal survival is robust despite renal damage. Adenine added to the mouse diet precipitates in the kidney which induces damage. This method has been successfully used to model CKD in younger mice. However, it has never been applied to older mice. This preliminary study tests different doses of adenine in the diet, given over a one-month period, in older male and female mice.

**Methods:** Male and female BALB/c mice were obtained from the NIH/NIA aged rodent colony at 24 weeks of age (analogous to ~30 year-old humans). All animals received the base casein diet for the first seven days. Then, four different doses of adenine (in the casein diet) were administered in a 7-day induction phase followed by a 21-day maintenance phase. The four doses were 0.30% induction / 0.20% maintenance; 0.30% / 0.15%; 0.20% / 0.15%; and 0.20% / 0.10%. Control was the base casein diet. Mice were individually housed (N = 10 total, 1 mouse/sex/diet). Body masses were measured three times per week until death or euthanasia due to low body mass. Kidneys were sectioned at 5  $\mu$ m and analyzed via H&E, PAS, and von Kossa staining.

**Results:** All adenine treated mice lost body mass (>30%) and most died before the study ended at 35 days. Females died faster than the dose-matched males. Even the lowest dose of adenine led to abnormal kidney histology (Figure 1). Alterations included dilated tubules and Bowman's spaces, peritubular leukocytes, thickening and atrophy of tubular basement membranes, and mineralization of tubular structures. Control mice did not lose body mass and had normal appearing kidney histology.

**Conclusions:** Adenine can be used to create a model of CKD - induced through tubulointerstitial nephropathy - in older mice; however, a low dose of adenine should be used. A low dose of 0.2% adenine for seven days followed by 0.1% adenine for 21 days is sufficient to model CKD but may result in early death.

Primary Presenter: **sierra crowe**

Project Title: *A Meta-Analysis of the Effects of Female Genital Mutilation of Sexual Function Using the Female Sexual Function Index*

Primary Mentor: gretchen heinrichs

Thematic Area: Global Health

Abstract:

**Background:** Female genital mutilation/cutting is a cultural practice prevalent in many countries that causes numerous adverse health effects. However, its effects on sexual function are not fully understood. The purpose of this paper is to determine how sexual function is affected by FGM/C.

**Design:** A meta-analysis to determine if sexual function is impacted by FGM/C.

**Methods:** Articles were found on PubMed, EMBASE, Google Scholar, MEDLINE, Cochrane, Scotus, PsychINFO, and CINAHL. Data was extracted and imported to Excel from all articles reporting FSFI scores for cut and uncut women. Statistical analysis and modeling was performed using RStudio v1.1.453.

**Results:** Total FSFI score for cut women score is 5.61 points lower than uncut women, and scores for all subdomains are significantly lower for cut women. Type 1, 2, and 3 women score 4.36, 9.39, and 7.74 points lower than cut, respectively.

**Conclusion:** This meta-analysis provides evidence that sexual function is diminished by FGM/C. Sexual health is a critical component of overall health and well-being, and a multi-faceted approach including social, cultural, and governmental action must be taken in order to address FGM/C.

Primary Presenter: **Nathan Cutshall**

Project Title: *“It makes people uneasy, but it's necessary. #BTSM” Using Twitter to Explore Advance Care Planning Among Brain Tumor Stakeholders*

Primary Mentor: Hillary Lum

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

Abstract

**Background:** Advance care planning (ACP) often occurs too late in the disease course of patients and stakeholders affected by brain tumors. Furthermore, the perspectives of brain tumor stakeholders on ACP are not well described. This study uses a social media tweet chat to understand perspectives on ACP among brain tumor stakeholders.

**Methods:** This qualitative descriptive study analyzed a tweet chat (real-time virtual discussion) of brain tumor stakeholders. The 1-hour tweet chat was hosted by) #BTSM (Brain Tumor Social Media), a patient-run Twitter community, in January 2018. Participants reflected on four discussion questions about ACP by including #BTSM in tweets. Unique tweets and stakeholder type (i.e. patient, caregiver, advocate or organization member, clinical provider and researcher, leader) were coded. The tweet chat was qualitatively analyzed to identify key themes.

**Results:** 52 participants from 4 countries contributed 336 unique Tweets. Most participants were patients (people with brain tumors), followed by clinical providers or researchers, and advocates or organizations. There were four key themes regarding brain tumor stakeholder perspectives about ACP: 1) cultural barriers prevent discussions of death; 2) ensuring one's voice is heard; 3) Goldilocks approach to timing “fearing ACP is too early or too late; and 4) crowdsourcing resources for ACP.

**Conclusions:** Stakeholders in the care of people with brain tumors engaged in ACP discussions via a social media tweet chat and highlighted important challenges and opportunities. Social media is a new avenue in which clinicians and patients may engage with each other to better understand each other's perspectives related to ACP.

Primary Presenter: **Andrew Dabasinskas**

Project Title: *Rate Control Versus Rhythm Control in Adult Patients with Chronic Atrial Fibrillation;*

*a Literature Review*

Primary Mentor: Natasha Altman

Thematic Area: Clinical Science

Abstract:

Abstract

As the population ages, atrial fibrillation is becoming more prevalent and is associated with significant morbidity, mortality, and healthcare costs. Typical treatment involves some combination of electroconversion, ablation, and/or pharmacological treatment achieving rate control or rhythm control. In patients with chronic atrial fibrillation, pharmacological rate control is hypothesized to reduce mortality to a greater extent than pharmacological rhythm control. A literature review was completed to compare outcomes between rate-controlled patients and rhythm-controlled patients within the same study. Twelve studies were analyzed that compared rate control to rhythm control. Due to the variety of study outcomes and comorbid cardiovascular conditions, comparisons between studies is limited at best. With limited evidence, rhythm control may be more beneficial for patients with comorbid rheumatic heart disease, comorbid nonischemic heart disease, paroxysmal atrial fibrillation, comorbid normotensive patients, and increasing exercise tolerance. With few research studies, pacing control may be beneficial for patients with overall cardiac comorbidities and reducing hospitalization.

Primary Presenter: **Alexander Dang**

Project Title: *Engaging Teens in Weight Management Conversations*

Primary Mentor: Janet Meredith

Thematic Area: Clinical Science

Abstract:

Background: In Aurora, CO, childhood obesity rates are higher (36-41%) than both Colorado (21.9%) and national (30%) averages.<sup>1</sup> To address this disparity, we conducted a community-based participatory research project to explore and compare the perspectives of teenage patients and healthcare providers about interactions regarding obesity and weight-related issues. Methods: Teenagers (n=47) participated in gender-separated focus groups about weight-related conversations with providers. Sessions were recorded and transcribed. Data were analyzed by open coding. A subsequent survey investigated providers' perspectives on weight management conversations with teens. Local teenagers formed an advisory board and were actively involved throughout the project. Results: From focus groups, four themes arose: (1) get to know the teen before talking about weight and then avoid using Body Mass Index (BMI) to start this conversation; (2) ask about the teen's motivations in health; (3) provide specific, personalized goals; and (4) include frequent follow-up and encouragement. Meanwhile, provider survey findings included that most providers: (1) were comfortable starting the weight management conversation; (2) used BMI to open the conversation; (3) felt ineffective in achieving positive weight change; and (4) saw a need to improve communication. Conclusion: A teen-approved methodology for weight management counseling can inform providers on how to better approach these conversations.

Primary Presenter: **Laurel Dang**

Project Title: *Nasogastric Tube Feeding in Adolescent Patients*

*Hospitalized for Various Eating Disorders*

Primary Mentor: Jennifer Hagman

Thematic Area: Clinical Science

Abstract:

Nasogastric (NG) tube feeding is a commonly employed, safe technique to aid in weight gain in patients hospitalized for eating disorders. Currently, NG tube placement is commonly used after oral refeeding therapy has failed in this patient population. While previous studies have demonstrated that early, routine placement of NG tubes may be more effective for better weight gain and improved psychiatric outcomes, little current evidence exists for their routine use in adolescent in-patient populations. Furthermore, most of these studies have only focused on anorexia nervosa. This is an ongoing, retrospective study analyzing the efficacy of NG tube feeding in the specialized eating disorder unit (EDU) at Children's Hospital Colorado amongst adolescent patients with various eating disorders. Primary outcomes include rate of weight gain, days of hospitalization, and rate of readmission to the EDU. This paper outlines the hypothesis and aims, background literature, and research design of this study. The study group is currently preparing to submit the protocol to the Colorado Institutional Review Board (COMIRB).

Primary Presenter: **Ryan Davenport**

Project Title: *Effects of calcaneal lengthening osteotomy on foot progression angle in children with cerebral palsy*

Primary Mentor: Jason Rhodes

Thematic Area: Clinical Science

Abstract:

### Background

The success of calcaneal lengthening osteotomy in treating pes planovalgus deformities in children with cerebral palsy (CP) has been clearly demonstrated using clinical observation, radiographic, and foot pressure data. An improvement in foot progression angle (FPA) has not been examined. Knowledge of a transverse plane rotational impact following calcaneal lengthening osteotomy would aid planning during more proximal transverse plane rotations of the lower extremity during single event multi-level surgeries (SEMLS).

### Research Question

We look at FPA as an indicator for rotational correction of pes planovalgus deformity following calcaneal lengthening osteotomy. The calcaneal lengthening osteotomy procedure includes an opening wedge in the lateral column of the calcaneus, thus we hypothesize that FPA will be internally rotated due to the location of the wedge placement.

### Methods

We retrospectively analyzed pelvis, hip, knee, ankle and FPA transverse plane rotations from gait analyses before and after calcaneal lengthening osteotomy from a sample of 24 feet in 15 patients (median age of 8 years, range 6-12) with spastic cerebral palsy. Preoperative and postoperative values were compared directly to one another and preoperative difference from normal was compared to postoperative difference from normal. The normal values for pelvis, hip, knee, ankle and FPA transverse plane rotations were  $0.3^{\circ}$ ,  $3.2^{\circ}$ ,  $-0.3^{\circ}$ ,  $0.8^{\circ}$ , and  $-5.9^{\circ}$ , respectively with negative values indicating external rotation. The normal values were determined from age-specific data collected through our gait laboratory.

### Results

The mean difference of preoperative to postoperative ankle rotation was  $-5.1^{\circ}$  which was significantly different from 0;  $p=0.04$ . There were no statistically significant differences for comparing preoperative to postoperative pelvic, hip, knee or FPA values. Additionally, there were no statistically significant differences for pelvic, hip, knee, ankle or FPA values when compared to normal values.

### Significance

Foot progression angle is the visible result of the torsional profile of the lower extremity, encompassing transverse rotations at multiple levels. In children with CP, lever arm dysfunction may cause rotational abnormalities at multiple levels. As SEMLS have become standard of care in children with CP, it is

important to understand how multi-level procedures interact to address transverse plane abnormalities. The results of this study suggest transverse plane rotations are not changed by calcaneal lengthening osteotomy and thus should not be considered in planning rotations in SEMLS cases. Weakness of this study include the retrospective nature, small sample size, and variance in time between gait studies.

Primary Presenter: **Carl Dernell**

Project Title: *NEEDS ASSESSMENT OF THE UNIVERSITY OF COLORADO SCHOOL OF MEDICINE UNDERGRADUATE MEDICAL EDUCATION€™S HEALTH SYSTEMS AND FINANCE CURRICULUM*

Primary Mentor: Rita Lee

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

Healthcare delivery in the United States is rapidly changing both in terms of infrastructure and implementation. 21st century physicians must understand the evolving healthcare systems in which they work if they are to maximize their efficacy as well as advocate for patient safety and health equity.

The overwhelming majority of Undergraduate medical school curricula contain required topics in the curricular domain often referred to as Health Systems Science in general, as well as specific topics regarding healthcare systems and finance. Despite this coverage, students at the University of Colorado School of Medicine (CUSOM) report low degrees of confidence in topics within the domain of Health Systems Science (HSS), including healthcare systems and finance.

We hypothesize that the CUSOM stands to improve in its curricular content concerning HSS in general, and in healthcare economics and finance in particular. We also hypothesize other US medical schools currently contain curricula that can provide a practical model on which to base future curricular reform.

Our literature review, MedEdPortal and iCOLLABORATIVE searches and results of our focused and structured interviews with other US medical schools suggest that the CUSOM successfully follows the recommendations of the ACGME to provide curricular content in HSS and therein does provide adequate curricular content specifically in healthcare economics and finance. Our results also more clearly demonstrate what is considered "best practice" regarding curricular coverage of HSS topics in general. We suggest that though the CUSOM is performing adequately, curriculum in these areas do stand to greatly improve by implementation of a two-fold strategy both for immediate and sustained benefit.

Primary Presenter: **Matthew Dillon**

Project Title: *Diamond Blackfan Anemia: Successful Approach to Allogeneic Hematopoietic Stem Cell Transplant Using Unrelated Cord Blood and Other Donor Sources*

Primary Mentor: Rodger Giller

Thematic Area: Basic Biomedical Science

Abstract:

Many patients suffering from the genetic condition Diamond Blackfan Anemia are chronically treated with steroids, blood-transfusions, or a combination. Currently, the only definitive therapy is transplant. Allogeneic hematopoietic stem cell transplant (HSCT) has been used successfully as curative therapy in steroid-refractory or transfusion-dependent patients with Diamond Blackfan Anemia (DBA). Unrelated umbilical cord blood (UCB)-HSCT using myeloablative cyclophosphamide-based conditioning has historically resulted in poor outcomes with high graft rejection and mortality rates. However, reduced toxicity preparative regimens used in bone marrow transplants are becoming more widely used. Despite this increased frequency, there remains a paucity of data looking at this specific method's use in DBA patients.

It was observed that the transplant regimen used at Children's Hospital Colorado has resulted in no mortality in patients transplanted for DBA. We present the outcomes of our single-institution experience with allogeneic HSCT in seven patients with DBA using a consistent myeloablative, reduced toxicity preparative regimen across several donor types, including UCB.

Primary Presenter: **Ding Ding**

Project Title: *Association Between Lymph Node Ratio and Recurrence and Survival Outcomes in Patients With Oral Cavity Cancer*

Primary Mentor: Sana Karam

Thematic Area: Clinical Science

Abstract:

Abstract

**Importance** Oral cavity squamous cell carcinoma (OCSCC) is associated with often-delayed clinical diagnosis, poor prognosis, and expensive therapeutic approaches. Prognostic accuracy is important in improving treatment outcomes of patients with this disease.

**Objectives** To assess lymph node ratio (LNR) and other factors in estimating response to treatment and provide prognostic information helpful for clinical decision making.

**Design, Setting, and Participants** A retrospective cohort study was conducted from January 1, 2000, to December 31, 2015, at an academic hospital in Denver, Colorado. Participants included 149 patients with primary OCSCC who received curative-intent surgery and/or postoperative adjuvant therapies. Analysis was performed from December 8, 2017, to August 15, 2018.

**Main Outcomes and Measures** Overall survival (OS), disease-free survival (DFS), locoregional disease-free survival (LRDFS), and distant metastasis-free survival (DMDFS) adjusted for known prognostic risk factors, as well as correlation of LNR with other histopathologic prognostic factors.

**Results** Of the 149 patients included in analysis, 105 were men (70.5%); the median age at diagnosis was 59 years (range, 28-88 years). Using the Kaplan-Meier method, the 5-year survival estimates for OS rate was 40.4% (95% CI, 31.3%-49.3%); DFS, 48.6% (95% CI, 38.6%-58.0%); LRDFS, 57.7% (95% CI, 46.6%-67.2%); and DMDFS, 74.7% (95% CI, 65.1%-82.0%). The median follow-up was 20 months for all patients and 34.5 months (range, 0-137 months) for surviving patients. Nonwhite race (hazard ratio [HR], 2.15; 95% CI, 1.22-3.81), T3-T4 category (HR, 1.99; 95% CI, 1.18-3.35), and LNR greater than 10% (HR, 2.71; 95% CI, 1.39-5.27) were associated with poorer OS. Nonwhite patients also had higher risk of locoregional failures (HR, 2.47; 95% CI, 1.28-4.79), whereas women were more likely to have distant metastasis (HR, 2.55; 95% CI, 1.14-5.71). Floor-of-mouth subsite had fewer locoregional recurrences than did other subsites (HR, 0.45, 95% CI, 0.21-0.99). An LNR greater than 10% independently was associated with worse OS (HR, 2.71; 95% CI, 1.39-5.27), DFS (HR, 2.48; 95% CI, 1.18-5.22), and DMDFS (HR, 6.05; 95% CI, 1.54-23.71). The LNR was associated with N-stage (Cramer V, 0.69; 95% CI, 0.58-0.78), extracapsular extension (Cramer V, 0.55; 95% CI, 0.44-0.66), lymphovascular invasion (Cramer V, 0.46; 95% CI, 0.27-0.61); number of excised lymph nodes (Cramer V, 0.24; 95% CI, 0.06-0.37), margin (Cramer V, 0.22; 95% CI, 0.05-0.38), and tumor thickness combined with depth of invasion (Cramer V, 0.25; 95% CI, 0.05-0.38).

**Conclusions and Relevance** Locoregional treatment failure remained the predominant pattern of failure. An advanced pathologic stage and nonwhite race were found to be associated with worse outcomes.

The findings from this study suggest that LNR is the most robust prognostic factor and appears to have implications for risk stratification in this disease.

Primary Presenter: **Michael Dittmar**

Project Title: *Needs Assessment of the University of Colorado School of Medicine Undergraduate Medical Education's Health Systems and Finance Curriculum*

Primary Mentor: Rita Lee

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

Healthcare delivery in the United States is rapidly changing both in terms of infrastructure and implementation. 21st century physicians must understand the evolving healthcare systems in which they work if they are to maximize their efficacy as well as advocate for patient safety and health equity.

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Primary Presenter: **Sara Dryden**

Project Title: *CRISIS PLAN DEVELOPMENT FOR FAMILIES WITH CHILDREN WITH CO-OCCURRING INTELLECTUAL/DEVELOPMENTAL DISABILITY AND MENTAL HEALTH DIAGNOSIS.*

Primary Mentor: Cordelia Rosenberg

Thematic Area: Clinical Science

Abstract:

Previous research has demonstrated that patients with co-occurring intellectual/developmental disability and mental health diagnosis (known as dual-diagnosed, or DD) are more likely to have behavioral problems, including aggression. These behavioral problems often result in emergency room visits where many families do not feel their needs are met. Studies of families with concrete plans for mental health crisis show an increased ability of the family to de-escalate a crisis and a decreased likelihood of emergency room visits. A survey of families in Colorado with children who have co-occurring intellectual/developmental disability and mental health diagnosis revealed that less than 50% had such a crisis plan in place. The goal of this project was to create a written crisis plan template specific to the DD population.

In order to develop this tool, we used online research to review currently available crisis plans, listened to previously recorded interviews with family members, and met with multiple families of DD individuals, mental and behavioral health providers, and members of a variety of community mental and behavioral health resources.

Through our research we identified several features necessary for a successful crisis plan and developed a crisis plan template. It includes four sections: a quick hand-off form, a pre-work section, a step-by-step crisis plan with available crisis resources, and a reflection. We believe because this crisis plan considers both the patient's intellectual/developmental disability as well as their mental health diagnoses, it will be effective in decreasing occurrences of crises, crisis severity and emergency service utilization.

Primary Presenter: **Paul Eigenberger**

Project Title: *Co-Production in Undergraduate Medical Education*

Primary Mentor: Steven Lowenstein

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

Background: A co-production paradigm of healthcare services has become increasingly popular in the United States and in Europe. Applying the same principles to health professions education it is possible to alter the traditional hierarchical relationship between faculty member and trainee. Co-produced curriculums may offer students a more engaged and fulfilling role in their educational experience which may translate to increased future career satisfaction. A project to implement a novel co-produced curriculum was undertaken within a pre-existing interdisciplinary extracurricular track at the University of Colorado Anschutz Medical Campus. The co-produced curricular content was focused on the care of urban underserved patient populations. Methods: A curriculum steering committee (CSC) was formed by a cohort of interdisciplinary students from within the Urban Underserved Track (UUT) along with core faculty mentors. To solicit student input for curriculum design, a survey was deployed to students who had previously completed one curricular year within the UUT. Feedback from this survey was used to guide curriculum design, and an updated curriculum was developed by the CSC student cohort with close faculty oversight. The co-produced curriculum was implemented starting in the 2016-2017 academic year. Following implementation, post-session and end-of-year surveys were collected to evaluate student perception and subjective effectivity of curricular changes. To create a sustainable model of curriculum coproduction, the cohort of students within the CSC transitioned their leadership roles to a new cohort of students from the year behind. 3 Results: Pre-curricular reform surveys consisted of 244 total responses, while post-curricular reform surveys consisted of 514 total responses. The rating of blocks when normalized according to the differing pre and post-reform sample sizes showed a significantly higher aggregate score for active sessions compared to didactic sessions when averaged over all survey questions (4.59 vs 4.41,  $p=0.033$ ). The first two cohorts responded favorably to the post-reform curriculum (77% favorable vs 23% indifferent) and to the co-production approach (79% favorable vs 14% indifferent vs 7% unfavorable). The third cohort also responded favorably to this methodology (73% vs 19% vs 7%). This cohort was overall satisfied with their UUT experience (61% very satisfied, 35% satisfied, 4% not satisfied). These students also overwhelmingly indicated that their UUT experience thus far has increased their interest in caring for underserved populations (85% increased interest vs 15% no impact vs 0% reduced interest). Discussion: The UUT was an ideal platform for implementing co-production because of self-selected students motivated to develop curricula, and integration with multiple health professionals, patients, and community members. The lack of institutional assessments also promoted an openness towards active and service learning. The co-production model improved the overall quality of the curriculum while promoting self-directed lifelong learning and a propensity towards academic medicine for participating students. Conclusion: 4 Preliminary findings suggest co-production can be an effective approach to curriculum development in undergraduate medical education.

Primary Presenter: **Luis Escobedo**

Project Title: *Community Partnering Against Racial Disparities in Infant Mortality*

Primary Mentor: Janet Meredith

Thematic Area: Public Health and Epidemiology

Abstract:

**Objectives:** The infant mortality rate in the United States is significantly higher among infants born to African American women than infants born to women of other races regardless of educational attainment or socioeconomic status. The purposes of this study were to understand conditions that lead to disparities and to outline best practices for addressing disparities through community perspective.

**Methods:** Researchers conducted 6 focus groups with African American women (n=27) in Denver, CO ranging from 18-80 years old. Women were included if they self-identified as African American and had been pregnant to 20+ weeks at least once. Researchers transcribed and coded the focus groups to perform inductive thematic analysis looking at themes surrounding prenatal care, birth experience, and the interaction between race and health.

**Results:** Major themes included barriers to quality prenatal care, barriers to social and emotional support, and discomfort with healthcare providers during pregnancy. Women perceived that healthcare professionals provided substandard care based on assumptions of marital status, insurance status, and education level. They also felt that they received conflicting advice from family and healthcare providers, and feared that asking questions of their providers would lead to loss of autonomy in decision-making.

**Conclusions for Practice:** The quality of prenatal care that women receive is affected by relationships with their healthcare providers and sense of autonomy and support in decision-making. To improve care and decrease chronic stress for African American women, both racism and implicit bias in the healthcare setting must be recognized and effectively addressed.

Significance

What is already known on this subject? Previous research demonstrates that the racial disparity in infant mortality is only partially explained by socioeconomic status and education. Racism and implicit bias have been proposed to independently impact outcomes.

What this study adds? This study provides community perspective on effects of racism and bias in healthcare. Community members suggest the need for provider understanding of implicit bias and culturally sensitive communication when engaging the African American community while providing upstream pre-conceptive counseling for women of reproductive age. This will only come if the affected population is continually engaged in crucial conversations.

Primary Presenter: **Robert Fineberg**

Project Title: *Population-Based Analysis of Demographic and Socioeconomic Disparities in Pediatric CNS Tumor Survival in the United States*

Primary Mentor: Adam Green

Thematic Area: Public Health and Epidemiology

Abstract:

**BACKGROUND:** Previous studies have demonstrated effects of racial and socioeconomic factors on survival of adults with cancer. While less studied in the pediatric population, data exist demonstrating disparities of care and survival in pediatric oncology patients based on socioeconomic and racial/ethnic factors. Brain cancers recently overtook leukemia as the number one cause of childhood cancer fatalities, but demographic and socioeconomic disparities in these tumors have not been adequately studied. **METHODS:** Data were obtained from the SEER Program of the National Cancer Institute (NCI). We selected patients under 19 years of age with central nervous system (CNS) tumors with malignant behavior, diagnosed between 2000 and 2013. We included patient demographics, tumor characteristics, treatment, and socioeconomic characteristics as covariates in the analysis. We measured overall survival and extent of disease at diagnosis. **RESULTS AND CONCLUSIONS:** Our findings on extent of disease at diagnosis suggest that neither Black race nor Hispanic ethnicity increased the chance of metastatic disease at presentation. However, we saw that Black and Hispanic patients with both metastatic and localized disease at diagnosis had clinically meaningful differences in survival likelihood compared to their White, non-Hispanic counterparts. These data suggest that racial and ethnic disparities appear to arise post-diagnosis, potentially due to the lack of access to high quality care, leading to poorer overall outcomes.

Primary Presenter: **Matthew Fioravanti**

Project Title: *An examination of humanitarian Aid coordination in Nicaragua among members of a novel online networking platform*

Primary Mentor: Jennifer Bellows

Thematic Area: Global Health

Abstract:

Within the realm of humanitarian organizations, it has been largely described that the path towards more effective and efficient aid programming lies not in proliferation of programming itself, but rather in increased collaboration between aid entities. Additionally, it has been observed that poorly coordinated humanitarian efforts within the same recipient market can cause measurable harm to the societies that they aim to serve. However, despite multiple well-organized global calls-to-action for increased collaboration within the international development community, relatively little change has been observed over time. Etiologies for the lack of coordination efforts range from political, to financial, to a general lack of awareness of other organizations, and much more. The utilization of internet-based networking platforms within the international development community is a relatively novel concept as internet access across the globe, though expanding rapidly, is far from comprehensive. In the past decade, however, access to high-speed internet within the country of Nicaragua, one of the largest per-capita recipients of aid in the Western hemisphere, has expanded measurably. This increased internet access prompted the development and launch in 2015 of the Nicaragua Non-Profit Network (NNN) website, which is a Nicaragua-specific internet-based networking platform serving the Nicaraguan nongovernmental organization (NGO) community with the aim of improving the overall coordination of aid programming. In an effort to assess the effects of such an online networking platform on NGO collaboration in Nicaragua, we conducted an annual survey of website member-NGOs. The survey was distributed annually over three years from 2016-2018. The 91 completed surveys show a strong belief ( $P < 0.001$ ) that an online networking platform such as the NNN is needed in Nicaragua among respondent members. Additionally, there is a statistically significant trend towards organizations with an annual budget larger than \$500,000 and organizations that have operated in Nicaragua longer than 10 years having more frequent communication habits suggesting that easy accessibility to online networking may preferentially benefit smaller and newer organizations. While data was not significant, there was a trend towards respondents who operate in Nicaraguan healthcare delivery observing overlap of health care services between the various providers of healthcare programming. An observation that has serious biological, ethical, and general safety implications.

Primary Presenter: **Nathan Fischer**

Project Title: *Co-Production in Undergraduate Medical Education*

Primary Mentor: Steven Lowenstein

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

Abstract

Background:

A co-production paradigm of healthcare services has become increasingly popular in the United States and in Europe. Applying the same principles to health professions education it is possible to alter the traditional hierarchical relationship between faculty member and trainee. Co-produced curriculums may offer students a more engaged and fulfilling role in their educational experience which may translate to increased future career satisfaction. A project to implement a novel co-produced curriculum was undertaken within a pre-existing interdisciplinary extracurricular track at the University of Colorado Anschutz Medical Campus. The co-produced curricular content was focused on the care of urban underserved patient populations.

Methods:

A curriculum steering committee (CSC) was formed by a cohort of interdisciplinary students from within the Urban Underserved Track (UUT) along with core faculty mentors. To solicit student input for curriculum design, a survey was deployed to students who had previously completed one curricular year within the UUT. Feedback from this survey was used to guide curriculum design, and an updated curriculum was developed by the CSC student cohort with close faculty oversight. The co-produced curriculum was implemented starting in the 2016-2017 academic year. Following implementation, post-session and end-of-year surveys were collected to evaluate student perception and subjective effectivity of curricular changes. To create a sustainable model of curriculum coproduction, the cohort of students within the CSC transitioned their leadership roles to a new cohort of students from the year behind.

Results:

Pre-curricular reform surveys consisted of 244 total responses, while post-curricular reform surveys consisted of 514 total responses. The rating of blocks when normalized according to the differing pre and post-reform sample sizes showed a significantly higher aggregate score for active sessions compared to didactic sessions when averaged over all survey questions (4.59 vs 4.41,  $p=0.033$ ). The first two cohorts responded favorably to the post-reform curriculum (77% favorable vs 23% indifferent) and to the co-production approach (79% favorable vs 14% indifferent vs 7% unfavorable). The third cohort also responded favorably to this methodology (73% vs 19% vs 7%). This cohort was overall satisfied with their UUT experience (61% very satisfied, 35% satisfied, 4% not satisfied). These students also overwhelmingly indicated that their UUT experience thus far has increased their interest in caring for underserved populations (85% increased interest vs 15% no impact vs 0% reduced interest).

Discussion:

The UUT was an ideal platform for implementing co-production because of self-selected students motivated to develop curricula, and integration with multiple health professionals, patients, and community members. The lack of institutional assessments also promoted an openness towards active and service learning. The co-production model improved the overall quality of the curriculum while promoting self-directed lifelong learning and a propensity towards academic medicine for participating students.

**Conclusion:**

Preliminary findings suggest co-production can be an effective approach to curriculum development in undergraduate medical education.

Primary Presenter: **Benjamin Fitzgerald**

Project Title: *Insurance Coverage, Emergency Department and Primary Care Use of Runaway/Homeless Youth in Colorado Six Months Before ACA Implementation*

Primary Mentor: Scott Harpin

Thematic Area: Public Health and Epidemiology

Abstract:

Introduction: Rates of health insurance coverage and primary care use among runaway/homeless youth (RHY) have

historically been lower than for same-aged peers. Conversely, emergency department use is commonly used as the

primary source of health care for RHY. Methods: In summer of 2013, we conducted focus groups and delivered

surveys to nearly 200 runaway/homeless youth in the lead social service agency serving youth in Denver and

Colorado Springs. Data were collected across program sites (drop-in center, emergency shelters, transitional housing

programs) by an interprofessional team of health sciences graduate students. Content analysis was conducted on

focus group data using Interpretive Description method; survey data were analyzed using univariate and bivariate

descriptive statistics. Results: Among RHY who took surveys, nearly half reported having insurance and over half had

visited an emergency department in the past year. Over half also reported having a clinic as their usual source of

health care. Five major themes emerged from content analysis, including: 1) the importance of word-of-mouth referrals

between youth; 2) a diverse set of circumstances and health issues that lead to an ER visit; 3) a variety of quality of

care delivered in ERs; 4) how primary care is utilized by RHY; and 5) how health insurance is viewed by RHY.

Discussion: This study describes RHY's health utilization from a spectrum of the cycle of homelessness, triangulating

survey data with the voices of youth in focus groups. Youth spoke of how important the RHY social network is in

gaining information about health needs and where respectful services can be found. There was little discussion or

concern about the universal health care mandate in the months prior to ACA implementation, and health seemed to be

prioritized lower on the hierarchy of needs, especially among those newer to the streets. Implications: The

implementation of the Affordable Care Act and Medicaid Expansion in states has afforded a natural experiment to

explore change among this population of vulnerable youth. Further research should look more deeply into insurance

coverage and primary care use since ACA has been implemented as well as motivations for changing health-seeking

behaviors among RHY. Social service programs might apply findings to fine-tuning service delivery around health

needs of RHY while in shelter and housing programs.

Primary Presenter: **Halley Flammer**

Project Title: *Training the Next Generation of Patient Advocates*

Primary Mentor: Heather Cassidy

Thematic Area: Public Health and Epidemiology

Abstract:

There are many social and economic factors that influence the health of a person to include: socioeconomic status, food insecurity, homelessness, lack of transportation, and poor access to medical care due to lack of health insurance. Many believe that physicians need to have a more active role in connecting patients to social services or other resources in the community. However, physicians receive minimal training in patient advocacy training during their medical school curriculum.

Primary Presenter: **Hania Flaten**

Project Title: *Genetic and metabolic markers predicting efficacy of Lisinopril therapy.*

Primary Mentor: Andrew Monte

Thematic Area: Clinical Science

Abstract:

Genetic and metabolic markers predicting efficacy of Lisinopril therapy.

Hania K. Flaten BA1, Brandon J. Sonn MS1,2,3, Jessica L. Saben PhD1, Angelo D'€Alessandro PhD4, Andrew A. Monte MD, PhD1,2,3,5

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\* Department of Structural Biology and Biochemistry, Metabolomics Core, University of Colorado Anschutz Campus, Aurora CO

\* Rocky Mountain Poison & Drug Center, Denver Health and Hospital Authority, Denver, CO, USA

**Background:** ACE inhibitors (ACEI) are the most commonly prescribed antihypertensive drugs and the third most commonly prescribed drug in the United States. However, only about 50% of hypertensive (HTN) patients respond to ACE therapy. Therefore, identifying biomarkers that predict ACE efficacy and safety will have widespread implications. The objective of this study is to evaluate genetic and metabolic markers that predict individualized responses to ACE inhibitor (lisinopril) treatment.

**Methods:** This study is a secondary analysis of subjects enrolled in a clinical trial examining the pharmacogenomic effectiveness of metoprolol succinate in HTN patients (NCT02293096). Hypertensive patients were started on an ACEI at the initial visit and had blood pressures reevaluated after 1 week. For this secondary analysis, we examined whole blood and plasma samples from patients at baseline and following 1 week of lisinopril treatment. Responders to lisinopril treatment were defined as individuals who had either a 10% decline in systolic blood pressure or a SBP of <140 at the week 1 visit. All others were considered non-responsive. Genomic (Illumina MEGA CHIP) and metabolomic (unsupervised HPLC-MS/MS with electron ion spray) analyses were performed and clinical data was

collected. Clinically relevant metabolites that showed trends in predictive potential for successful treatment with Lisinopril were identified.

Results: We analyzed forty-five samples composed of 26 male and 19 female subjects. Twenty-three subjects reported their race as white and 37 reported ethnicity as non-Hispanic. Nineteen subjects (42%) were responsive to Lisinopril. There was a significant difference in mean BMI between responders and non-responders (responder:  $29.7 \pm 3.9$  kg/m<sup>2</sup> vs. non-responder:  $34.0 \pm 6.7$  kg/m<sup>2</sup>,  $p=0.009$ ). Several metabolites were found to have significantly different levels when responders were compared to non-responders: gamma-glutamylputrescine, octadecanoic acid, eicosatetraenoic acid, sphingosine 1-phosphate, cysteine, octanoylcarnitine, hexanoylcarnitine, and ADP. Genetic analyses associated with these metabolic pathways are in progress.

#### Conclusions:

The data suggest that patients with higher BMI and levels of lipid oxidation may be less likely to respond to ACEI therapy. As we continue to identify predictors of response to ACEI, we must consider the cost of the tests, which may still be prohibitive to using these markers clinically.

Primary Presenter: **Nicholas Fling**

Project Title: *Emergency Medicine Rapid Needs Assessment in El Salvador*

Primary Mentor: Jennifer Bellows

Thematic Area: Global Health

Abstract:

**Background:** El Salvador suffers a striking burden of trauma with the world's highest homicide rate and rates of motor vehicle accident deaths 2.5 times greater than those of the developed world. Despite this, dedicated emergency care training and standardizations-of-care and equipment in public hospitals remains scarce.

**Objective:** The aim of this study is to establish a baseline measure of current capacities and practices in public San Salvador emergency departments as they pertain to the care of the critically injured.

**Methods/Design:** In June and July of 2016, a team of two interviewers conducted in-person interviews of nine key emergency department operations personnel at each of the eight public emergency departments in the metropolitan San Salvador area using the sidHARTE needs-assessment tool which comprises 329 distinct questions.

**Results:** Of the 72 individuals sought, 70 participated. Of the 8 hospitals, 100% report consistent electricity. 37.5% report inconsistent access to running water, 100% report 24-hour access to all vital laboratory studies as well as reliable access to supplies of blood. Half of the EDs surveyed report access to an ultrasound machine and 37.5% report the ability to perform emergency sonography after-hours. EDs had, on-average, 60% (31.9/53) of Essential Emergency Medicines, 81% (52/64) of Essential Emergency Supplies, and 90% of Essential Emergency Equipment (5.4/6). None of the hospitals (including 2 non-responders) had held mass-casualty incident training in the last year. As well, no hospital reported regular facility-sponsored opportunities for continuing medical education.

**Conclusions:** This study characterized the resources and emergency care capacity of San Salvador's public emergency departments. A high degree of variability was observed among emergency department resources and staffing. Additional efforts should be made to characterize the populations arriving in each emergency department in order to assure resources identified in this study are best matched to the needs of those populations and that the referring practices of local EMS providers match the capabilities of the hospitals.

Primary Presenter: **Andrew Flynn**

Project Title: *Active tuberculosis after treatment for latent tuberculosis infection*

Primary Mentor: Robert Belknap

Thematic Area: Public Health and Epidemiology

Abstract:

Setting: Denver Metro TB Clinic, Colorado, USA

Objective: Describe risk and rate of active tuberculosis (TB) in a population that started therapy for latent TB infection (LTBI). Among patients who developed active TB, describe patient and disease characteristics and drug resistance.

Design: Patients who began LTBI therapy between January 1, 2006 and December 31, 2017 were identified through prescription fills in the electronic health record (EHR). Diagnoses with active TB after starting LTBI treatment were identified through linkage to cases in the Colorado State TB database (TBDB) from January 1, 2006 through June 30, 2018. Patient and disease characteristics were obtained from the EHR and by chart review.

Results: Thirty-eight of 8474 patients treated for LTBI during the study period were diagnosed with active TB after starting LTBI therapy. Twelve were excluded for having active TB at baseline, 11 developed TB during LTBI therapy, and 15 developed disease after therapy. Thirteen of 26 (50%) had a positive culture and none were resistant to the drug they had received. The cohort active TB rate was 155 per 100,000 patient-years in the first year and 25 per 100,000 in subsequent years. Active TB cumulative risk was 3 per 1000 persons.

Conclusion: Subclinical active TB that is missed by symptom screening and chest radiography is rare but does occur. We did not find any evidence for acquired drug resistance in patients diagnosed with active TB after being prescribed LTBI treatment.

Primary Presenter: **Richie Fuld**

Project Title: *Biomechanical Comparison of Low Profile Contoured Locking Plate with Single Compression Screw to Fully Threaded Compression Screws for 1st MTP Fusion in a Cadaver Model*

Primary Mentor: Kenneth Hunt

Thematic Area: Basic Biomedical Science

Abstract:

**BACKGROUND:** Open MTP arthrodesis using locked plates produces good clinical outcomes. However, arthroscopic fusion with new generation fully threaded compression screws is emerging as an alternative. The purpose of this study was to compare low profile contoured locked plates to fully threaded compression screws for first MTP fusion, in a biomechanical cadaver model.

**MATERIALS AND METHODS:** The first rays of eight matched pairs of fresh frozen cadaveric feet underwent dissection and DEXA scanning to measure bone mineral density (BMD). The "plate" group was prepared with cup-and-cone reamers, and fixation of the MTP joint with one compression screw and low profile dorsal locked plate. The matched pair "screws" group was prepared through a simulated arthroscopic technique, achieving fixation with two new generation fully threaded compression screws. Plantar MTP gap was recorded with an extensometer during 250,000 90N cyclic loads followed by a single load failure.

**RESULTS:** The screws group demonstrated significantly greater stiffness, 31.6 N/mm (plates) and 51.7 N/mm (screws) ( $P = 0.0045$ ). There was no significant difference in plantar gapping or load-to-failure, 198.6 N (plates) and 290.1 N (screws) ( $P = .2226$ ). Stiffness and load-to-failure were highly correlated to BMD for the screws group,  $r = 0.79$  and  $r = 0.94$ , respectively, but less so for the plate group,  $r = 0.36$  and  $r = 0.62$ , respectively. Maximum metatarsal head height measured on lateral view was strongly correlated with load-to-failure for both the plate and screws only groups ( $r > 0.9$ ).

**CONCLUSION:** This data demonstrates that hallux MTP arthrodesis utilizing fully threaded compression screws is similar in plantar gapping and load-to-failure when compared to low profile locking plate, but with significantly more stiffness. These results support an increased role of fully threaded screws for MTP arthrodesis using either arthroscopic or open technique. However with decreased bone mineral density plate fixation may remain the better fixation choice.

**CLINICAL RELEVANCE:** Our data suggests that with regards to construct stability, fully threaded headless compression screws may be just as effective as low profile locking plates, but bone mineral density and MTPJ fluoroscopic measurements should be considered in the decision making process for fixation.

Primary Presenter: **Jake Gadbow**

Project Title: *An Integrated Psychiatry Clinic for Patients with Non-Epileptic Seizures: A Group Therapy Approach*

Primary Mentor: Laura Strom

Thematic Area: Clinical Science

Abstract:

A high percentage of patients presenting to epilepsy centers have a functional neurological disorder with apparent seizures ultimately diagnosed as non-epileptic seizures (NES). Meta analyses suggest that psychological treatment is required but this treatment is not reliably available, resulting in reentry of these patients to neurology clinics, urgent, and emergent care settings, reducing access for these services to epileptic patients and resulting in inadequate psychological care for the patient with NES. A sustainable, group therapy focused treatment clinic for patients with NES was developed as a combined effort between the Departments of Neurology and Psychiatry at the University of Colorado Hospital, consisting of a 5-week psychoeducational group, a 12-week psychodynamic therapy group, individual therapy, medication management, and family assessment. Two hundred seventy seven patients were diagnosed with NES and enrolled in the NES clinic from July 2016 to October 2018 (50 of whom were referred to the clinic having been diagnosed previously). Patient retention after referral for treatment was 82.6% and group therapy adherence was 84.1%. An analysis of seventy four patients shows that anxiety, trauma, and insomnia are the most common psychiatric comorbidities. The majority of these patients (82.4%) are on at least one psychiatric medication and 24.6% of patients with non-epileptic seizures alone are on an anti-epileptic medication at the time of diagnosis. We conclude that this clinic model is effective at recruiting, retaining, and engaging patients in appropriate treatment for their NES.

Primary Presenter: **Jakob Gamboa**

Project Title: *Using Social Media to Increase Preventative Behaviors against Arboviral Diseases: A Pilot Study among Teens in the Dominican Republic*

Primary Mentor: Daniel Olson

Thematic Area: Public Health and Epidemiology

Abstract:

This study evaluated social media as a health communication tool to promote education and encourage preventative behaviors against Zika and other arboviral diseases in a Low- and Middle-Income Country (LMIC). In 2016, 31 youth ages 14-18 from three communities in the Dominican Republic were enrolled into either two trial groups receiving a 3-month intervention of a prevention-focused Facebook group or a control group. Arboviral prevention knowledge and practice were evaluated with pre-and post-surveys. Knowledge scores increased significantly in the intervention groups (51.1% increase) compared to the control group (1.2% increase,  $p < 0.0001$ ). The intervention groups also showed a significant increase in the frequency of preventative behaviors in all categories (Primary bite prevention  $p = 0.017$ , Household vector control  $p = 0.0024$ , Community vector control  $p = 0.0021$ ). However, differences in the degree of online activity were observed between the two intervention groups. Increased online engagement parameters were associated with statistically significant increases in survey scores ( $p < 0.0001$ ) and preventative behaviors in all categories ( $p = 0.0009-0.0011$ ). This study demonstrates the effectiveness of engagement in social media peer-to-peer education groups as an accessible, low-cost intervention to improve arboviral disease knowledge and prevention practices in youth in the LMIC of the Dominican Republic.

Primary Presenter: **Nicholas George**

Project Title: *History of Cataract Surgery*

Primary Mentor: Ken Hovland

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

Cataract surgery is the most frequently performed surgery worldwide and has a rich and detailed history consisting of multiple advancements in both thought and technique. The earliest surgeries date back to 600 BCE, during which the technique of couching was first used, and this remained the predominant method until intracapsular and extracapsular cataract extraction were popularized in the mid-1700s, though couching is still employed in remote parts of the world. Patients were left aphakic, meaning without a lens, until the 1940s when it was found that certain materials were suitable to be implanted into the eye as an artificial lens. The current standard technique of cataract surgery, phacoemulsification, was discovered in the 1960s, and other techniques and adjuncts continue to be researched and developed.

Primary Presenter: **Bijan Ghaffari**

Project Title: *A cross-sectional analysis comparing knowledge, attitudes, and intentions surrounding exclusive breastfeeding between primiparous and multiparous pregnant women at Dhulikhel Hospital, Nepal*

Primary Mentor: Jennifer Bellows

Thematic Area: Global Health

Abstract:

Nepali children have high rates of stunting and wasting. The World Health Organization recommends exclusive breastfeeding (EBF) for the first 6 months of life as a means of promoting good nutrition and decreasing infant/child mortality and morbidity. While breastfeeding is common in Nepal, awareness about EBF and its benefits are lacking. This study was conducted to compare knowledge, attitudes, intentions, and perceived barriers to EBF in a population of pregnant Nepali women receiving antenatal care at Dhulikhel Hospital. A cross-sectional questionnaire, administered between July and August 2016, was completed by 300 participants aged 18 to 38 years-old. 193 participants were expecting their first child (primiparous), with the remaining 107 previously had at least one child (multiparous). While 188 (63%) of those surveyed intend to feed their child only breastmilk for the first six months, only 89 (30%) were familiar with the term "Exclusive Breastfeeding." There were statistically significant differences between primiparous and multiparous participants' knowledge about exclusive breastfeeding, as well as several attitudes and beliefs surrounding infant nutrition. Despite high rates of breastfeeding, the lack of knowledge surrounding exclusive breastfeeding introduces the risk for breastfeeding rates to decrease, and for other risky feeding behaviors to become more prevalent. As the practice of EBF is crucial to addressing stunting and infant mortality, implementing a formal EBF intervention tailored to the Dhulikhel community is recommended. This secondary analysis demonstrates that families may be more easily influenced during the primiparous period.

Primary Presenter: **Jennifer Gile**

Project Title: *PER2 as novel therapeutic target in midazolam induced delirium*

Primary Mentor: Tobias Eckle

Thematic Area: Basic Biomedical Science

Abstract:

Delirium occurs in 30% of critically ill patients, and the risk of dying during admission doubles in those patients. Molecular mechanisms causing delirium are unknown, however, critical care units consistently disrupt patients' circadian rhythms which is highly associated with the occurrence of delirium. Exposure to benzodiazepines (e.g. midazolam) is a major contributor to the development of delirium. Thus we tested the effects of midazolam on the regulation of the circadian rhythm protein Per2 in the mouse brain. We analyzed the effects of midazolam on Per2 mRNA expression in wild-type mouse brains and found a robust and significant downregulation of Per2 transcript levels. Using midazolam in a T-maze alternation model, in open field studies (line crossing/center square entries) or in novel recognition tests, we were able to establish a novel mouse model for delirium. Following studies using midazolam in a T-maze alternation model, we found up to 72h after midazolam treatment that mice exhibited significant deficits in a T-maze alternation model with significant downregulation of Per2 protein in the hippocampus and the SCN. Following studies in Per2<sup>-/-</sup> mice confirmed a functional and specific role of Per2 in midazolam induced delirium. Using the recently identified small molecule nobiletin as a Per2 enhancer, we were able to abolish the midazolam induced delirium phenotype in wild type mice. Based on these preliminary studies we hypothesize that Per2 plays a major role in the pathogenesis of delirium and that Per2 stabilization in the brain attenuates delirium. These results suggest Per2 as a potential drug target using the Per2 enhancer nobiletin as therapy in delirium.

Primary Presenter: **Catharina Giudice**

Project Title: *Neuroanatomical Correlates of Sensory Deficits in Children with Neonatal Arterial Ischemic Stroke*

Primary Mentor: Kevin Shapiro

Thematic Area: Clinical Science

Abstract:

**AIM** Abnormal sensory processing behavior during infancy has been associated with developmental delays. Children with neonatal arterial ischemic stroke (NAIS) are at high risk for having developmental deficits, yet sensory processing has not been described in this population. Our objective was to characterize the sensory processing outcome following NAIS and identify neuroanatomical correlates of abnormal sensory processing.

**METHODS** We longitudinally evaluated children with NAIS at 12, 18, and/or 30 months in areas of cognitive, motor, and language development. We gathered sensory processing data using the Sensory Profile. These data were analyzed against early MRI using a voxel-based approach.

**RESULTS** Eighteen children with NAIS were evaluated longitudinally, of which five (33%) exhibited atypical sensory processing. Children with sensory processing deficits had lower overall developmental scores in motor, cognitive, and language domains. Neuroanatomical correlates were identified in the posterior periventricular white matter extending superiorly into the supramarginal gyrus and inferiorly into the fusiform and inferior temporal gyri.

**INTERPRETATION** Our results provide new evidence that children with NAIS may experience difficulty processing sensory information, which is most likely associated with injuries in the posterior periventricular white matter, supramarginal gyrus, fusiform gyrus, and posterior thalamic radiation.

Primary Presenter: **Noah Goldstein**

Project Title: *Physician knowledge of radiation exposure and risk in medical imaging*

Primary Mentor: James Borgstede

Thematic Area: Clinical Science

Abstract:

Purpose

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Medical imaging is an increasingly important source of radiation exposure for the general population, and there are risks associated with such exposure; however, recent studies have demonstrated poor understanding of medical radiation among various groups of health care providers. This study had two aims: (1) analyze physicians' knowledge of radiation exposure and risk in diagnostic imaging across multiple specialties and levels of training, and (2) assess the effectiveness of a brief educational presentation on improving physicians' knowledge.

Methods

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From 2014 to 2016, 232 health care providers from multiple departments participated in an educational presentation and pre- and postpresentation tests evaluating knowledge of radiation exposure and risk at a large academic institution.

Results

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Knowledge of radiation exposure and risk was relatively low on the prepresentation test, including particularly poor understanding of different imaging modalities, with 26% of participants unable to correctly identify which modalities expose patients to ionizing radiation. Test scores significantly increased after the educational presentation. Radiologists had higher prepresentation test scores than other specialties, and therefore less opportunity for improvement, but also demonstrated improvement in radiation safety knowledge after education. Aside from radiology, there was no significant difference in initial knowledge of radiation exposure and risk among the other specialties.

Conclusions

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Providers' knowledge of radiation exposure and risk was low at baseline but significantly increased after a brief educational presentation. Efforts to educate ordering providers about radiation exposure and risk are needed to ensure that providers are appropriately weighing the risks and benefits of medical imaging and to ensure high-quality, patient-centered care.

Primary Presenter: **Fred Gonzales**

Project Title: *Assessing the preferred and effective modalities of computer-assisted learning in medical education*

Primary Mentor: Rita Lee

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

The use of computer-assisted learning modalities in medical education has gained much momentum in the last decade. Many programs are integrating asynchronous, online resources to supplement specific aspects of their curricula. However, the field of pathology has yet to expand on these resources, outside of websites that present pathology cases and virtual histology. This study aims to assess a disease specific online resource at various levels of medical education. More specifically, the learning efficacy of two different module formats are evaluated to determine if an interactive or presentation module format produces different learning outcomes. Each module contains the same information and a case study on autosomal recessive polycystic kidney disease (ARPKD). ARPKD is the most common ciliopathy affecting children and has variable phenotype based on the type of mutation in the PKHD1 gene. Approaching this disease specific module from a basic science and pathologic approach allows for it to be utilized by learners at various stages of medical education. The educational value of each module was evaluated through quantitative comparisons between pre- and post-test scores, assessed before and after utilizing the module, as well as qualitative measures through a module survey. A retention study was conducted thirty days after participants completed the module to determine the long-term educational value of each teaching modality. This study found that there is no difference in learning outcomes when an interactive or presentation style module is utilized, however, learners feel more engaged with the content when using an interactive module. Consequently, online learning modules that present clinical cases in a highly integrated manner show promise as an effective health sciences education tool.

Primary Presenter: **Taylor Goodstein**

Project Title: *A Retrospective Study of Patients Undergoing Radical Cystectomy and Receiving Peri-Operative Naloxegol or Alvimopan: Comparison of Length of Stay*

Primary Mentor: Shandra Wilson

Thematic Area: Clinical Science

Abstract:

Alvimopan is a  $\mu$ -opioid receptor antagonist used in the post-operative period to decrease rates of post-operative ileus (POI) following radical cystectomy (RC) and thereby shorten length of stay (LOS). Naloxegol is a much less expensive drug of the same class that has yet to be studied for prevention of POI in the peri-operative period. The purpose of the current study is to evaluate the differences in LOS and development of POI in patients post-RC who take alvimopan versus those who take naloxegol, with the hope that drug efficacy can be evaluated against the significant difference in cost burden between the two drugs. The study population included all adult patients between 18-89 years of age with bladder cancer undergoing radical cystectomy with urostomy at University of Colorado Hospital. Those patients who received usual post-operative care as well as either alvimopan or naloxegol between September 2011 and December 2017 were selected for analysis. Patients who did not take either medication or were switched from one drug to the other were excluded from the study. A zero-truncated binomial regression analysis was used to analyze differences in length of stay in patients who received alvimopan versus those who received naloxegol. Additionally, the incidence of post-operative ileus was compared between treatment groups. 130 patients who underwent RC and received either alvimopan or naloxegol were included in the study: 75 (58%) received alvimopan and 55 (42%) received naloxegol. Baseline characteristics were similar between treatment groups. There was no significant difference in the length of stay between patients who received alvimopan and patients who received naloxegol after adjusting for age, sex, BMI, length of surgical time, or stage of disease ( $p = 0.41$ ). There was no significant difference between the two drugs for development of POI ( $p = 0.85$ ). Development of POI was significantly associated with a longer LOS ( $p = 0.007$ ). The analysis showed that naloxegol was comparable to alvimopan when it came to length of hospital stay following RC. Therefore, naloxegol may be offered as a less expensive, effective alternative to alvimopan.

Primary Presenter: **Katie Gorman**

Project Title: *Determining Job Prospects and Destinations for University of Colorado Department of Anesthesiology Graduates (2011-2018)*

Primary Mentor: Steven Zeichner

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

There are many factors to consider when measuring the success of an Anesthesiology residency program. One such metric is the percentage of residents who go on to pursue a fellowship. Another is the ease of job obtainment post training. Especially in the constantly evolving field of Anesthesiology, it is vital for current and future trainees to have access to comprehensive data regarding the job prospects of a Department. Information was collected and analyzed from the University of Colorado's Department of Anesthesiology classes from 2011-2018. Additionally, a survey was sent out to recent graduates inquiring about rationale behind first job selection. The majority of residents (66.7%) who train at CU remain in Colorado for either first job or fellowship. Graduates cite geographical location, job description, and stability of group as ultimate deciding factors in first job selection. Medical students should heavily consider their motivation to remain in the state when applying to the residency program.

Primary Presenter: **Michael Gracia**

Project Title: *A Retrospective Evaluation Between Common Orthopedic Procedures Performed During Childhood with Functional and Quality of Life Outcomes in Early Adulthood in Individuals with Cerebral Palsy*

Primary Mentor: Patricia Heyn

Thematic Area: Clinical Science

Abstract:

#### ABSTRACT

**Aim** To evaluate the relationship between long-term outcomes in physical function and quality of life (QoL) with the number and timing, relative to puberty-age norms, of pediatric orthopedic surgical procedures done on individuals with cerebral palsy transitioning to adulthood using gait speed, GDI, adult GMFCS, and grip strength in the evaluation of physical function and self-reported PROMIS-57 and WHODAS II data in the assessment of QoL.

**Methods** A retrospective chart review was undertaken on the 72 ambulatory young (mean age  $24.44 \pm 5.33$ ) adults with CP to obtain patient demographic data, as well as, historical features related to their pediatric surgical interventions. As part of a cross-sectional study the GMFCS were evaluated of these 72 young adults along with gait speed, GDI, and grip strength as were the QoL metrics including the World Health Organization's Disability Assessment Schedule II (WHODAS II) and the Patient-Reported Outcomes Measurement Information System-57 (PROMIS-57). The cohort was then grouped based on the study variables (age at intervention, number of interventions) and liner regression was executed in search for statistically significant correlation between them and the aforementioned functional and QoL outcome measures.

**Results** There were no statistically significant correlations between number and timing of surgeries undertaken with gait speed, GDI, adult GMMFCS, grip strength, and WHODAS II results among the study cohort, nor was there correlation between number of surgeries and PROMIS-57 results. However, the comparison between the three different age groups in the Physical Function sub-domain of PROMIS 57 revealed a statistically significant difference ( $p < 0.05$ ) between participants who had their first surgery during puberty (PROMIS-57 Physical Function score =  $22.33 \pm 6.89$ ) and the participants who had their first surgery after puberty (PROMIS-57 Physical Function score =  $29.38 \pm 8.11$ ).

**Interpretations** In concurrence with current literature, earlier surgical intervention among individuals with CP can lead to higher physical function according to one advanced, adaptive, self-reported metric for QoL. No correlations were found between any of the study variables and the objective outcome measures of physical function, suggesting there continues to remain a disconnect between what is documented and observed by physicians and health care professions and what is experienced by those with CP. Further studies that account for initial function, and those that consider type of surgical intervention could further advance understanding of the complexity of outcomes for adults with CP who have undergone surgical intervention.

Primary Presenter: **Abhinav Gupta**

Project Title: *Statin Use Associated with Improved Overall and Cancer Specific Survival in Patients with Head and Neck Cancer*

Primary Mentor: Sana Karam

Thematic Area: Clinical Science

Abstract:

Objectives

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Studies have shown the utility of lipid-lowering agents in improving outcomes in various cancers. We aim to explore how statins affect overall survival and cancer specific survival in head and neck cancer patients using population-based datasets.

Patients and methods

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Using the Surveillance, Epidemiology, and End Results (SEER)-Medicare linked dataset, we separated HNC patients into three groups: those with no hyperlipidemia (nH), those with hyperlipidemia and not taking a statin (HnS), and those with hyperlipidemia and taking a statin (H $\bar{E}$ + $\bar{E}$ S). Overall survival (OS) and cancer specific survival (CSS) were compared between the three groups based on disease subsite (oral cavity, oropharynx, and other) using Kaplan-Meier and multivariate Cox regression analysis (MVA), controlling for demographic, socioeconomic, staging, treatment, and comorbidity covariates. Using Pearson chi-square analysis, we also compared the incidence of cancer-related toxicity events.

Results

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There were 495 nH, 567 HnS, and 530 H $\bar{E}$ + $\bar{E}$ S patients. H $\bar{E}$ + $\bar{E}$ S patients had superior OS and CSS (73.0, 81.2%) relative to nH (58.6, 69.1%) and HnS groups (61.7, 69.2%) ( $p\bar{E}$ < $\bar{E}$ 0.01). On MVA, H $\bar{E}$ + $\bar{E}$ S patients showed improved OS ( $p\bar{E}$ < $\bar{E}$ 0.01) and CSS ( $p\bar{E}$ = $\bar{E}$ 0.04) compared to nH (HR $\bar{E}$ = $\bar{E}$ 1.64, 1.56) and HnS (HR $\bar{E}$ = $\bar{E}$ 1.40, 1.37). MVA stratified by subsite yielded similar results for oral cavity and oropharyngeal disease. Toxicity-related events did not differ significantly between the groups.

Conclusion

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HNC patients with hyperlipidemia and taking a statin demonstrated improved outcomes compared to nH and HnS patients, further supporting statins' role as a potential adjuvant anti-neoplastic agent in HNC. Further prospective studies to investigate the impact of statins on HNC outcomes are warranted.

Primary Presenter: **Eric Haaland**

Project Title: *Assessing Cost and Health Outcomes in People With Developmental Disabilities During Pediatric to Adult Healthcare Transitions*

Primary Mentor: Laura Pickler

Thematic Area: Public Health and Epidemiology

Abstract:

The importance to the health of young people of a smooth and coordinated pediatric to adult health care transition (HCT) has been recognized for several decades. As children with developmental disabilities have increasingly lived to adulthood, physicians, researchers and policymakers have been confronted with the additional challenges of helping these individuals transition to adult services. Many models of HCT services have been proposed and tested but few, high-quality empirical data assessing the efficacy of these models exist. Additionally, while health policy makers have set goals for all individuals with developmental disabilities to receive HCT services, the percentage of this population receiving such services has remained frozen at ~40% for over 10 years. Due to the often complex picture of health in this population, poorly coordinated transitions of care have the potential to negatively affect health outcomes and increase expenditure. Our goal was to determine whether and how developmentally disabled individuals are receiving HCT support services in Colorado, and whether individuals are experiencing negative health outcomes and/or expenditure. In this study parents/caregivers of developmentally disabled adults, ages 18-26 were electronically surveyed with the assistance of local Community Centered Board (the gateway for Medicaid-funded disability services in Colorado) who identified the target group and emailed the surveys. 15 responses were collected of which 2 received some sort of coordinated HCT support services. However, none of the respondents reported adverse health outcomes or increased expenditures during or around the time of transition of care. This study is inconclusive. Given the limited number of participants and the possibility that adverse events due to uncoordinated healthcare transitions may be relatively rare further research should target larger study populations, ideally statewide Medicaid data.

Primary Presenter: **John Hallett**

Project Title: *Improving chronic illness self-management with the Apsal̓alooke Nation: Development of the Baal̓a nnilah Program (Paper)*

or

*From interviews to intervention: Developing a chronic illness self-management program in an Indigenous community (Poster)*

Primary Mentor: Suzanne Held

Thematic Area: Public Health and Epidemiology

Abstract:

Since 1996, members of the Apsal̓alooke (Crow) Nation and faculty and students at Montana State University have worked on a successful community-based participatory research partnership, leading to increased trust and improvements in health awareness, knowledge, and behaviors. As major barriers to health and healthy behaviors have caused inequities in morbidity and mortality rates for multiple chronic diseases among the Apsal̓alooke people, community members chose to focus the next phase of research on improving chronic illness (CI) management. Existing CI self-management programs include aspects inconsonant with Apsal̓alooke culture and neglect local factors seen as vital to community members managing their health conditions. To understand facilitators and barriers to CI management, community members shared stories about what it is like to manage their CI. This paper provides information on how our partnership used story data and extensive qualitative co-analysis to develop a community-based intervention called Baal̓a nnilah. Components of the intervention approach and intervention content are detailed and similarities and differences from other chronic illness management programs are described. Our collaborative process and product can be helpful for other communities interested in using story data to develop research projects, deepen their understanding of health, and increase health equity.

Primary Presenter: **Eitan Halper-Stromberg**

Project Title: *Bronchoalveolar Lavage Fluid From People With COPD Reveals Metabolites Associated with Disease*

Primary Mentor: Russell Bowler

Thematic Area: Basic Biomedical Science

Abstract:

**Rationale:** Chronic obstructive pulmonary disease (COPD) typically results after years of smoking and is a significant health burden in the United States. Subphenotypes that manifest as part of this disease include emphysema, chronic bronchitis, and COPD exacerbations. Some classes of proteins, such as sphingolipids and amino acids, have previously been associated with subphenotypes of COPD. Here we present the first large-scale untargeted mass spectrometry results on bronchoalveolar lavage fluid (BALF) from 116 subjects from the SPIROMICS cohort.

**Objectives:** To use mass spectrometry to determine which proteins in BALF are associated with subphenotypes of COPD.

**Methods:** An untargeted mass spectrometry assay was performed on BALF from 116 subjects from the SPIROMICS cohort. Results were annotated with compound names, KEGG ids, and HMDB ids, if possible. About eight thousand proteins were identified across the entire cohort. Missing data was imputed using K-nearest neighbor proteins. Normalization involved log-transformation on raw abundances and batch correction. Regression analyses on COPD subphenotypes was performed with clinical covariate correction and false discovery rate correction.

**Measurements and Main Results:** Nearly eight thousand proteins in BALF were identified. We focused our analysis on proteins that were annotated with a chemical name at the least, about three thousand in total. Most of these proteins were also detected in untargeted mass spectrometry from the plasma of the 116 individuals. In spite of the large proportion of proteins identified in both BAL and plasma, the correlation between plasma proteins and BALF proteins was relatively weak. Many proteins in BALF found to be associated with COPD subphenotypes were not associated with the subphenotypes when measured in plasma.

**Conclusions:** Bronchoalveolar lavage fluid demonstrates proteins that are associated with COPD subphenotypes.

Primary Presenter: **Tessa Harland**

Project Title: *Progesterone-only Contraception is Associated with a Shorter Progression-Free Survival in Premenopausal Women with WHO Grade I Meningioma*

Primary Mentor: D. Ryan Ormond

Thematic Area: Clinical Science

Abstract:

**Background:** The hormonally active nature of intracranial meningioma has prompted research examining the risk of tumorigenesis in patients using hormonal contraception. Studies exploring estrogen-only and estrogen/progesterone combination contraceptives have failed to demonstrate a consistent increased risk of meningioma. By contrast, the few trials examining progesterone-only contraceptives have shown higher odds ratios for risk of meningioma. With progesterone-only contraception on the rise, the risk of tumor recurrence with these specific medications warrants closer study.

**Objective:** We sought to determine whether progesterone-only contraception increases recurrence rate and decreases progression-free survival in pre-menopausal women with surgically resected WHO Grade I meningioma.

**Methods:** Comparative analysis of 67 pre-menopausal women taking hormone-based contraceptives (progesterone-only medication, n=21; estrogen-only or estrogen/progesterone combination medication, n=46) who underwent surgical resection of WHO Grade I intracranial meningioma was performed. Differences in demographics, degree of resection, adjuvant therapy and time to recurrence were compared between the two groups.

**Results:** Compared to patients taking combination or estrogen-only contraception, those taking progesterone-only contraception demonstrated a greater recurrence rate (33.3% vs 19.6%) with a reduced time to recurrence (18 vs 32 months, p=0.038) despite a significantly shorter follow-up (p=0.014). There were no significant demographic or treatment related differences.

**Conclusion:** The results from this study suggests that exogenous progesterone-only medications may represent a specific contraceptive subgroup that should be avoided in patients with meningioma.

Primary Presenter: **Robin Harland**

Project Title: *Kenton Kares Health Project*

Primary Mentor: Mandy Allison

Thematic Area: Public Health and Epidemiology

Abstract:

Schools have been targeted as a convenient and effective site for promotion of pediatric health. The purpose of this study is to improve wellness and healthcare access of students and their families at a diverse elementary school in a low-income neighborhood of Aurora, CO. Methods involved creation of a resource guide including medical, dental, food, and clothing resources in the area for students and families. Next, key informant interviews of faculty were performed to assess the effectiveness of the resource guide and to determine what the school community valued in improving health and wellness at the school. Once the results of key informant interviews were compiled, pertinent findings were presented to parents and faculty at the parent coffee hour event, where suggestions on how to resource and sustain further changes are discussed. Reviews from faculty showed general satisfaction with the resource guide. The most common health issues mentioned by faculty and parents interviewed include asthma, environmental quality, and overweight/obesity prevalence among students. The most common suggestion for promotion of health and wellness among students was having more afterschool sports programming for students.

Primary Presenter: **Daniel Harter**

Project Title: *Post-mortem Discrepancies with In Vivo Diagnosis and Analysis on its Impact on Hospital and Clinical Practice*

Primary Mentor: Carrie Marshall

Thematic Area: Public Health and Epidemiology

Abstract:

Up to a third of death certificates are found to be in error and 50% of autopsies produce unexpected findings that were unknown prior to death<sup>1</sup>. Additionally, the field of medicine carries the burden that between 5-20% of inpatient hospital deaths are preventable<sup>[[1]]</sup> (#\_ftn1). Historically, the means by which disease and its summary treatment were audited was by means of autopsy. However, despite these discrepancies, and the weighted consequences to the field that are derived from their lack of recognition, the rate of autopsies, as well as their perceived value, has precipitously dropped in recent decades. This literature review, with accompanying survey of modern medical and practitioners to parallel several of the key questions produced from the text by Rolla B. Hill in 1988, seeks to clarify some of the lingering questions and confusion regarding this precipitous drop-off. Additionally, this paper hopes to not only stress the central role the autopsy has played in the paradigm shift of science moving from heuristic and often superstitious nature of medicine in its history, but to reaffirm its continued need in the modern medical field as not only a continued source of discovery, but in its central role as the final audit of a patient's diagnoses and treatments. Finally, this paper intends to suggest solutions to some of the barriers that ultimately hinder the autopsy from taking place in order to help ensure future medical practice continues to be high value and high quality.

[[1]] (#\_ftnref1) Defined as qualifying as a Goldman Class I Major Error, in which findings on autopsy show that a "Discrepancy of a primary diagnosis with an adverse impact on the patient's survival. A primary diagnosis is either the immediate cause of death or the underlying disease that initially prompted the patient to seek medical attention. A Class I discrepancy indicates that, if the diagnosis had been made and appropriate therapy instituted, the patient would have been expected to live. An example would be a person dying of an unrecognized but treatable infection" (Hill, 1988).

Primary Presenter: **Carolyn Ho**

Project Title: *Obstetrics and Gynecology Communications Training for Medical Students*

Primary Mentor: Joseph Hurt

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

Recently, the importance of improved communication skills within medical education has become increasingly emphasized although there is still no set standard for communications training. Our goal is to demonstrate a communication intervention model that will improve student communication skills based on the Obstetrics Communications Assessment Tool (OCAT) grading scale we created. We hope to create a standardized communication intervention that can be used at various institutions in the future.

In this RCT, approximately 40 CUSOM third-year medical students will be randomly split into a variable and control group. The control group will participate in two sets of standardized patient encounters and graded by the OCAT on two separate days split between three weeks. The variable group will experience an intervention between the two sets of encounters. The communications intervention will include a lecture on the importance of communication skills in healthcare, a small group role playing session with patient cases, personal reflections, mentorship, peer feedback, and interactions with real patients. The OCAT results will be analyzed to see if there are any significant differences between the groups.

Progress to date consists of extensive background research and putting together a basic intervention module and schedule. One major obstacle encountered so far is that the dependability of the OCAT grading scale is still being tested. Once the OCAT study has been finished and the data analyzed, if it proves to be a reliable tool, we will move on to using it in the intervention module test.

Primary Presenter: **Johnny Hoang**

Project Title: *Anti-Peptidylarginine Deaminase Antibodies Are Present in the Sputum of RA Patients and Can Activate Peptidylarginine Deaminase-4 Enzyme Activity*

Primary Mentor: Kristen Demoruelle

Thematic Area: Clinical Science

Abstract:

Background/Purpose: Anti-peptidylarginine deiminase (PAD)-4 antibodies (Abs) are present in a portion of RA patients and associate with more severe joint disease, suggesting that they play a role in pathogenesis. A subset of anti-PAD4 Abs cross-react with PAD3, and these Abs are found to enhance PAD4 enzyme activity at physiologic calcium concentrations which can lead to increased citrullination. Anti-PAD3/4 cross-reactive Abs have also been associated with more severe lung disease in RA, suggesting they may have a direct effect in the lung. Because sputum anti-CCP Abs have been identified in RA, we sought to explore the presence and activity of anti-PAD4 Abs in the sputum of RA patients.

Methods: A total of 106 patients were included in this study. Of this cohort, there were 35 patients diagnosed with RA, 46 patients at-risk of RA (serum CCP+ or first-degree relative with RA), and 25 healthy controls. Induced sputum was tested for CCP using commercial ELISAs. Serum and sputum were tested for anti-PAD4 Abs using an established immunoprecipitation method. All anti-PAD4+ samples underwent testing for the presence of PAD3 cross-reactivity. To determine the effect of anti-PAD Abs on PAD4 enzymatic activity, Igs were purified from each anti-PAD+ sample and their effect on citrullination of the histone H3 substrate by PAD4 at increasing calcium concentrations (i.e. 0.2 and 2 mM) was measured by an anti-citrullinated histone H3 immunoblot.

Results:

Among the 35 RA patients with RA, 6 (17.1%) had antibodies against PAD4 in their serum. Of those 6 subjects, 2 displayed serum antibodies against PAD3. Regarding the sputum samples, 3 (8.57%) subjects with anti-PAD4 antibodies in their serum displayed sputum reactivity for anti-PAD4 antibodies. 1 (2.86%) subject displayed dual anti-PAD3/4 reactivity in the sputum sample. Serum anti-PAD4 antibodies were more prevalent in RA patients with sputum anti-CCP antibodies, with all anti-PAD4+ RA patients demonstrating sputum anti-CCP positivity. In the AR cohort, only 1 (2.17%) subject showed anti-PAD4 positivity in either their serum or sputum. Similarly, only 1 (2.17%) subject had anti-PAD3/4 reactivity in either sample. The HC population showed no detection of serum or sputum anti-PAD4 or anti-PAD3/4 antibodies. All three samples (serum and sputum) with measurable anti-PAD3/4 antibodies were able to increase PAD4 activity at a calcium concentration at physiologic state. Of the three samples, 2 subjects were in the RA group, while the remaining subject was part of the AR group.

Conclusion: In this study, for the first time anti-PAD4 antibodies have been found in the sputum in a portion of RA patients. A smaller portion of AR individuals also display anti-PAD3/4 antibodies in their serum and sputum. This is of interest as the presence of anti-PAD3/4 antibodies in RA patients have been associated with higher disease severity based both clinically and on radiography. Although the lung may not be the pathologic site for autoantigen citrullination by PAD enzymes in RA, there is evidence that increased PAD function does exist in the lung, possibly allowing for increased ACPA production

Primary Presenter: **Andrew Jacobsmeyer**

Project Title: *Intracranial extraosseous recurrence of Ewings sarcoma: A single institution experience*

Primary Mentor: Meg Macy

Thematic Area: Clinical Science

Abstract:

The incidence and clinical course of patients with intracranial extraosseous Ewings Sarcoma (ES) is not well described. We present a single institution analysis of recurrent pediatric ES with intracranial extraosseous involvement. In 80 patients with ES, the prevalence of intraparenchymal involvement was 7.5% (six patients). Of the five deaths from disease, progression varied greatly with a median survival of 73 days. The higher incidence could be secondary to treatment modifications or increased detection. These findings are useful for decisions at the time of CNS involvement and could lead to modifications for future ES clinical trials.

Primary Presenter: **Nikolas Johs**

Project Title: *A Qualitative Focus Group Study of Perceived Barriers and Benefits to Exercise by Self-Described Exercise Status among Older Adults Living with HIV*

Primary Mentor: Kristine Erlandson

Thematic Area: Public Health and Epidemiology

Abstract:

**Objectives:** Although exercise interventions have been shown to improve health outcomes among older people with HIV (PLWH), this population remains highly sedentary. The purpose of this study was to examine the differences in perceived barriers and benefits to exercise among older PLWH by self-identified exercise status.

**Design:** Five focus groups were conducted among PLWH: two groups of exercising men, two groups of non-exercising men, and one group of women (mixed exercisers and non-exercisers). Themes were analyzed in relation to the social ecological model (SEM), utilizing the constant comparative approach.

**Setting:** Patients were recruited from an academic medical center HIV clinic and community locations.

**Participants:** PLWH aged 50 or older, diagnosed with HIV for at least two years, with no other health conditions that would preclude exercise.

**Primary and Secondary Outcome Measures:** Determine facilitators, barriers, and ideal environment for exercise or physical activity and whether these differ between older PLWH who self-identify as an exerciser or non-exerciser.

**Results:** Among 25 men (11 exercisers and 14 non-exercisers) and 4 women (3 non-exercisers and 1 exerciser), non-exercisers mentioned fewer benefits to exercise (n=46) than exercisers (n=75). Exercisers emphasized positive reinforcement, positive mood change and increased energy as benefits of exercise; interpersonal benefits of exercise were also discussed twice as often for exercisers than non-exercisers. Non-exercisers emphasized barriers to exercise including lack of motivation, lack of self-efficacy, and a negative perception of gym culture. Non-exercisers identified a need for age-appropriate activities as a feature of an ideal exercise environment. Both groups identified time, cost, and health-related challenges as barriers to exercise.

**Conclusions:** Unique exercise barriers and benefits by self-identified exercise status provide important insights into the design of future interventions to initiate and maintain exercise.

Primary Presenter: **Carrie Keffler**

Project Title: *Internalized Transphobia and Mental Health €“ Outcomes; Implications; and Directions*

Primary Mentor: Robert Davies

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

The goal of this paper was to examine the stigma experienced by the transgender, gender fluid, and gender queer patient populations and the mental health consequences of experiencing such stigma. Literature search reviews indicate that there are significant mental health consequences subsequent to the internalization of societal stigma in transgender and gender nonconforming patient populations. Further, these negative health consequences can be framed using both the minority stress theory (MST) as well as the more recently conceptualized psychological mediation framework (PMF) model. From a neurobiological perspective, environmental stressors can be illustrated to effect both the HPA axis, resulting in hyperactivity of the stress response, as well as an over-activation of the habenula, a region of the diencephalon recently implicated in depression. This review is important for the future psychiatric care of transgender and gender nonconforming individuals as it not only suggests a causal explanation from a psychosocial viewpoint, but also illustrates the potential neurobiological underpinnings at play. Knowing the underlying biopsychosocial risk factors will allow future progress towards not only the targeted treatment of mental illness in TGNC patient populations, but also, ideally ultimately its prevention.

Primary Presenter: **Judas Kelley**

Project Title: *Biomechanical Comparison of Low Profile Contoured Locking Plate with Single Compression Screw to Fully Threaded Compression Screws for 1st MTP Fusion in a Cadaver Model*

Primary Mentor: Kenneth Hunt

Thematic Area: Clinical Science

Abstract:

**BACKGROUND:** Open MTP arthrodesis using locked plates produces good clinical outcomes. However, arthroscopic fusion with new generation fully threaded compression screws is emerging as an alternative. The purpose of this study was to compare low profile contoured locked plates to fully threaded compression screws for first MTP fusion, in a biomechanical cadaver model.

**MATERIALS AND METHODS:** The first rays of eight matched pairs of fresh frozen cadaveric feet underwent dissection and DEXA scanning to measure bone mineral density (BMD). The "plate" group was prepared with cup-and-cone reamers, and fixation of the MTP joint with one compression screw and low profile dorsal locked plate. The matched pair "screws" group was prepared through a simulated arthroscopic technique, achieving fixation with two new generation fully threaded compression screws. Plantar MTP gap was recorded with an extensometer during 250,000 90N cyclic loads followed by a single load failure.

**RESULTS:** The screws group demonstrated significantly greater stiffness, 31.6 N/mm (plates) and 51.7 N/mm (screws) ( $P = 0.0045$ ). There was no significant difference in plantar gapping or load-to-failure, 198.6 N (plates) and 290.1 N (screws) ( $P = .2226$ ). Stiffness and load-to-failure were highly correlated to BMD for the screws group,  $r = 0.79$  and  $r = 0.94$ , respectively, but less so for the plate group,  $r = 0.36$  and  $r = 0.62$ , respectively. Maximum metatarsal head height measured on lateral view was strongly correlated with load-to-failure for both the plate and screws only groups ( $r > 0.9$ ).

**CONCLUSION:** This data demonstrates that hallux MTP arthrodesis utilizing fully threaded compression screws is similar in plantar gapping and load-to-failure when compared to low profile locking plate, but with significantly more stiffness. These results support an increased role of fully threaded screws for MTP arthrodesis using either arthroscopic or open technique. However with decreased bone mineral density plate fixation may remain the better fixation choice.

**CLINICAL RELEVANCE:** Our data suggests that with regards to construct stability, fully threaded headless compression screws may be just as effective as low profile locking plates, but bone mineral density and MTPJ fluoroscopic measurements should be considered in the decision making process for fixation.

Primary Presenter: **Leah Kellogg**

Project Title: *An examination of humanitarian Aid coordination in Nicaragua among members of a novel online networking platform.*

Primary Mentor: Jennifer Bellows

Thematic Area: Global Health

Abstract:

Within the realm of humanitarian organizations, it has been largely described that the path towards more effective and efficient aid programming lies not in proliferation of programming itself, but rather in increased collaboration between aid entities. Additionally, it has been observed that poorly coordinated humanitarian efforts within the same recipient market can cause measurable harm to the societies that they aim to serve. However, despite multiple well-organized global calls-to-action for increased collaboration within the international development community, relatively little change has been observed over time. Etiologies for the lack of coordination efforts range from political, to financial, to a general lack of awareness of other organizations, and much more. The utilization of internet-based networking platforms within the international development community is a relatively novel concept as internet access across the globe, though expanding rapidly, is far from comprehensive. In the past decade, however, access to high-speed internet within the country of Nicaragua, one of the largest per-capita recipients of aid in the Western hemisphere, has expanded measurably. This increased internet access prompted the development and launch in 2015 of the Nicaragua Non-Profit Network (NNN) website, which is a Nicaragua-specific internet-based networking platform serving the Nicaraguan nongovernmental organization (NGO) community with the aim of improving the overall coordination of aid programming. In an effort to assess the effects of such an online networking platform on NGO collaboration in Nicaragua, we conducted an annual survey of website member-NGOs. The survey was distributed annually over three years from 2016-2018. The 91 completed surveys show a strong belief ( $P < 0.001$ ) that an online networking platform such as the NNN is needed in Nicaragua among respondent members. Additionally, there is a statistically significant trend towards organizations with an annual budget larger than \$500,000 and organizations that have operated in Nicaragua longer than 10 years having more frequent communication habits suggesting that easy accessibility to online networking may preferentially benefit smaller and newer organizations. While data was not significant, there was a trend towards respondents who operate in Nicaraguan healthcare delivery observing overlap of health care services between the various providers of healthcare programming. An observation that has serious biological, ethical, and general safety implications.

Primary Presenter: **Arian Khorshid**

Project Title: *Co-Production in Undergraduate Medical Education*

Primary Mentor: Steve Lowenstein

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

Background:

A co-production paradigm of healthcare services has become increasingly popular in the United States and in Europe. Applying the same principles to health professions education it is possible to alter the traditional hierarchical relationship between faculty member and trainee. Co-produced curriculums may offer students a more engaged and fulfilling role in their educational experience which may translate to increased future career satisfaction. A project to implement a novel co-produced curriculum was undertaken within a pre-existing interdisciplinary extracurricular track at the University of Colorado Anschutz Medical Campus. The co-produced curricular content was focused on the care of urban underserved patient populations.

Methods:

A curriculum steering committee (CSC) was formed by a cohort of interdisciplinary students from within the Urban Underserved Track (UUT) along with core faculty mentors. To solicit student input for curriculum design, a survey was deployed to students who had previously completed one curricular year within the UUT. Feedback from this survey was used to guide curriculum design, and an updated curriculum was developed by the CSC student cohort with close faculty oversight. The co-produced curriculum was implemented starting in the 2016-2017 academic year. Following implementation, post-session and end-of-year surveys were collected to evaluate student perception and subjective effectivity of curricular changes. To create a sustainable model of curriculum coproduction, the cohort of students within the CSC transitioned their leadership roles to a new cohort of students from the year behind.

Results:

Pre-curricular reform surveys consisted of 244 total responses, while post-curricular reform surveys consisted of 514 total responses. The rating of blocks when normalized according to the differing pre and post-reform sample sizes showed a significantly higher aggregate score for active sessions compared to didactic sessions when averaged over all survey questions (4.59 vs 4.41,  $p=0.033$ ). The first two cohorts responded favorably to the post-reform curriculum (77% favorable vs 23% indifferent) and to the co-production approach (79% favorable vs 14% indifferent vs 7% unfavorable). The third cohort also responded favorably to this methodology (73% vs 19% vs 7%). This cohort was overall satisfied with their UUT experience (61% very satisfied, 35% satisfied, 4% not satisfied). These students also overwhelmingly indicated that their UUT experience thus far has increased their interest in caring for underserved populations (85% increased interest vs 15% no impact vs 0% reduced interest).

Discussion:

The UUT was an ideal platform for implementing co-production because of self-selected students motivated to develop curricula, and integration with multiple health professionals, patients, and community members. The lack of institutional assessments also promoted an openness towards active and service learning. The co-production model improved the overall quality of the curriculum while promoting self-directed lifelong learning and a propensity towards academic medicine for participating students.

Conclusion:

Preliminary findings suggest co-production can be an effective approach to curriculum development in undergraduate medical education.

Primary Presenter: **Kevin Kim**

Project Title: *Screening Emergency Department Patients For Aberrant Opioid Drug-Related Behavior*

Primary Mentor: Jason Hoppe

Thematic Area: Public Health and Epidemiology

Abstract:

INSTITUTIONS: 1. Emergency Medicine, University of Colorado School of Medicine, Englewood, CO. 2. Harvard Medical School, Boston, MA. 3. Emergency Medicine, Brigham and Women's Hospital, Boston, MA.

Objectives: The recent rise in opioid related drug deaths has paralleled the increased availability of opioid analgesics (OA). OAs are commonly prescribed from the emergency department (ED) for moderate to severe pain. Unfortunately, ED physicians do not have the benefit of validated tools to identify at patients at risk of aberrant opioid use. This project evaluated three validated, office based OA risk-screening tools in the ED: Screener and Opioid Assessment for Patients with Pain - Revised (SOAPP-R), Drug Abuse Screening Test (DAST-20) and Opioid Risk Tool (ORT).

Methods: This observational study included a convenience sample of ED patients  $\geq 18$  years old with a painful condition in two academic hospitals for whom the clinician considered prescribing an OA. Subjects completed the three tools on a tablet. The statewide prescription drug monitoring program (PDMP) was accessed as part of routine care. Risk tool scores and PDMP controlled medication prescription data were linked in a de-identified data set. The pre-defined at-risk scores for each of the screeners were analyzed relative to aberrant behavior, defined as  $\geq 4$  OA prescriptions and  $\geq 4$  different prescribers for scheduled medications in the prior 12-months. The study was approved by IRBs at both institutions.

Results: A total of 154 patients were approached and 121 patients were enrolled from two hospitals (109 from site A, 12 from site B). Median age of subjects was 35 years old (IQR: 27-48), 60% were female. Past OA use was reported by 68% (104/121) and 23% (28/121) reported opioid use within the past 7 days. SOAPP-R was the only tool that was significantly associated with identifying aberrant opioid behavior: OR 2.8 (95%CI 1.04-7.4), compared with ORT (OR 1.2 (95%CI 0.5-3.4)) and DAST-20 (OR 0.6 (95%CI 0.1-4.9)). SOAPP-R had the highest sensitivity (SN) of 33% (95%CI 17-54%), specificity (SP) of 85% (95%CI 76-91% and positive predictive value (PPV) of 39% (95%CI 20-61%). ORT had SN 22% (95%CI 9-40%), SP 82% (95%CI 72-89%) and PPV 30% (95% CI 13-53%). DAST-20 had SN 10% (95%CI 1.0-37%, SP 79% (95%CI 69-86%) and PPV 8.7% (95% CI 1.1-28%) for aberrant OA related behavior.

Conclusions: Compared with DAST-20 and ORT, we found that SOAPP-R has superior test characteristics for detecting aberrant opioid drug-related behavior by PDMP criteria in ED patients where OA treatment was considered.

Primary Presenter: **Janet Kim**

Project Title: *Decreased regional gray matter volume in male adolescents with substance use disorder and limited prosocial emotions*

Primary Mentor: Joseph Sakai

Thematic Area: Clinical Science

Abstract:

**Objective:** Prior studies have looked at regional gray matter brain differences in adolescents with substance use disorders (SUD); however, SUDs often have many common comorbidities including conduct disorder (CD). CD can be further subtyped as with or without limited prosocial emotions (LPE) in which those with LPE are characterized by high levels of callous-unemotional traits. In this study, we compared regional gray matter volume of male adolescents with SUD and CD-plus-LPE to healthy community youth. **Methods:** Of 38 male adolescents (15-17 years), 20 had SUD and CD-plus-LPE and 18 were typically developing controls without these conditions. We obtained T1-weighted volumetric magnetic resonance images and used voxel-based morphometric toolbox (VBM8) to analyze regional gray matter volume differences. **Results:** Compared to controls, adolescents with SUD and CD-plus-LPE were found to have significantly less gray matter volume in two clusters. Cluster 1 involved the left frontal inferior pars triangularis and orbitalis, middle frontal gyrus and Brodmann area 11. Cluster 2 included the right angular gyrus, middle temporal gyrus, supramarginal gyrus, superior temporal gyrus, and a very small portion of precuneus. **Conclusions:** Compared to typically developing youth, male adolescents with SUD and CD-plus-LPE were shown to have decreased gray matter volume in the ventrolateral prefrontal cortex (vlPFC; Cluster 1), orbitofrontal cortex (OFC; Cluster 1), the temporoparietal junction (TPJ; Cluster 2) and a very small portion of the precuneus (Cluster 2). These areas have been associated with inhibition (vlPFC), reward and valuation in decision making (OFC), and social cognition and perspective taking (TPJ). Our findings are consistent with previous work showing adolescents with SUD and/or CD-plus-LPE may differ from typically developing youth in decision making related to reward, inhibition and social cognition.

Primary Presenter: **Queenter Kisang**

Project Title: *Increasing the number of community members with an advance care directive using education in rural Colorado.*

Primary Mentor: Mark Deutchman

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

ABSTRACT:

INCREASING THE NUMBER OF COMMUNITY MEMBERS WITH AN ADVANCE CARE DIRECTIVE USING EDUCATION IN RURAL COLORADO. QM Kisang (MS IV). University of Colorado €“ School of medicine, Aurora, Colorado.

Background:

Despite advancement in technology and care for the sick, there are still many people that have no well-informed advanced care directive(ACD) or advance care plan (ACP) in place if they are unable to advocate for themselves.

Objective:

The hypothesis of this study is that because patients are not well informed about the importance, details and process to attain and update an ACD, there is a high number of people in the local community that do not have an ACD. The aim of this study is therefore to show that there will be an increase in the number of people who have an advance care directive in place by providing education to the patient population in order to help facilitate discussions about having an ACD and filling one out.

Methods:

Adult members of the local community (Lamar, Colorado) were invited to attend a lecture about the elements and importance of the Colorado MOST form that is being used in the primary care office as part of Advance Care Directives (ACD) and planning. 15 members (5 males and 10 females) of the community participated. They were given a written survey immediately before and after the lecture with the goal of seeing their level of education about ACD before and after the lecture and if they were more willing to fill one out after the lecture. Those who indicated that they wanted to participate in follow up were called six months later to see if they did talk to their care providers about an ACD and filled one out.

Summary of results:

Of the 15 people who attended the lecture; 5(33.3%) reported knowing somewhat about an ACD, 8(53.3%) reported knowing only about its existence, while 2(13.3%) had never heard of it before. After the lecture and discussions; 3(20%) reported knowing all of its features, 9(60%) reported knowing most of its features and 3(20%) reported knowing somewhat about it. Before the lecture and discussion

5(33.3%) recorded that having an ACD was very important and 8(53.3%) reported it was important while 2(13.3%) indicated it was not really important. However, after the lecture and discussion, 13(86.7%) reported that it was very important and 2(13.3%) indicated that it was important. Of the 13 people who indicated they were going to talk to their care providers about having an ACD, during our six months follow up, 3(23.1%) reported that they had had the discussion with their care provider and had updated an existing ACD plan, 5(38.5%) reported that they had talk to their care provider and filled out a new ACD plan, 2(15.3%) reportedly talked to their provider and were scheduled to get documentation done during their next visit while 3(23.1%) had not seen their care provider yet but were very sure that they were going to talk about an ACD during their next visit.

#### Conclusion:

Educating a rural community about what an ACD is and why it is important resulted in an increase in the number of people that talked to their loved ones about ACD and the number of people who eventually fill one out

Primary Presenter: **John Koopman**

Project Title: *Discover Health Project: Rural Community Outreach and Health Education Through Library-Based Programs*

Primary Mentor: Mark Deutchman

Thematic Area: Public Health and Epidemiology

Abstract:

Rural areas in Colorado have reduced access to health education resources when compared with urban cities. Resources such as health outreach initiatives, museum health exhibits, and medical programming are valuable and beneficial to all communities. The primary overarching goal and purpose of the Discover Health project is to improve access to health-related educational materials by physically bringing these resources into the communities that need them the most. Individuals are thus enabled to learn about pertinent health issues and encouraged to actively engage in decisions regarding their own health. A bilingual library-based rotating health exhibit with interactive educational programming was developed to target high need areas, with the highest need areas identified as primarily rural and Hispanic communities. An additional project goal identified was to increase long-term healthcare access, literacy, and support in these communities by encouraging local youth to pursue careers in the various health fields. This goal was also incorporated into the project in almost all aspects. As of this writing, the exhibit has completed rotations at nine libraries. The achievement of goal outcomes is measured through collected pre and post surveys of the health education programming, as well as via demographic data and surveys of the exhibit as a whole to measure the effectiveness of these educational methods. The project has potential to make major positive contributions to the health literacy of these communities. Preliminary data collected from the programming surveys shows a modest and statistically significant improvement in health knowledge and participant feedback that the programming is effective and stimulating for the public. However, data is lacking regarding other aspects of the project including use of the interactive exhibits and the exhibit's capability to foster interest in the health professions.

Primary Presenter: **Alex Kretowicz**

Project Title: *Chromoblastomycosis within a Traumatized Nevus*

Primary Mentor: Whitney High

Thematic Area: Clinical Science

Abstract:

Chromoblastomycosis (CBM) is a chronic and progressive cutaneous and subcutaneous mycosis that presents clinically with polymorphic, hyperkeratotic, scaly, verrucous plaques or nodules, and histologically as muriform yeast.<sup>1</sup> This disease is caused by fungi of the Dematiaceae family (most commonly *Fonsecaea pedrosoi*), a group of dimorphic, filamentous molds distinguished by their melanin production.<sup>1-6</sup> This case report discusses a 43-year-old female presenting with a longstanding ulcerated mole on her right hand. She desired removal for it was becoming bothersome. Histologic examination revealed a traumatized nested nevocytic process without malignant features. On very close inspection; however, there were a few areas with acute neutrophilic inflammation and round, double walled, pigmented brown structures resembling copper pennies (Medlar bodies). Periodic acid-Schiff (PAS) staining and Gomori's methenamine silver (GMS) staining both highlighted the fungus, and Fontana Masson staining highlighted melanin, in the fungus. With the diagnosis of CBM, the patient was started on Itraconazole with a plan for one year course. To our knowledge, this is the first report of CBM present within a nevus. Of course the unexpected comingling of a CBM within a large nevus could have easily led to misdiagnosis, particularly given the scarce Medlar bodies.<sup>7</sup> When reviewing any traumatized nevus, a careful search for complicating infections or circumstances should not be overlooked.

Primary Presenter: **William Kromka**

Project Title: *A systematic review of predictors of adult mental health emergency department recidivism and interventions to reduce recidivism*

Primary Mentor: Scott Simpson

Thematic Area: Clinical Science

## Abstract:

### Background

Frequent utilizers of the emergency department are a minority of patients that account for a majority of visits to psychiatric emergency services and general emergency departments.

### Objective

The primary aim of this systematic review is to synthesize the literature by describing patient characteristics correlated with adult mental health ED recidivism and the efficacy of interventions for reducing recidivism.

### Methods

A systematic review of the literature was performed following a PRISMA protocol checklist in PubMed, PsycINFO, and Google Scholar databases.

### Results

Thirty-one articles, mostly retrospective cohort studies, met inclusion criteria. The most commonly studied socio-demographic and clinical characteristics associated with frequent users were age, homelessness, diagnosis of schizophrenia or a substance use/abuse disorder, and receipt of current psychiatric treatment. There were seven different categories of interventions that were studied; only two demonstrated a significant reduction in recidivism.

### Conclusions

Based on the current literature, high utilization of emergency mental health care is most strongly associated with financial and economic factors. These frequent users are also typically characterized as having substance use/abuse disorders, a diagnosis of schizophrenia, and current psychiatric treatment. Though most interventions have been unsuccessful in mitigating recidivism, certain ED-based interventions that modified patient care based on the acute clinical needs demonstrated a significant

reduction in recidivism. Further interventions should involve modifications to care at the level of the hospital as well as the community and follow-up care.

Primary Presenter: **Colton Ladbury**

Project Title: *Impact of Estimated Dose of Radiation to Immune Cells on Outcomes Following Chemoradiation for Locally-Advanced Non-Small Cell Lung Cancer*

Primary Mentor: Sameer Nath

Thematic Area: Clinical Science

Abstract:

Purpose

Emerging data suggests that unintended radiation dose to the host immune system may contribute to tumor progression and death in patients undergoing treatment for locally-advanced non-small cell lung cancer (LA-NSCLC). Previously, a model for calculating the estimated dose of radiation to immune cells (EDRIC) was found to be associated with clinical outcomes in patients with LA-NSCLC treated with definitive chemoradiation on RTOG 0617. The aim of this study was to externally validate this association in an independent cohort.

Methods

From 2004 to 2017, 117 patients with stage III NSCLC were treated with curative-intent chemoradiation. EDRIC was calculated as a function of the number of radiation fractions and mean doses to the lung, heart, and the remaining body. The primary endpoint was overall survival (OS), and secondary endpoints were local progression-free survival (LPFS) and disease-free survival (DFS).

Results

The median follow-up for all patients was 16 months with 77% of patients followed until death. Median EDRIC was 6.1 Gy (range, 2.5-10.0 Gy). Use of intensity-modulated radiation therapy trended towards a lower EDIC ( $p=0.07$ ). A higher EDRIC correlated with a lower absolute neutrophil count ( $p=0.0007$ ) and absolute lymphocyte count nadir ( $p=0.0007$ ). On multivariate analysis, EDRIC was significantly associated with OS (HR 1.17,  $p=0.03$ ), LPFS (HR 1.17,  $p=0.02$ ), and DFS (HR 1.15,  $p=0.04$ ), whereas total radiation dose and planning target volume were not.

Conclusion

This study supports the association of estimated dose of radiation to immune cells in the host with increased myelosuppression and worsened tumor control and survival following the definitive treatment of LA-NSCLC. Tailoring radiotherapy to spare the immune system may be an important future direction to improve outcomes in this population.

Primary Presenter: **Kevin Lee**

Project Title: *Breathing Easier: Improving COPD Screening and Diagnosis at Evans Army Community Hospital*

Primary Mentor: Jaime Baker

Thematic Area: Clinical Science

Abstract:

### Introduction

Chronic Obstructive Pulmonary Disease (COPD) is a severe cause of morbidity and mortality in the aging military veteran population. Studies have shown that COPD is underdiagnosed or improperly diagnosed, and often not formally evaluated until irreversible pulmonary damage is present. Emerging data suggests that COPD progression occurs most rapidly at the beginning of the disease, and early identification and intervention could alter the disease course and improve patient outcomes. We endeavored to determine the adherence to the GOLD criteria of COPD diagnosis in the Evans Army Community Hospital (EACH) Internal Medicine Clinic as well as assess the utilization of COPD screening criteria for early identification of COPD.

### Methods

We conducted a retrospective chart review in the AHLTA electronic medical record on 100 patients seen between October 2016 and September 2017 using several ICD codes related to COPD. We collected data on gender, age, spirometry history, existing COPD diagnosis, and smoking history. Patient records were evaluated for COPD screening appropriateness adherence to the GOLD Criteria of COPD diagnosis, including PFTs. In a smaller subset of patients, PFTs were more closely evaluated.

### Results

Less than 50% of patients meeting COPD screening criteria - ever-smokers with one respiratory symptom - received spirometry for work up of COPD. Of the patients with COPD, 75% diagnoses had no record of confirmatory spirometry €“ a key component of GOLD Criteria. Of the subset of patients whose spirometry results were more closely evaluated, 25% had misinterpreted pulmonary function tests.

### Discussion

COPD is a severe cause of morbidity and mortality in the patient populations seen regularly in VA and military outpatient clinics. Although our study was limited to only 100 patients over a one-year period, our data suggests that there are significant barriers preventing patients with, or at risk of developing, COPD from receiving best standard of care. One obvious barrier, both to our study and to patient care, is

the AHLTA electronic medical record, where it is difficult to locate spirometry results or even an accurate smoking history. In order to overcome this barrier, we instituted a systematic procedure change to track smoking history and spirometry results in the preventative medicine section of AHLTA. Since this section is already utilized to track aspects of care such as diabetic foot screening, colonoscopies, and influenza vaccines, our goal is to make smoking history and PFT results significantly more accessible, helping to improve adherence to the GOLD criteria, and to expedite workup, diagnosis, and ultimately treatment of COPD.

Primary Presenter: **Gina Lee**

Project Title: *Discover Health*

Primary Mentor: Mark Deutchman

Thematic Area: Public Health and Epidemiology

Abstract:

Rural areas in Colorado have reduced access to health education resources when compared with urban cities. Resources such as health outreach initiatives, museum health exhibits, and medical programming are valuable and beneficial to all communities. The primary overarching goal and purpose of the Discover Health project is to improve access to health-related educational materials by physically bringing these resources into the communities that need them the most. Individuals are thus enabled to learn about pertinent health issues and encouraged to actively engage in decisions regarding their own health. A bilingual library-based rotating health exhibit with interactive educational programming was developed to target high need areas, with the highest need areas identified as primarily rural and Hispanic communities. An additional project goal identified was to increase long-term healthcare access, literacy, and support in these communities by encouraging local youth to pursue careers in the various health fields. This goal was also incorporated into the project in almost all aspects. As of this writing, the exhibit has completed rotations at nine libraries. The achievement of goal outcomes is measured through collected pre and post surveys of the health education programming, as well as via demographic data and surveys of the exhibit as a whole to measure the effectiveness of these educational methods. The project has potential to make major positive contributions to the health literacy of these communities. Preliminary data collected from the programming surveys shows a modest and statistically significant improvement in health knowledge and participant feedback that the programming is effective and stimulating for the public. However, data is lacking regarding other aspects of the project including use of the interactive exhibits and the exhibit's capability to foster interest in the health professions.

Primary Presenter: **Jeffrey Lee**

Project Title: *Using Adenoma Weight and Volume to Predict Multigland Disease in Primary Hyperparathyroidism*

Primary Mentor: Maria Albuja-Cruz

Thematic Area: Clinical Science

Abstract:

**Introduction:** Intraoperative parathyroid hormone monitoring (IPM) is the current gold standard for intraoperative determination of multi-gland disease (MGD) in patients with primary hyperparathyroidism (PHPT). A prior study found that the risk of persistent disease after a minimally invasive parathyroidectomy (MIP) is higher if the weight of the resected gland is  $\geq 200$ mg. The purpose of this study is to determine if the weight or volume of the first resected adenoma can serve as a reliable predictor of MGD. This would provide surgeons with immediate and inexpensive information to assist with the decision of conversion from a MIP to bilateral neck exploration (BNE).

**Methods:** Retrospective review of prospectively collected data of 469 consecutive patients who underwent initial parathyroidectomy for PHPT at a single tertiary medical center from January 2010 to June 2015 was performed. IPM was used in all cases and an intraoperative cure was defined by a  $>50\%$  drop of the preoperative parathyroid hormone (PTH) at 10 minutes after excision and a PTH value within normal limits. One hundred seventy-six patients met criteria for inclusion in this study. Data were analyzed for patient demographics, operative procedure, first resected adenoma weight and volume, the presence of MGD, complications, cure, and persistent disease.

**Results:** Of the 176 patients, 75% had a single adenoma and 25% had MGD. The mean weight for the single adenoma group was 866 mg compared to 476 mg for the MGD group ( $P < 0.05$ ). A weight of  $\geq 200$ mg was used as a cutoff to distinguish a single adenoma from MGD (sensitivity 84%, specificity 37%, PPV 79%, NPV 44% and accuracy 72%;  $P = 0.79$ ).

The mean volume for the single adenoma group was 1.11cm<sup>3</sup> compared to 0.53cm<sup>3</sup> for the MGD group ( $P < 0.05$ ). A volume of  $\geq 0.3$ cm<sup>3</sup> was used as cutoff to differentiate a single adenoma from MGD (sensitivity 74%, specificity 50%, PPV 82%, NPV 39% and accuracy 68%;  $P = 0.98$ ).

Final cure for PHPT was achieved in 97% of the patients included in the study. The median follow-up was 25 months.

**Conclusions:** Weight and volume of the first resected adenoma are not accurate measures to determine the presence of MGD in patients with PHPT, despite a significant difference in mean weight and volume between the single adenoma vs. MGD groups. Surgeons'™ judgment and IPM remain paramount in the operative management of patients with PHPT.

**Keywords:** primary hyperparathyroidism, parathyroid weight, parathyroid volume, multigland disease.

Primary Presenter: **Katy Lehenbauer**

Project Title: *Hyperoxia Tolerant Rats May Serve as an Ideal Aging Model in Studying Age-Related Diseases*

Primary Mentor: John Repine

Thematic Area: Basic Biomedical Science

Abstract:

A novel strain of rat which survives indefinitely in hyperoxia has been shown to display many advantageous characteristics, including the ability to resist oxidative stress, acute respiratory distress syndrome (ARDS), anxiety, obesity, diabetes, and fatty liver development, while also being able to live and exercise longer. These rats offer a promising aging model in further research of combating disease and the rising costs of health care. An initial goal of this individual project was to find a minimally invasive tolerance phenotype sorting method for F2rats based on blood PMN/MNC ratios so that F2 non-tolerant rats may serve as a genetically similar control for tolerant rats in ongoing studies; a secondary goal of this project was to further study differences in tolerant and control livers at a baseline and after being fed high fat diets in fatty liver development. Blood PMN/MNC ratios were determined via sample collection and manual counting; hyperoxia challenge was conducted in a 100% oxygen chamber. Livers were studied using Anti-CD163 antibody. A significant difference in blood PMN/MNC ratios was determined in SD control and tolerant rats; however, the phenotype of hyperoxia tolerance was not able to be predicted in F2 rats based on respective PMN/MNC ratios. Liver staining showed decreased expression of CD-163 in high fat diet challenged tolerant rats, providing additional evidence that the tolerant rats resist fatty liver development. Further studies will be conducted to continue to characterize and determine the origin of superiority in the novel rat strain.

Primary Presenter: **Caleb Liberman**

Project Title: *FOOD EDUCATION AND ENVIRONMENTAL DEVELOPMENT IN AURORA: A FOOD INSECURITY INTERVENTION PROGRAM PILOT STUDY*

Primary Mentor: Liliane Diab

Thematic Area: Public Health and Epidemiology

Abstract:

Food insecurity is a local, national, and global concern that has been implicated as a contributing factor to the cycle of poverty and has significant impacts on child health. Communities across the United States report difficulty accessing food and food insecurity, and the USDA reported that 9.4% of American children experienced food insecurity in 2015. In an effort to combat food insecurity in Aurora, Colorado, the Food Education and Environmental Development (FEED) Aurora program was created. The purpose of this study was to investigate the efficacy of the FEED Aurora program on health attitudes in participants. Twenty-seven children ages 6-13 years old participated in the inaugural FEED Aurora summer program, which consisted of eight summer sessions centered on lessons of food, health, and wellness. A validated intake and exit survey supplied by Cooking Matters was administered to all program participants. The data collected from these surveys was analyzed using a paired two-tailed Student's t- test and did not demonstrate a statistical difference between the intake and exit surveys for any of the 13 qualitative questions. Of the twenty-seven participants, seventeen children graduated from the FEED Aurora program; the requirements for graduation were attendance at four out of the eight sessions. While improvements in healthy eating attitudes were expressed by the FEED Aurora participants qualitatively, there were several limitations with the data collection that obscured the quantitative results. Overall, there remains promise in programs that incorporate both cooking and gardening components for pediatric populations; however, there remains difficulty in quantifying the effects of such programs through survey data.

Primary Presenter: **Taylor Lynch**

Project Title: *The Importance of Clinical Experience in the Preclinical Years of Medical School and Curriculum Reform; a Case Based study*

Primary Mentor: Dave Richards

Thematic Area: Global Health

Abstract:

Abstract:

Introduction: The purpose of this work was to perform a literature review, analyze a case, and finally propose curriculum reform to better prepare University of Colorado School of Medicine (CUSOM) medical students both clinically and ethically for their third- and fourth-year clinical clerkships as well as for international rotations for Global Health Track (GHT) students.

Case Presentation: The case analyzes a 37-year-old male polypharmacy overdose in Cape Town, South Africa. A medical student doing an international rotation was placed in a difficult ethical position where he was asked by a local physician to place a central line with little prior training.

Management and Outcome: The resident walked the student through the placement of the femoral central line and the patient ultimately survived and was discharged several days later.

Discussion: This paper argues for a curriculum reform including a basic and advanced skills course required for first and second year medical students. Additionally, the paper will also discuss several ethical and cultural cases designed to better prepare students for international rotation through the South African Emergency Medicine Foundation (SAEMF).

Conclusions: Early clinical skills exposure as well as case-based ethical scenarios better prepare students for the demands of the second half of medical school as well as international rotations

Primary Presenter: **Madison Lyon**

Project Title: *Overall Survival and Quality of Care in Rural vs. Urban Patients Undergoing Radical Cystectomy*

Primary Mentor: Shandra Wilson

Thematic Area: Clinical Science

Abstract:

Overall Survival and Quality of Care in Rural vs. Urban Patients Undergoing Radical Cystectomy

Category: urologic oncology

Abstract:

**Background and Objectives:** There are known disparities in health care access between rural and urban areas within the U.S., which may have significant repercussions for patient outcomes. The purpose of this study was to assess for differences in quality of care indicators and survival of patients with muscle-invasive bladder cancer (MIBC) who underwent radical cystectomy (RC) from urban versus rural areas.

**Methods:** A retrospective review was performed to identify patients who underwent RC for MIBC at the University of Colorado Hospital between 2004 and 2016. Electronic medical records were reviewed for patient demographic and clinical data. Home addresses were geocoded to a latitude/longitude location and loaded into ArcMAP to determine urbanicity. The primary outcome measure was overall survival (OS). As a secondary objective, quality of care indicators, including time to RC following MIBC diagnosis and percentage of patients receiving neoadjuvant chemotherapy, were assessed. Multivariable logistic regression analysis was performed.

**Results:** 437 patients were analyzed, including 321 (73.5%) urban patients and 116 (26.5%) rural patients. Mean age was 67.6 years (range 31-91 years). Median follow-up was 81.6 months (13-170.2 months). After controlling for age and comorbidities, there was no difference in OS between urban and rural patients (55.3% vs. 56.9%, respectively,  $p=0.33$ ). Rural patients were more likely to work in an occupation associated with a higher risk of bladder cancer ( $p=0.02$ ) and less likely to smoke ( $p=0.05$ ) than urban patients. There was no significant difference in quality of care indicators between urban and rural patient populations.

Conclusions: At our academic tertiary care institution, patients from rural locations undergoing RC for MIBC did not have worse OS or quality of care, as measured by timely RC and prevalence of receiving neoadjuvant chemotherapy. While needing further study, these results are encouraging that, despite barriers to accessing treatment, patients from rural locations are receiving similar care at our institution to those in a more proximate, urban setting.

Funding: University of Colorado Cancer Center

Primary Presenter: **Anirudh Madabhushi**

Project Title: *Comparison of Different Surgical Approaches to Inferior Oblique Overaction*

Primary Mentor: Dr Jasleen Singh

Thematic Area: Clinical Science

Abstract:

**BACKGROUND:** Inferior oblique overaction (IOOA) is a common condition seen by pediatric ophthalmologists, either primary or with other forms of strabismus[1]. Surgery is the primary intervention[2-4]. The purpose of this study is to compare surgical outcomes of recession, anteriorization, myotomy and myectomy.

**METHODS:** A retrospective chart review of all patients undergoing IOOA correction from July 2010 to March 2017 at the Children's Hospital of Colorado was performed. Preoperative grading of IOOA (+0.5 to +4.0) was compared to post-operative IOOA (0 to +4.0). Decrease in IOOA was considered a success with resolution (grade 0) of IOOA.

**RESULTS:** There were a total of 296 patients with 408 eyes. Gender and age were similar across surgery types. 95.1% of patients had a decrease in IOOA with recession (n=183) of the inferior oblique while 86.3% decreased to no IOOA. Anteriorization of the inferior oblique (n=127) decreased overactivity in 97.6% of patients with 83.5% improving to zero degree of IOOA. Myotomy of the inferior rectus (n=91) was found to decrease overaction in 98.9% of patients and reduce IOOA to zero in 89.0%. Myectomy (n=7) patients had zero post-operative IOOA in all seven eyes. There was no significant difference between type of surgery and outcome.

**CONCLUSION:** All four surgical interventions were found to be equally successful in reducing the amount of IOOA. There is no inferior surgical intervention when choosing an approach to IOOA. Myotomy is technically faster and safer as it does not require suturing to the globe.

Primary Presenter: **Jacob Mago**

Project Title: *The Extremity/Mechanism/Shock Index/GCS (EMS-G) Score: A Novel Pre-Hospital Scoring System for Early and Appropriate MTP Activation*

Primary Mentor: Franklin Wright

Thematic Area: Clinical Science

Abstract:

Abstract

Background: Numerous in-hospital scoring systems to activate massive transfusion protocols (MTP) have been proposed; however, to date, pre-hospital scoring systems have not been robustly validated. Many trauma centers do not have blood or pre-thawed plasma available in the trauma bay, leading to delays in balanced transfusion. This study aims to assess pre-hospital injury and physiologic parameters to develop a pre-hospital scoring system predictive of need for massive transfusion (MT) prior to patient arrival.

Methods: A retrospective review of all adult trauma activations and alerts from July 2014-July 2018 from an urban level 2 trauma center was performed utilizing our trauma registry. Logistic regression model with stepwise regression multivariate analysis was performed to develop a new scoring system, with point totals assigned proportional to the odds ratios of requiring MT for each variable. Internal validation of the EMS-G score was performed using a subset of the data which was not utilized for development of the scoring system, and sensitivity and specificity were compared to previously validated in-hospital scoring systems applied in the pre-hospital setting.

Results: 763 patients were included with 94 patients (12.3%) receiving early MT, defined as 4 units pRBC in 4h or ED death. In-hospital models for predicting MT such as Assessment of Blood Consumption (ABC) or Shock Index (SI) have sensitivities and specificities of 46/85% and 94/79%, respectively for early MTP utilization based on pre-hospital data. Pre-hospital variables found to be predictive of MT were used to develop the EMS-G (Extremity, Mechanism, Shock Index, GCS) score. This system assigns obvious extremity injury €“1 point, penetrating mechanism €“2 points, shock index  $\geq 0.9$  -2 points, GCS  $\leq 8$  €“3 points. A score of 3 or greater was chosen to maximize sensitivity and specificity for pre-hospital MT activation. EMS-G score based on pre-hospital report is 89% sensitive, 84% specific, with a PPV of 44% and NPV of 98% for early MT. Using this system, 25% of trauma activations met criteria for pre-hospital MTP activation.

Conclusion: The EMS-G Score has increased sensitivity and specificity compared to the ABC Score in the pre-hospital setting and appears more appropriate than shock index alone at predicting massive transfusion. This scoring system allows trauma centers to activate MTP prior to patient arrival to ensure early and appropriate blood product administration without creating unnecessary blood product waste.

Primary Presenter: **Evan Manning**

Project Title: *The Addition of Oblique Radiographs in the Evaluation of Sacroiliitis*

Primary Mentor: Liron Caplan

Thematic Area: Clinical Science

Abstract:

Abstract:

Objectives

Sacroiliac joint (SIJ) radiographs are used to evaluate sacroiliitis in patients with suspected ankylosing spondylitis (AS). However, inconsistency in plain film techniques is well-documented and current dogma advocates against oblique images despite preliminary data suggesting better correlation with magnetic resonance imaging. This study evaluated whether the addition of oblique radiographs altered reliability in grading sacroiliitis using the modified the New York criteria (mNY), assessment of sacroiliitis severity, classification of AS, or reader confidence in scoring.

Methods

SIJ radiographs of US Veterans enrolled in the Program to Understand Long-term Outcomes of Spondyloarthritis (PULSAR) registry were evaluated by three readers using the mNY criteria. Inter-reader reliability was compared between Ferguson-views alone and Ferguson-views supplemented with oblique views. Mean mNY radiographic score and the proportion of patients meeting diagnostic criteria for AS were compared between one- and three-view radiographs. Patient characteristics were evaluated for association with severity of SIJ disease.

Results

Oblique radiographs did not improve inter-reader reliability in mNY scoring compared to Ferguson views alone (Kappa 0.305 vs 0.298,  $p>0.05$ ). Oblique views however did increase the mean mNY score compared to single-view radiographs (3.06 vs 2.82,  $p<0.001$  by t-test), improved reader confidence ( $p<0.001$ ), and increased the percentage of patients meeting AS classification (83% vs 73%). Mean three-view scores were also more predictive of treatment history.

Conclusions

Although oblique radiographs did not improve inter-rater reliability in scoring sacroiliitis, the increase in severity scoring and AS diagnoses from these added views may result in earlier diagnosis and treatment.

Primary Presenter: **Joshua Mares**

Project Title: *Synergistic Reduction of Apoptosis With Diazoxide and Erythropoietin in Spinal Cord Ischemic Injury*

Primary Mentor: Brett Reece

Thematic Area: Basic Biomedical Science

Abstract:

Paraplegia remains a devastating complication of thoracoabdominal aortic intervention. Metabolic stress induces expression of beta common receptor sub-unit of erythropoietin (EPO) receptor (bcR) to exert a neuroprotective effect in spinal cord ischemia reperfusion injury (SCIR). Diazoxide (DZ) has been shown to induce ischemic tolerance. We previously reported that DZ upregulated bcR expression and enhanced the neuroprotective effects of EPO through the upregulation of bcR. We hypothesize that bcR expression induced by DZ

before ischemia amplifies the antiapoptotic effects of EPO in a murine model of SCIR. Methods. Experimental groups included phosphate buffered saline (PBS) pretreatment D PBS immediately

before the operation, PBSDEPO, DZDPBS, DZDEPO, and

sham. Spinal cord ischemia was induced by a 4-minute

thoracic aortic cross-clamp. Functional scoring (Basso

Mouse Score) was done at 12-hour intervals for 48 hours.

Spinal cords were harvested for histologic analysis, and

antiapoptotic factors (caspase 3, 8, and 9, B-cell lymphoma-2,

and neuroglobin) were evaluated by Western blot analysis.

Results. The motor function of DZDEPO group was

significantly preserved compared with all other groups.

The levels of cleaved caspase 8 and 3 in DZDEPO were

significantly lower than in the other groups. Mice treated

with DZDEPO had significantly fewer terminal deoxy-

nucleotide transferase-mediated deoxy uridine triphos-

phate nick-end labeling (TUNEL) positive cells than other groups.

Conclusions. Optimized upregulation of bcR by DZ

can increase the extrinsic antiapoptotic effects of EPO.

Better understanding of this synergetic mechanism may serve to help prevent ischemic complications caused by aortic intervention.

Primary Presenter: **Derek Marlor**

Project Title: *Utilization of Percentage of Predicted Forced Vital Capacity to Stratify Rib Fracture Patients: an Updated Clinical Practice Guideline*

Primary Mentor: Abid Khan

Thematic Area: Clinical Science

Abstract:

**INTRODUCTION:** Rib fractures are the most common injury found after blunt thoracic trauma and are a source of significant morbidity and mortality, in the elderly. Early identification of at-risk patients and appropriate hospital disposition are key to any effort to mitigate morbidity and mortality from these injuries, which often present in delayed fashion. There are several clinical practice guidelines (CPG) based on forced vital capacity that attempt to predict which patients are at high risk for decompensation, but most of them fail to consider patient characteristics such as age, height, or body habitus. These characteristics can significantly change a patient's clinical prognosis and are considered in Percentage of Predicted FVC (PP FVC). The goal of this study is to update current the CPG with values based on PP FVC instead of FVC and to determine appropriate hospital disposition for patients with rib fractures.

**METHODS:** A retrospective study of 266 patients with rib fractures was conducted. Patients were divided into three groups based on admission FVC of <1000, 1001-1500, or >1500 for analysis. Data was analyzed via ANOVA and Youden's J Index tests.

**RESULTS:** Patients that were placed in the high risk category were more likely to be older than 65, be admitted to the ICU, transferred to the ICU, be intubated, and have overall longer hospital stay. Updated CPG triage cutoffs for admission to ICU, Step Down, and Floor were redefined as PP FVC values of <25%, 25-45% and >45% respectively.

**CONCLUSION:**

The updated CPG based on PP FVC takes patient specific factors into account and may be a better tool to help predict patients that are at risk for decompensation following multiple rib fractures.

Primary Presenter: **Matthew Minturn**

Project Title: *Efficacy and impact of an LGBTQ health elective for first- and second-year medical and physician assistant students*

Primary Mentor: Rita Lee

Thematic Area: Public Health and Epidemiology

Abstract:

**INTRODUCTION:** Individuals who identify as lesbian, gay, bisexual, transgender, or queer (LGBTQ) face significant health disparities and barriers to accessing care. LGBTQ patients may face providers who lack knowledge of LGBTQ health issues, are biased, or express negative attitudes about LGBTQ patients. Despite growing evidence of this problem, U.S. and Canadian medical schools have traditionally offered few curricular hours dedicated to LGBTQ-related topics, and many medical students feel unprepared to care for LGBTQ patients. **METHODS:** We developed a 10-hour LGBTQ health curriculum for preclinical medical and physician assistant students. Content included LGBTQ terminology, inclusive sexual history taking, primary care and health maintenance recommendations, transition-related care, a panel discussion with LGBTQ community members, and practice with standardized patients. Participants were surveyed before and after completing the curriculum to assess for an increase in confidence and actual knowledge related to LGBTQ-specific care. **RESULTS:** Forty first- and second-year medical students completed the sessions and provided valid responses on the pre- and post-course surveys. Nearly all participants initially felt unprepared to sensitively elicit information, summarize special health needs and primary care recommendations, and identify community resources for LGBTQ individuals. There was significant improvement in participants' confidence in meeting these objectives after completion of the five sessions. Actual knowledge of LGBTQ health issues increased minimally, but with significant increase in knowledge of LGBTQ-related terminology. **DISCUSSION:** Our 10-hour LGBTQ health curriculum was effective at improving medical students' cultural competency and self-confidence in working with LGBTQ patients, but was less effective at increasing LGBTQ-related medical knowledge.

Primary Presenter: **Abbas Mulla**

Project Title: *Domains of quality for clinical ethics case consultation: a mixed-method systematic review*

Primary Mentor: Matt Wynia

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

Abstract

Background: “Clinical ethics consultation” (CEC) is the provision of consultative services by an individual or team with the aim of helping health professionals, patients, and their families grapple with difficult ethical issues arising during health care. There are almost 25,000 articles in the worldwide literature on CEC, but very few explicitly address measuring the quality of CEC. Many more address quality implicitly, however. This article describes a rigorous protocol for compiling the diverse literature on CEC, analyzing it with a quality measurement lens, and seeking a set of potential quality domains for CEC based on areas of existing, but hitherto unrecognized, consensus in the literature.

Methods/design: This mixed-method systematic review will follow a sequential pattern: scoping review, qualitative synthesis, and then a quantitative synthesis. The scoping review will include categorizing all quality measures for CEC discussed in the literature, both quantitative and qualitative. The qualitative synthesis will generate a comprehensive analytic framework for understanding the quality of CEC and is expected to inform the quantitative synthesis, which will be a meta-analysis of studies reporting the effects of CEC on pre-specified clinical outcomes.

Discussion: The literature on CEC is broad and diverse and has never been examined with specific regard to quality measurement. We propose a novel mixed-methods approach to compile and synthesize this literature and to derive a framework for assessing quality in CEC.

Primary Presenter: **Madhav Narayan**

Project Title: *Patient Preferences for Communication of Tailored Survival Estimates*

Primary Mentor: Larry Allen

Thematic Area: Clinical Science

Abstract:

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Abstract

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Background

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Despite the availability of validated risk scores for survival in heart failure (HF), individualized estimates are not typically provided directly to patients. This study sought to explore patient prefe

Primary Presenter: **Shane Nau**

Project Title: *COL4A1 Mutations in Two Infants with Congenital Cataracts and Porencephaly: An Ophthalmologic Perspective*

Primary Mentor: Emily McCourt

Thematic Area: Clinical Science

Abstract:

COL4A1 mutations present with a spectrum of clinical phenotypes often involving the cerebrovascular and ophthalmic systems. We present two cases of COL4A1 mutations that presented with congenital cataracts and porencephaly. Both patients had posterior cortical cataracts and radiographically-defined bilateral posterior lenticonus. Considering the long-term clinical implications of this mutation, pediatric ophthalmologists should consider COL4A1 mutations when confronted with posterior cortical cataracts, bilateral posterior lenticonus, and neurovascular pathology.

Primary Presenter: **David Nguyen**

Project Title: *Transitioning Super-Utilizers Back To Primary Care*

Primary Mentor: Jeremy Long

Thematic Area: Public Health and Epidemiology

Abstract:

TRANSITIONING SUPER-UTILIZERS BACK TO PRIMARY CARE. DQ Nguyen, (M.D., GS), ET Snyder (M.D., GS), KM Donovan, SS Sabalot, DJ Rinehart, and JA Long, Intensive Outpatient Clinic, Denver Health, Denver, CO.

The Intensive Outpatient Clinic (IOC) is a specialized clinic at Denver Health for healthcare super-utilizers dedicated to reducing their emergency department visits and inpatient admissions. However, the IOC has reached maximum patient capacity and many patients no longer require IOC-level resources. Researchers sought to understand what qualities of the IOC should be transferred to primary care to ensure a successful transition. 19 super-utilizers were interviewed regarding their IOC experiences. Interviewers also met with primary care staff regarding resources needed for transition. Patient interviews revealed three primary themes that conveyed the effectiveness of the IOC: kindness/friendliness, staff actions, and access. Combining patient and clinic staff voices, our transition recommendations include: establish patient/provider goals during initial IOC visit; perform periodic check-ins with the patient regarding these goals; identify patient necessities for health maintenance upon transition; acclimate patient to shorter appointment times before transitioning; bridge the transfer with a patient psychosocial needs assessment and a case manager; and provide the receiving clinic with centralized patient information.

Primary Presenter: **Nicholas Nguyen**

Project Title: *Can Faculty Predict Student Grades by Narrative Assessments: A review of medical student evaluations from 2007-2010.*

Primary Mentor: Christopher King

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

**Background:** Attendings at CUSOM within the department of internal medicine have been partial to assigning their learners an overall performance grade, which they include in their narrative assessments. This explicit grade prediction may remove the ambiguity that can arise from written evaluations.

**Objective:** The goal of this project was to determine how frequently attendings at CUSOM included predictions of their learner's overall performance in their narrative assessments, and whether these recommendations align with the student's final grade as determined by the grading committee.

**Methods:** We reviewed 3 years of evaluation comments, academic year (AY) 2007-10, from attending physicians overseeing students on the Hospitalized Adult Care Block of the CUSOM Phase III Curriculum. An evaluation was considered as containing a prediction if a descriptor of "pass", "high pass", or "honors" was included in the evaluation and was used to describe clerkship performance.

**Results:** Of the 943 evaluations reviewed, 63 evaluations contained a prediction (6.68%). Of the 44 predictions with final grades, the breakdown of correctly predicted grades were as follows: 72.40% correctly predicted honors, 33.33% correctly predicted high pass, and 66.67% correctly predicted pass. The accuracy of overall predictions was 61.40%.

**Conclusions:** Our project evaluated one component of assessments commonly incorporated in written evaluations. Given the above findings, we suggest further investigation into how both faculty and students view the utility of predictions and whether they clarify how the student performed clinically. This knowledge will be helpful to clerkship directors nationally in assigning normative grades as it will inform if these statements should hold any weight, and how the grading committee should view this language when allocating grades.

Primary Presenter: **Phuong Nguyen**

Project Title: *Neural Responses Are Abnormal During Reflexive Blinking in Blepharospasm: An Event-Related fMRI Study*

Primary Mentor: Brian Berman

Thematic Area: Clinical Science

Abstract:

**Objective:** Use functional MRI (fMRI) to investigate the neural mechanisms underlying reflexive blinking in blepharospasm (BSP) patients compared to healthy controls (HC).

**Background:** Blepharospasm (BSP) is an isolated focal dystonia characterized by increased blinking and involuntary muscle spasms of the eyelid. While the etiology of BSP remains unknown, many studies suggest it is associated with dysregulated inhibition and abnormal sensorimotor integration.

**Design/Methods:** 15 BSP patients and 15 HC were recruited. Randomly timed air-puffs to the left eye were used to induce reflexive eye blinks during an 8-min fMRI scan. Continuous surface electromyography and video recordings were used to monitor blink responses. Data were analyzed using an event-related design with SPM12. Significance for voxel-wise analysis was defined as  $p < 0.05$ , corrected for multiple comparisons using the autocorrelation function approach incorporated into the 3dClustSim function in AFNI.

**Results:** Data from one BSP subject was excluded due motion artifact. Data from 15 HC (11F, age 60.9 +/- 5.5) were compared to that of 14 BSP (10F, 61.6 +/- 8.0). Reflexive eye blinks in HC were associated with activation of the right anterior cingulate and left insular cortices. Compared to HC, BSP patients showed increased activation in the right post-central gyrus, left precentral gyrus, and left occipital cortex. BSP disease duration negatively correlated with reflexive-blink activity in the cerebellum and in the right temporal gyrus. Disease severity (Jankovic Rating Scale) negatively correlated with activity in the dorsal pons and left occipital cortex.

**Conclusions:** Reflexive blinking in BSP is associated with increased activation in sensorimotor cortices suggesting a loss of inhibition within the sensorimotor network. Decline in cerebellar activity with disease duration suggests an adaptive role, while reduced response during reflexive blinking in the pons with increasing disease severity suggests that changes in the corneal blink reflex circuitry are linked to the manifestation of symptoms.

Primary Presenter: **Caroline Nguyen**

Project Title: *Small molecule inhibition of CXCR3 attenuates experimental model of Crohn's disease*

Primary Mentor: Eoin McNamee

Thematic Area: Basic Biomedical Science

Abstract:

**Purpose of Study:** Inflammatory bowel disease (IBD) is a group of disorders characterized by idiopathic chronic inflammation of the intestine. Though IBD affects millions of individuals in the US and is responsible for billions of health care dollars, there is very limited treatment and no cure for the disease. Previous investigators have implicated the importance of the chemokine receptor CXCR3 in the propagation of IBD, as evidenced by the increased expression of its ligands in diseased tissue. Our work aims to discover the expression profile of CXCR3 and its ligands CXCL9, CXCL10, and CXCL11 and whether a small molecule inhibitor of CXCR3, AM487, can attenuate the murine model of Crohn's disease, a subset of IBD.

**Methods Used:** Mice to be treated with the small molecule inhibitor received once daily subcutaneous injections of the drug for 10 days. Real time PCR, flow cytometry, ELISA, FACs sorting, and histology were used to evaluate the expression profile of CXCR3 and its ligands, the cytokine phenotype of the cells expressing CXCR3, and the extent of disease.

**Summary of Results:** CXCR3 is expressed preferentially by inflammatory T cells in the gut, and these CXCR3+ T cells, and its ligands, are significantly increased in disease, at the site of inflammation. The small molecule inhibitor AM487 is capable of attenuating the severity of disease in the murine model of Crohn's disease.

**Conclusions:** CXCR3+ T cells play an important role in potentiating inflammation in the gut. Better understanding of its expression profile will allow for more specific and effective methods of treating Crohn's disease. We show that small molecule inhibition of CXCR3 is capable of mitigating disease severity in our model of IBD.

Primary Presenter: **Derek Nhan**

Project Title: *Using the Remnant ACL to Restore Knee Stability after Partial ACL Tear: Biomechanical Analysis using a Cadaveric Model*

Primary Mentor: Rushyuan (Jay) Lee

Thematic Area: Basic Biomedical Science

Abstract:

**Introduction:** Partial anterior cruciate ligament (ACL) tears can cause knee instability. Current treatment consists of replacing the torn ACL. We propose that a coring osteotomy to retension the residual ACL bundle restores knee stability after partial ACL tear in a cadaveric model.

**Methods:** In 8 adult cadaveric knees, we measured at 30° and 90° of flexion with the ACL intact (baseline) and in 3 conditions: 1) "partial-tear state" after sectioning the anteromedial ACL bundle; 2) "ACL-retensioned state" after performing an oblique coring osteotomy of the ACL tibial insertion to centralize and retension the posterolateral ACL bundle; and 3) "ACL-deficient state" after sectioning the remaining ACL.

**Results:** At baseline, mean ( $\pm$  standard deviation) translation was  $10 \pm 2.7$  mm at 30° of flexion and  $8.4 \pm 3.6$  mm at 90° of flexion. In the partial-tear state, all knees had greater anterior translation at 30° and 90° compared with baseline (both,  $P < .001$ ). In the ACL-retensioned state, translation was less than in the ACL-deficient state ( $P .001$  at 30° and 90°), and translation was not significantly different from the intact state (mean,  $9.2 \pm 1.8$  mm at 30° and  $7.2 \pm 2.2$  mm at 90°). ACL-deficient knees had significantly greater translation at 30° and 90° compared with all other states. Though rotational testing demonstrated the least laxity at 30° and 90° in the retensioned and intact states, respectively, and the most laxity in the deficient state, rotation was not significantly different between any of the states.

**Conclusion:** This study shows that, in the setting of ACL laxity with sufficient remnant tissue, reorientation and retensioning via a osteotomy of the remaining ACL fibers is a potential method to restore knee stability after a partial ACL tear.

Primary Presenter: **Bryan Nycz**

Project Title: *Evaluation of bloodstream infections, Clostridium difficile infections, and gut microbiota in pediatric oncology patients*

Primary Mentor: Dan Frank

Thematic Area: Basic Biomedical Science

Abstract:

Bloodstream infections (BSI) and Clostridium difficile infections (CDI) in pediatric oncology/hematology/bone marrow transplant (BMT) populations are associated with significant morbidity and mortality. The objective of this study was to explore possible associations between altered microbiome composition and the occurrence of BSI and CDI in a cohort of pediatric oncology patients. Stool samples were collected from all patients admitted to the pediatric oncology floor from Oct. 1<sup>st</sup> Dec. 2012. Bacterial profiles from patient stools were determined by bacterial 16S rRNA gene profiling. Differences in overall microbiome composition were assessed by a permutation-based multivariate analysis of variance test, while differences in the relative abundances of specific taxa were assessed by Kruskal-Wallis tests. At admission, 9 of 42 patients (21%) were colonized with C. difficile, while 6 of 42 (14%) subsequently developed a CDI. Furthermore, 3 patients (7%) previously had a BSI and 6 patients (14%) subsequently developed a BSI. Differences in overall microbiome composition were significantly associated with disease type ( $p = 0.0086$ ), chemotherapy treatment ( $p = 0.018$ ), BSI following admission from any cause ( $p < 0.0001$ ) or suspected gastrointestinal organisms ( $p = 0.00043$ ). No differences in baseline microbiota were observed between individuals who did or did not subsequently develop C. difficile infection. Additionally, multiple bacterial groups varied significantly between subjects with post-admission BSI compared with no BSI. Our results suggest that differences in gut microbiota not only are associated with type of cancer and chemotherapy, but may also be predictive of subsequent bloodstream infection.

Primary Presenter: **Stephan Papp**

Project Title: *Evaluating Progress in Female Representation and Reputation at a National Conference for Hospital Medicine*

Primary Mentor: Marisha Burden

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

Women hospitalists comprised only 26% of speakers at major national hospitalist meetings from 2006 to 2012 despite consistently being half of the academic workforce. This study consisted of a retrospective analysis of speakers or workshop leaders at the Society of Hospital Medicine National Convention for 2015 to 2018. The programs of each conference were collected and the gender and profession of each speaker was determined by web searches and direct communication when necessary. Of the 688 presentations given by hospitalist, only 238 (35%) were given by women. A significant discrepancy still exists among Society of Hospital Medicine presenters.

Primary Presenter: **Daniel Paz de Araujo**

Project Title: *Preoperative Surgical Risk Prediction: Historical Approaches, the SURgical Risk Preoperative Assessment System (SURPAS), and Future Directions.*

Primary Mentor:

Thematic Area: Clinical Science

Abstract:

Current preoperative surgical risk prediction emphasizes estimation of an individual patient's risk of postoperative complications through a combination of nationally reported values for aggregates of patients and each individual clinician's assessment of their patient's relevant comorbidities. This estimation frequently fails to provide accurate, individualized preoperative surgical risk prediction necessary to guide shared decision making, informed consent, and care optimization. Various quantitative risk prediction models have been proposed to offer patients and providers with accurate, quantitative preoperative risk assessment, however the clinical use of these models has generally been limited. This paper offers first a narrative review of relevant published literature to describe historical efforts at quantitative preoperative surgical risk prediction with specific focus on the successes and limitations of these tools. Second, the SURgical Risk Preoperative Assessment System (SURPAS), developed at the University of Colorado, will be described as an evidence-based approach to individualized preoperative surgical risk prediction. Finally, this paper will examine the future direction of individualized preoperative surgical risk prediction as a key component of emerging "prehabilitation" and "perioperative surgical home" (PSH) initiatives that effectively guide patient and provider decision making, standardize informed consent, and optimize perioperative interventions to improve postoperative outcomes.

Primary Presenter: **Paul Pelletier**

Project Title: *Literature Review*

Primary Mentor: Tyler Anstett

Thematic Area: Clinical Science

Abstract:

**Objective:** This is a qualitative review paper looking at published articles that address admission handoffs that occur when patients are transferred from the emergency department to other hospital services. The purpose of this paper is to thoroughly evaluate current handoff procedures, barriers to adequate handoffs, the interdepartmental relations that support or hinder handoffs, and possible way to improve the admission process.

**Methods:** A basic literature review was performed using PubMed and Embase. Exclusion criteria included non-full length articles (abstracts, conference reviews, and conference papers). A brief title and abstract review was used to find relevant articles.

**Results:** A total of 186 articles were found. After the abstract review, 34 of these articles were selected for full length review. Articles showed that handoffs are an opportunity for medical error or to catch mistakes already made depending on how they are performed. Handoffs are related to patient safety, job stress, and other hospital performance criteria. The fast paced nature of emergency departments and hospital wards, separated locations, professional differences, and communication problems can all contribute to poor handoffs. Possible interventions to improve handoffs include increased awareness of the importance of handoffs, creating an environment for collaboration, and using a standardized handoff technique.

**Conclusion:**

Interdepartmental interactions and relationships are an important part of modern medicine. Handoffs between services are significant for safe and efficient patient care and are worthy of the time and effort required to master them. Many possible improvements have been provided to improve handoff procedures, but further study is needed to examine their true value and effect on interdepartmental relations.

Primary Presenter: **Danielle Pite**

Project Title: *Why Do We Dance? Stories of Dance and Healing*

Primary Mentor: Robyn Gisbert

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

This project focuses on the importance of narrative medicine and the role of dance in health by telling the stories of dancers with various health conditions that participate in an integrated dance company. The dancers have varying abilities and disabilities and were interviewed to share the stories of why they dance and how participating in the integrated dance company has impacted their health. The goal was to use narrative medicine, an increasingly important tool in medicine, to shed light on how dance has helped them recover from injury and overcome expectations. Three main themes arose from the interviews and literature review: 1) dance as a form of physical therapy, 2) dance as a safe space to express emotions and process difficult events and 3) the importance of having a sense of community. The project brings a more personal side to medicine by using the art of storytelling. The hope is that these stories will provide health care providers with a more three-dimensional picture of how people across ability statuses can use dance to promote their health. COMIRB: 16-2762

Primary Presenter: **Aarti Prasad**

Project Title: *Engaging Teens in Weight Management Conversations*

Primary Mentor: Janet Meredith

Thematic Area: Clinical Science

Abstract:

Background: In Aurora, CO, childhood obesity rates are higher (36-41%) than both Colorado (21.9%) and national (30%) averages.<sup>1</sup> To address this disparity, we conducted a community-based participatory research project to explore and compare the perspectives of teenage patients and healthcare providers about interactions regarding obesity and weight-related issues. Methods: Teenagers (n=47) participated in gender-separated focus groups about weight-related conversations with providers. Sessions were recorded and transcribed. Data were analyzed by open coding. A subsequent survey investigated providers' perspectives on weight management conversations with teens. Local teenagers formed an advisory board and were actively involved throughout the project. Results: From focus groups, four themes arose: (1) get to know the teen before talking about weight and avoid using Body Mass Index (BMI) to start this conversation; (2) ask about the teen's motivations in health; (3) provide specific, personalized goals; and (4) include frequent follow-up and encouragement. Meanwhile, provider survey findings included that most providers: (1) were comfortable starting the weight management conversation; (2) used BMI to open the conversation; (3) felt ineffective in achieving positive weight change; and (4) saw a need to improve communication. Conclusion: A teen-approved methodology for weight management counseling can inform providers on how to better approach these conversations.

Primary Presenter: **Garrett Prince**

Project Title: *Topical 5-Fluorouracil in Dermatologic Disease*

Primary Mentor: Michael Cameron

Thematic Area: Clinical Science

Abstract:

**Background:** 5-fluorouracil (5-FU) has proven to be an effective therapy in the treatment of a variety of dermatologic conditions. Approved by the United States Food and Drug Administration for the treatment of actinic keratoses and superficial basal cell carcinoma, topical 5-FU has also demonstrated efficacy in the treatment of a variety of other dermatologic diseases.

**Methods:** A search of the MEDLINE standard computer database, MEDLINE advanced database, and EMBASE database was conducted.

**Results:** Thirty-four articles met criteria for inclusion in this review. These articles represented 16 randomized controlled trials and 18 case series. Each article was reviewed and summarized.

**Conclusions:** Topical 5-FU is used in a variety of dermatologic disease processes with a wide range of efficacy and levels of evidence. Based on extent and level of evidence, our disease-specific systematic review found that the evidence is strongest for topical 5-FU use in the treatment of actinic keratosis, squamous cell carcinoma, and basal cell carcinoma. This review serves as a comprehensive summary of topical 5-FU use in dermatology.

Primary Presenter: **Srinidhi Radhakrishnan**

Project Title: *Postoperative Infections in Women Undergoing Hysterectomy for Benign Indications: A Cohort Study*

Primary Mentor: Tyler Muffly

Thematic Area: Clinical Science

Abstract:

Our objective is to determine the incidence of postoperative infections following hysterectomy by route of surgery. We hypothesize that vaginal hysterectomy has lower rates of postoperative infection than laparoscopic and abdominal hysterectomies based on recommendations from the American Congress of Obstetricians and Gynecologists.

Primary Presenter: **Saikripa Radhakrishnan**

Project Title: *The Patient Who Says He is Ready to Die - Ethical Case Study*

Primary Mentor: Daniel Goldberg

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

This paper involved identifying a case from the AMA Journal of Ethics website and applying an 8-step process to recognize and answer specific ethical questions that arise. The case involves an elderly patient with a terminal medical condition who requests to not proceed with life-prolonging measures and thereby chooses death.

The key ethical questions identified is whether a doctor should encourage a patient with a terminal condition to pursue surgical treatment. My initial reaction was to acquiesce with the patient's requests and support his decision to halt further surgical treatment. The biggest ethical values in conflict are patient autonomy versus beneficence. Namely, the argument for patient autonomy is that it respects the patient's request to stop treatment. However, beneficence encourages pursuing treatment to improve the patient's disease burden. These values permeate the choices of many stakeholders within the case, like the patient, the provider, the hospital system, and the society at large. After completing the analysis, three options arose for the provider to choose from: he/she could recommend proceeding with the surgery, withholding from the surgery, or implementing another treatment option. The culture of medicine is shifting to prioritize patient autonomy over beneficence, with an emphasis on providing informed consent in order to strengthen the patient-provider relationship and have patients actively involved in their treatment. Certain scenarios preclude the ability to achieve informed consent and/or respect patient autonomy. These include emergencies, times when the patient does not have capacity, or times when the disease is refractory to standard treatment and innovative treatments must be considered. To prevent these scenarios, having a clear and documented advanced directive can help the provider abide by the patient's wishes when the patient is not able to verbalize them himself.

Primary Presenter: **Alexander Rajic**

Project Title: *Non-standardized odor identification testing in cognitively impaired adults.*

Primary Mentor: Peter Pressman

Thematic Area: Clinical Science

Abstract:

**Background:** Previous studies have identified odor identification dysfunction as a biomarker for neurodegenerative disorders, particularly Alzheimer Disease (AD) and amnesic mild cognitive impairment (aMCI). While validation studies have relied upon standardized odor identification kits, the current study aims to assess the utility of using non-standardized odor identification testing, consisting of asking patients to identify common odorous substances, such as coffee grounds.

**Methods:** A multi-component study with a cross-sectional arm evaluating odor identification ability via non-standardized testing and cognitive status, as well as longitudinal analysis evaluating relationship between odor identification ability and change in Montreal Cognitive Assessment (MOCA) score at clinical follow-up. Cross-sectional analysis utilized logistic regression with ROC analysis, followed by sensitivity and specificity calculations. Longitudinal analysis utilized mixed effects modeling.

**Results:** Olfaction testing results utilizing coffee grounds were highly correlated with cognitive status while correcting for age. Arm 1 consisted of all participants (both amnesic and non-amnesic disorders), with an AUC of 0.7737 ( $p < 0.0001$ ), and sensitivity and specificity of 65.45% and 66.67%, respectively. Arm 2 consisted of normal controls and amnesic disorders, with an AUC of 0.8208 ( $p < 0.0001$ ), and sensitivity and specificity of 75.00% and 75.00%. Arm 3 consisted of normal controls and non-amnesic disorders, with AUC of 0.6971 ( $p = 0.0090$ ), and sensitivity and specificity of 57.41% and 66.67%. In the longitudinal analysis, odor identification ability was highly correlated with likelihood of MOCA score decline at follow-up ( $p < 0.0001$ ).

**Conclusion:** Non-standardized olfaction testing has reasonable diagnostic utility for cognitive impairment in adults, holding promise as a screen for undifferentiated adult patients presenting for cognitive complaints. Sub-analysis demonstrated that the results are largely driven by participants with amnesic disorders, consistent with previous studies. Longitudinal results suggest that olfactory dysfunction is associated with progressive forms of cognitive disorder.

Primary Presenter: **Kathleen Raskob**

Project Title: *Improving Knowledge, Skills, and Attitudes of Future Health Care Professionals Toward Caring for Resource-Limited Patients: Four years of the Poverty Immersion in Colorado Springs (PICOS)*

Primary Mentor: Erik Wallace

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

The Poverty Immersion in Colorado Springs (PICOS) is an experiential immersion program that engages health professional students and community stakeholders to describe and analyze the social determinants of health in the community, demonstrate knowledge and skills while experiencing poverty, identify their own attitudes toward resource-limited people, and recognize the relationship between adverse childhood experiences (ACEs) and health outcomes. Health professional students learn from and care for patients from varied socioeconomic backgrounds. However, most future health professionals may have few personal experiences with poverty. Therefore, students may have difficulty empathizing with and caring for resource-limited patients based on few shared life experiences. Participants were invited to attend lectures, a classroom poverty simulation, an overnight stay at a homeless shelter, and complete experiential case scenarios over two days. In 2018, participants also aided in a foot care clinic and needs assessments for people staying at a homeless shelter. Quantitative pre- and post-test data on PICOS objectives were analyzed by paired t-test. Seventy-nine participants (49 medical students, 18 health sciences graduate students, and 12 community stakeholders) completed PICOS. Knowledge of social determinants of health, ACEs, and skills necessary to obtain and utilize basic resources improved in all 79 participants ( $p < 0.05$ ). Seven of twelve attitude statements toward resource-limited people improved in all 79 participants. Six of twelve attitude statements improved in the 49 medical students ( $p < 0.05$ ). A two-day experiential program focused on poverty can improve the knowledge, skills, and attitudes of health professional students toward patients with limited resources. Results are limited as participants self-selected for the program. Programs like PICOS should solicit participation by additional health professional providers and students in order to better understand and empathize with the resource-limited patients they will serve. The relatively low cost (

Primary Presenter: **Tyler Reinking**

Project Title: *Engaging Teens in Weight Management Conversations*

Primary Mentor: Janet Meredith

Thematic Area: Clinical Science

Abstract:

Abstract:

Background: In Aurora, CO, childhood obesity rates are higher (36-41%) than both Colorado (21.9%) and national (30%) averages.<sup>1</sup> To address this disparity, we conducted a community-based participatory research project to explore and compare the perspectives of teenage patients and healthcare providers about interactions regarding obesity and weight-related issues. Methods: Teenagers (n=47) participated in gender-separated focus groups about weight-related conversations with providers. Sessions were recorded and transcribed. Data were analyzed by open coding. A subsequent survey investigated providers' perspectives on weight management conversations with teens. Local teenagers formed an advisory board and were actively involved throughout the project. Results: From focus groups, four themes arose: (1) get to know the teen before talking about weight and then avoid using Body Mass Index (BMI) to start this conversation; (2) ask about the teen's motivations in health; (3) provide specific, personalized goals; and (4) include frequent follow-up and encouragement. Meanwhile, provider survey findings included that most providers: (1) were comfortable starting the weight management conversation; (2) used BMI to open the conversation; (3) felt ineffective in achieving positive weight change; and (4) saw a need to improve communication. Conclusion: A teen-approved methodology for weight management counseling can inform providers on how to better approach these conversations.

Primary Presenter: **Lorena Rincon-Cruz**

Project Title: *Palonosetron and hydroxyzine pre-treatment reduces the objective signs of experimentally-induced acute opioid withdrawal in humans: a double-blinded, randomized, placebo-controlled crossover study*

Primary Mentor: Lawrence Chu

Thematic Area: Clinical Science

Abstract:

Background: Treatments for reducing opioid withdrawal are limited and prone to problematic side effects. Laboratory studies, clinical observations, and limited human trial data suggest 5-HT<sub>3</sub>-receptor antagonists and antihistamines may be effective. Objectives: This double-blind, crossover, placebo-controlled study employing an acute physical dependence model evaluated whether (i) treatment with a 5-HT<sub>3</sub>-receptor antagonist (palonosetron) would reduce opioid withdrawal symptoms, and (ii) co-administration of an antihistamine (hydroxyzine) would enhance any treatment effect. Methods: At timepoint T= 0, healthy (non-opioid dependent, non-substance abuser) male volunteers (N = 10) were pre-treated with either a) placebo, b) palonosetron IV (0.75 mg), or c) palonosetron IV (0.75 mg) and hydroxyzine PO (100 mg) in a crossover study design. This was followed at T = 30 by intravenous morphine (10 mg/70kg). At T = 165, 10 mg/70kg naloxone IV was given to precipitate opioid withdrawal. The objective opioid withdrawal score (OOWS) and subjective opioid withdrawal score (SOWS) were determined 5 and 15 minutes after naloxone administration (T = 170, 180, respectively). Baseline measurements were recorded at T = ~30 and T = ~15. Results: Comparison of average baseline OOWS scores with OOWS scores obtained 15 minutes after naloxone was significant (p = 0.0001). Scores from 15 minutes post-naloxone infusion showed significant differences in OOWS scores between treatment groups: placebo, 3.7 ± 2.4; palonosetron, 1.5 ± 0.97; and palonosetron with hydroxyzine, 0.2 ± 0.1333. Conclusions: Pretreatment with palonosetron significantly reduced many signs of experimentally-induced opioid withdrawal. Co-administration with hydroxyzine further reduced opioid withdrawal severity. These results suggest that 5-HT<sub>3</sub> receptor antagonists, alone or in combination with an antihistamine, may be useful in the treatment of opioid withdrawal.

Primary Presenter: **Allison Rippy**

Project Title: *CAMP: CoRHSP Attendees in Medical Professions*

Primary Mentor: Mark Deutchman

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

The Colorado Rural Health Scholars Program (CoRHSP) is a three-week summer camp for 20 high school students from rural Colorado who are interested in pursuing careers in healthcare. The camp has been run for 23 consecutive years. Each year, University of Colorado School of Medicine allocates approximately \$60,000 to fund this program at no cost to the participants. The program is run by medical students with support from the School of Medicine's Office of Student Life. The goal of the program is to increase the number of health workers in rural Colorado, while providing a leadership opportunity for medical students. No longitudinal tracking of participants or leaders has been conducted to explore the impact of the experience on their future careers and educational decisions.

We conducted an online survey of past participants to assess the impact CoRHSP has had on their education and careers. We found that CoRHSP has a statically significant impact on increasing participants' interest in healthcare careers and working in a rural area. There was not a statistically significant increase of interest in attending college. Participants frequently reported that long-lasting friendships with fellow participants was the most meaningful aspect of the program.

As junior counselors of CoRHSP in 2015 and co-directors in 2016, we have gained valuable insight into the summer camp's goals and mode of operation. Our goal with this project is to demonstrate the value of the CoRHSP program and to ensure continued support for the program.

Primary Presenter: **Phillip Ross**

Project Title: *Head Loss As an Explanation of the Steal Phenomenon in Microvascular Surgery*

Primary Mentor: Frederic Deleyiannis

Thematic Area: Clinical Science

Abstract:

Vascular steal has been cited to help explain end-organ ischemia after microvascular reconstruction. Attempts to clarify a mechanism of vascular steal have been made by modeling blood circulation after a simple electrical circuit, suggesting that the free flap provides a path of least resistance for blood flow and thereby compromises end-organ perfusion. We present a case of a posterior medial thigh perforator flap for the reconstruction of a diabetic foot ulcer in a patient with a single vessel providing inflow to the foot. In the context of this case, we provide a novel explanation for the steal phenomenon using the Hagen-Poiseuille law and the property of head loss in fluid dynamics and discuss how the vessel size of the free flap may contribute to a steal phenomenon.

Primary Presenter: **Benjamin Saccomano**

Project Title:

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*Radiation-induced Cataracts in Children With Brain Tumors Receiving Craniospinal Irradiation.*

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Primary Mentor: John Repine

Thematic Area: Clinical Science

Abstract:

Radiation is a well-known cause of the development of cataracts. For children with brain tumors, craniospinal irradiation (CSI) would be expected to result in a significant risk of cataract development. We reviewed the incidence of cataracts in children with brain tumors who received CSI at our institution. Of 45 children who received CSI and had ophthalmologic examinations, 13 developed cataracts. The median time to develop cataracts was 27.6 months. Seven children underwent surgery for cataract. Given this high incidence of cataracts, we suggest routine eye examinations for all children receiving CSI.

Primary Presenter: **Eric Sasine**

Project Title: *Lecture-Based Flashcards Show Voluntary Use Among Medical Students*

Primary Mentor: Matthew Rustici

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

Abstract

Background

Flashcards are frequently used by medical students. Research has shown improved retention and exam scores among medical students who study with flashcards. No studies have examined the frequency of use of different types of flashcards in medical education, such as whether the cards are based on lecture content, third-party resources, or a mixture. This study analyzes the frequency of voluntary use of a peer-created, lecture-based flashcard system among preclinical medical students.

Methods

A lecture-based online flashcard set was created by the first author as a preclinical student. The flashcards were organized into courses that corresponded to each of the preclinical courses at the University of Colorado School of Medicine (CUSOM), with one deck of cards made for each lecture. A link to the flashcards was emailed to three graduating classes (approximately 551 students) at CUSOM. Frequency of use of the flashcards was measured by the number of students who added a course to their online profile, the mean number of card views, and the number of students who viewed a total number of cards in one deck greater than half the number of unique cards in that deck, defined as "superusers".

Results

Of the approximately 551 students emailed a link to a set of peer-created, lecture-based flashcards, 27.1% added a course to their profiles. A mean of 6.1% of students became superusers. The mean of card views among all users who added the course was 760. The median was 255.

Conclusion

A peer-created, lecture-based flashcard system demonstrates voluntary use among preclinical medical students.

Disclosures

The authors have no conflicts of interest to disclose.

Primary Presenter: **Hannah Schara**

Project Title: *Elder abuse detection, reporting, and care: a needs assessment*

Primary Mentor: Skotti Church

Thematic Area: Public Health and Epidemiology

Abstract:

Abstract

**Background:** Elder mistreatment is a largely under-recognized and under-reported public health issue. Healthcare providers, although in a unique position to report, represent a marginal proportion of reports of elder abuse to law enforcement or APS. This may be due to inadequate training making providers ill equipped to accurately identify, report, and care for abuse victims.

**Methods:** We performed a needs assessment to understand the knowledge, attitudes, and practices of healthcare providers (physicians, advanced practice practitioners, social workers, mental health providers, etc.) and students. We surveyed providers at a large academic medical center as well as rural based community providers about their previous training, experience, and confidence in detecting, reporting, and managing suspected elder abuse. Results were analyzed with percentages, ranges, means, and t-test as appropriate.

**Results:** Two hundred and three providers completed the survey, including 90 students. Those surveyed included 12 geriatricians, 20 family medicine providers, 20 internists, 40 emergency medicine physicians, and 14 other providers. Almost all felt that healthcare providers play an important role in recognizing and reporting abuse (88%), and in determining the care and social needs for victims (87%). However, only 51% of respondents received formalized training in elder abuse. Providers most often report having encountered neglect with 54% having cared for a patient in the last 6 months as compared to physical (30%), verbal (41%), sexual (0%), and financial (22%) abuse. Most providers reported more comfort in detecting, reporting, and caring for victims of physical abuse (79%, 70%, 72%, respectively) than any other type of abuse, and reported the most discomfort with sexual and financial abuse. Overall, primary care providers were more comfortable in the detection of financial abuse, while emergency providers were more comfortable in the care of physical abuse and neglect victims.

**Conclusion:** While healthcare providers receive some training in elder abuse, most desire more training and were only comfortable managing physical abuse. Further development of educational tools for reporting, detection, and care management of abuse should focus on all types of abuse to improve the care of these vulnerable and complex patients.

Primary Presenter: **Sara Schuster**

Project Title: *Unprotected Sex while Visiting Denver: Emergency Contraception Access in Colorado Pharmacies.*

Primary Mentor: Carol Stamm

Thematic Area: Clinical Science

Abstract:

Unprotected Sex while Visiting Denver: Emergency Contraception Access in Colorado Pharmacies. SM Schuster (MD candidate in the School of Medicine), H Yi, CA Stamm (MD, FACOG), L Borgelt (PharmD), K Cleland (MPA, MPH).

Background: Plan B One-Step has been available over the counter for women of all ages since 2013, and generic forms were made available in 2014. There are no federally imposed restrictions on who can purchase emergency contraception and it can be sold on store shelves in no security packaging. However, the actual access for emergency contraception in pharmacies is dependent on each store's individual policies. Given this potential for variability, someone seeking emergency contraception can have a very different experience depending on which store they select.

Objective: The goal of this project was to obtain an overview of what buying emergency contraception is like in pharmacies in highly trafficked areas of Denver, Boulder, and Colorado Springs.

Methods: To simulate a casual visitor, two students visited pharmacies based on their location near major roads and popular tourist destinations, and how easily they could be found on internet search of "pharmacy" on default smartphone navigation apps and Google Maps. Each pharmacy was then surveyed in person to determine if emergency contraception was available on shelves, where in the store it was located, and any additional restrictions on purchase. Stores were also subjectively assessed for ease of locating emergency contraception by the students.

Results: 37 pharmacies were surveyed. In 25% [9/37] of stores, emergency contraception was available on store shelves and not locked in any container or placement. In 35% [13/37] of stores, emergency contraception was on the shelf locked in a container requiring employee assistance, and 5% [2/37] had a place for emergency contraception on shelves but were out of stock. Of the 24 stores carrying emergency contraception on shelves, the family planning (75%), and feminine care (21%) aisles were the most common locations. 19% of stores had an age restriction, and in 3% of stores men were not able to purchase emergency contraception. In 22% of stores an ID was required for purchase of emergency contraception regardless of age or location in store. Locating emergency contraception was "very difficult" in 3% of stores, "somewhat difficult" in 26%, "somewhat easy" in 22%, and "very easy" in 49%. Stores providing emergency contraception on the shelf compared to behind a counter, stores providing emergency contraception on the shelf most often rated "very easy" [18/24], while stores with emergency contraception behind the counter most frequently were rated as "somewhat difficult" [7/13].

Conclusion: Overall, approximately one-third of stores did not have emergency contraception on store shelves and one-fifth had a minimum age restriction. Surveyors perceived stores in which emergency

contraception was available on the shelves as providing an easier and more comfortable experience for purchase. Colorado visitors may not have an easy time accessing emergency contraception if needed while visiting this state.

Primary Presenter: **WAFIK SEDHOM**

Project Title: *DISTINCT ROLES OF PIK3CA IN ENRICHING AND MAINTAINING OF CANCER STEM CELLS IN HEAD AND NECK SQUAMOUS CELL CARCINOMA*

Primary Mentor: Shi-Long Lu

Thematic Area: Basic Biomedical Science

Abstract:

Locoregional invasion, treatment-resistance, recurrence and metastasis are the major causes of head and neck squamous cell carcinoma (HNSCC)-related mortality. It is suggested that cancer stem cells (CSCs) play pivotal roles in driving primary tumor growth, tumor relapse and establishment of metastasis. Here, we report that overexpression of PIK3CA, which is the most frequently amplified oncogene in HNSCC, promotes the onset of epithelial-to-mesenchymal transition (EMT) and enriches CSC characteristics. However, PIK3CA is not required to maintain these phenotypes. Intriguingly, genetic suppression of major components of PI3K signaling paradoxically promoted CSC population. Further molecular analysis disclosed that overexpression of PIK3CA activates multiple receptor tyrosine kinases (RTKs), in which ephrin receptors (Ephs), tropomyosin receptor kinases (Trk) and mast/stem cell growth factor receptor (c-Kit) contribute to maintain the CSC traits. Accordingly, simultaneously targeting these RTKs by multi-kinase inhibitor ponatinib superiorly eliminates CSCs and metastasis of PIK3CA-overexpressing HNSCC cells. Our result supports a multiple targeted agent-based strategy for targeting-CSC therapy and thus controls recurrence and metastasis in HNSCC patients with PIK3CA amplification.

Primary Presenter: **Brandon Sklar**

Project Title: *Insurance Acceptance Analysis among Outpatient Psychiatrists in Colorado*

Primary Mentor: Joe Sakai

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

Background: There has been increasing insurance non-acceptance rates among psychiatrists, and it has been suggested to be growing in recent years.

Methods: A survey was developed to investigate rates of insurance non-acceptance among outpatient psychiatrists in Colorado and psychiatrist characteristics and value responses that predict insurance acceptance. It was distributed to members of the Colorado Psychiatric Society. Results will be analyzed using MANCOVA and multiple logistic regression to illustrate factors that predict insurance acceptance.

Results: Pending further data collection and analysis.

Conclusions: Pending further data collection and analysis.

Primary Presenter: **Hogan Slack**

Project Title: *“Obviously, you can’t give me medical advice over the internet, but…”: Quality of Medical Advice Provided Between Members of an Online Message Board for Implanted Defibrillator Patients*

Primary Mentor: Christopher Knoepke

Thematic Area: Clinical Science

Abstract:

Abstract

**Background:** Patients use Web-based medical information to understand medical conditions and treatments. A number of efforts have been made to understand the quality of professionally created content; however, none have described the quality of advice being provided between anonymous members of Web-based message boards.

**Objective:** The objective of this study was to characterize the quality of medical information provided between members of an anonymous internet message board addressing treatment with an implantable cardioverter-defibrillator (ICD).

**Methods:** We quantitatively analyzed 2 years of discussions using a mixed inductive-deductive framework, first, for instances in which members provided medical advice and, then, for the quality of the advice.

**Results:** We identified 82 instances of medical advice within 127 discussions. Advice covered 6 topical areas: (1) Device information, (2) Programming, (3) Cardiovascular disease, (4) Lead management, (5) Activity restriction, and (6) Management of other conditions. Across all advice, 50% (41/82) was deemed generally appropriate, 24% (20/82) inappropriate for most patients, 6% (5/82) controversial, and 20% (16/82) without sufficient context. Proportions of quality categories varied between topical areas. We have included representative examples.

**Conclusions:** The quality of advice shared between anonymous members of a message board regarding ICDs varied considerably according to topical area and the specificity of advice. This report provides a model to describe the quality of the available Web-based patient-generated material.

Primary Presenter: **Ellen Snyder**

Project Title: *Denver Health Intensive Outpatient Clinic Stepdown*

Primary Mentor: Jeremy Long

Thematic Area: Public Health and Epidemiology

Abstract:

The Intensive Outpatient Clinic (IOC) is a specialized clinic at Denver Health for healthcare super-utilizers dedicated to reducing their emergency department visits and inpatient admissions. However, the IOC has reached maximum patient capacity and many patients no longer require IOC-level resources. Researchers sought to understand what qualities of the IOC should be transferred to primary care to ensure a successful transition. 19 super-utilizers were interviewed regarding their IOC experiences. Interviewers also met with primary care staff regarding resources needed for transition. Patient interviews revealed three primary themes that conveyed the effectiveness of the IOC: kindness/friendliness, staff actions, and access. Combining patient and clinic staff voices, our transition recommendations include: establish patient/provider goals during initial IOC visit; perform periodic check-ins with the patient regarding these goals; identify patient necessities for health maintenance upon transition; acclimate patient to shorter appointment times before transitioning; bridge the transfer with a patient psychosocial needs assessment and a case manager; and provide the receiving clinic with centralized patient information.

Primary Presenter: **Blake Snyder**

Project Title: *The Pursuit of a Career in Global Health:*

*1. Risk Factors and Epidemiologic Predictors of Blood Stream Infections with New Delhi Metallo-b-lactamase (NDM-1) Producing Enterobacteriaceae*

*2. Accuracy of computer-assisted vertical cup-to-disk ratio grading*

Primary Mentor: Jeremy

Keenan

Thematic Area: Global Health

Abstract:

1.

**Background:** Carbapenem-resistant Enterobacteriaceae conferred by New Delhi metallo-b-lactamase (NDM-1) resistance mechanism is endemic in India and Southeast Asia. An understanding of risk factors for NDM-1 infections is necessary to guide prevention strategies.

**Methods:** Our retrospective case-control study included patients admitted at Christian Medical College (CMC), Vellore between May 2010 and August 2014 with carbapenem-resistant *Klebsiella pneumoniae* blood stream infection (BSI). We compared NDM-1 producing strains to two control groups: BSI with other multidrug resistant (MDR) strains and BSI with pan-sensitive strains. Outcomes assessed included: 1) infection with any MDR strain compared to pan-sensitive; and, 2) infection with NDM-1 strain as compared to other MDR.

**Results:** Medical (OR 10.4) and neonatal (OR 0.7) ICU admission, central venous catheter placement (CVC, OR 7.4) predicted MDR BSI. Prior carbapenem use (OR 8.4) and CVC (OR 4.8) predicted acquisition of a NDM-1 strain.

**Conclusions:** CVC placement, prior carbapenem use, and ICU admission were significantly associated with BSI with NDM-1 producing and other MDR strains.

2.

**Purpose:** Glaucoma screening can be performed by assessing the vertical-cup-to-disk ratio (VCDR) of the optic nerve head from fundus photography, but VCDR grading is inherently subjective. This study investigated whether computer software could improve the accuracy and repeatability of VCDR assessment.

**Methods:** In this cross-sectional diagnostic accuracy study, 5 ophthalmologists independently assessed the VCDR from a set of 200 optic disk images, with the median grade used as the reference standard for subsequent analyses. Eight non-ophthalmologists graded each image by two different methods: by visual inspection and with assistance from custom-made publically available software. Agreement with the reference standard grade was assessed for each method by calculating the intraclass correlation

coefficient (ICC), and the sensitivity and specificity determined relative to a median ophthalmologist grade of  $\approx 0.7$ .

Results: VCDR grades ranged from 0.1 to 0.9 for visual assessment and from 0.1 to 1.0 for software-assisted grading, with a median grade of 0.4 for each. Agreement between each of the 8 graders and the reference standard was higher for visual inspection (median ICC 0.65, interquartile range 0.57 to 0.82) than for software-assisted grading (median ICC 0.59, IQR 0.44 to 0.71);  $P=0.02$ , Wilcoxon signed-rank test). Visual inspection and software assistance had similar sensitivity and specificity for detecting glaucomatous cupping.

Conclusion: The computer software used in this study did not improve the reproducibility or validity of VCDR grading from fundus photographs compared with simple visual inspection. More experience was correlated to higher agreement.

Trial Registration: Not Applicable

3.

Background: Verification of trachoma elimination requires monitoring after discontinuation of trachoma program activities, though such surveys are not commonly done.

Methods: Conjunctival examinations and smartphone photography were performed on a random sample of pre-school children from 15 villages in a region of Burkina Faso thought to have eliminated trachoma.

Results: No clinically active trachoma was detected by in-field or photographic evaluation. Smartphone images demonstrated high agreement with field grading (>99% concordance).

Conclusions: Trachoma appears to have been eliminated from this area of Burkina Faso. Smartphone cameras may be a useful aid for monitoring in resource-limited settings.

4.

Visual impairment and blindness in the developing world are increasingly a result of non-communicable diseases that would benefit from early detection and treatment. However, the optimal methods and setting for a screening program, as well as the cost-effectiveness of eye disease screening in a developing country, have not been well characterized. To address this gap in knowledge, we instituted an eye disease screening program at both a general medical clinic and a diabetes clinic at Chiang Mai University Hospital in northern Thailand. Clinic patients 50 years and older who agree to participate will undergo visual acuity screening, intraocular pressure testing, and fundus photography, with referral to the ophthalmology clinic according to pre-specified criteria. We have outlined two specific aims in this research: first, to assess the sensitivity and specificity of different tests for detecting diabetic retinopathy, and second, to determine the incremental cost-effectiveness of screening in the diabetes clinic relative to the general medical clinic. Detection of asymptomatic eye disease through screening should lead to earlier treatment and less visual impairment, which should in turn improve the population's quality of life and mitigate the costs associated with visual impairment.

Primary Presenter: **CHChristina Spandler**

Project Title: *Development of Recombinant Varicella Zoster Virus containing CRISPR/Cas9*

Primary Mentor: Ravi Mahalingam

Thematic Area: Basic Biomedical Science

Abstract:

Varicella Zoster Virus (VZV) causes varicella (chickenpox), becomes latent in the trigeminal and dorsal root ganglia, and reactivates decades later to produce zoster (shingles) in the elderly. The VZV vaccine is a live attenuated virus that also becomes latent and can reactivate later on in life and cause shingles and associated serious neurological complications. Shingles affects more than 1 million people in the U.S. annually. The goal of this project is to control the expression of genes necessary for host reinfection by using the CRISPR-Cas9 system. We will use the Cas-9 protein and guide RNA sequence to edit the VZV genome, specifically VZV open reading frame (ORF) 63 which is present as duplicate copy in ORF70. Expression of ORF63/70 is necessary for virus replication. By using the CRISPR-Cas9 system to edit the latent VZV genome in the host, we can control the expression of genes essential for virus reactivation.

Primary Presenter: **Kelsey Spaur**

Project Title: *Utilization of Intravenous Catheters by Prehospital Providers during Pediatric Transports*

Primary Mentor: Kathleen Adelgais

Thematic Area: Clinical Science

Abstract:

Introduction: Prehospital intravenous (IV) access in children may be difficult and time-consuming. Emergency Medical Service (EMS) protocols often dictate IV placement; however, some IV catheters may not be needed. The scene and transport time associated with attempting IV access in children is unknown. The objective of this study is to examine differences in scene and transport times associated with prehospital IV catheter attempt and utilization patterns of these catheters during pediatric prehospital encounters. Methods: Three non-blinded investigators abstracted EMS and hospital records of children 0€“18 years of age transported by EMS to a pediatric emergency department (ED). We compared patients in which prehospital IV access was attempted to those with no documented attempt. Our primary outcome was scene time. Secondary outcomes include utilization of the IV catheter in the prehospital and ED settings and a determination of whether the catheter was indicated based on a priori established criteria (prehospital IV medication administration, hypotension, GCS < 13, and ICU admission). Results: We reviewed 1,138 records, 545 meeting inclusion criteria. IV catheter placement was attempted in 27% (n = 149) with success in 77% (n = 111). There was no difference in the presence of hypotension or median GCS between groups. Mean scene time (12.5 vs. 11.8 minutes) and transport time (16.9 vs. 14.6 minutes) were similar. Prehospital IV medications were given in 38.7% (43/111). One patient received a prehospital IV medication with no alternative route of administration. Among patients with a prehospital IV attempt, 31% (46/149) received IV medications in the ED and 23% (34/396) received IV fluids in the ED. Mean time to use of the IV in the ED was 70 minutes after arrival. Patients with prehospital IV attempt were more likely to receive IV medication within 30 minutes of ED arrival (39.1% vs. 19.0%, p = 0.04). Overall, 34.2% of IV attempts were indicated. Conclusions: Prehospital IV catheter placement in children is not associated with an increase in scene or transport time. Prehospital IV catheters were used in approximately one-third of patients. Further study is needed to determine which children may benefit most from IV access in the prehospital setting.

Primary Presenter: **Indira Sriram**

Project Title: *I, EHR*

Primary Mentor: Steven Lowenstein

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

The electronic health record is now an entrenched part of health care in the United States. These systems proliferated rapidly after the federal government incentivized their implementation, through the Affordable Health Care Act 1. In the last few years, several physicians have expressed concern about the impact of the EHR on their ability to provide compassionate and humanistic care 2. Still others have suggested that the EHR is a major cause of physician burnout and have suggested that the “Patient” receives a higher quality of care than the real patient 3,4. In this work, we sought to create a best practice guideline that could empower providers to use the EHR as a tool for humanistic care, rather than a barrier. To create our guideline, we used a standardized questionnaire to interview eleven physicians about their EHR usage. We compiled their responses, and based on major narrative themes, we developed four suggestions including: stop typing when patients are relaying sensitive information, integrate the EHR directly into the process of information sharing, introduce the EHR to the patient and explain its role, and finally, create shorter, more specific notes.

Primary Presenter: **Kelly Stewart**

Project Title: *Sore Throat, Fever and Negative Rapid Strep Test?*

*Keep your differential broad or risk missing Fusobacterium and potentially fatal Lemierre's Syndrome*

Primary Mentor: Jaime Baker

Thematic Area: Clinical Science

Abstract:

We present a case of a 20 year-old male patient who was diagnosed with Lemierre's Syndrome caused by *Fusobacterium necrophorum*. Our patient was seen in the outpatient setting three times over the course of six days due to chief complaint of sore throat. By the time the patient presented to our emergency department on day seven of his illness, he was diagnosed with Lemierre's Syndrome, a life-threatening condition characterized by antecedent oropharyngeal infection, thrombophlebitis of the internal jugular vein, septic emboli and bacteremia<sup>1</sup>. Blood cultures were positive for *Fusobacterium necrophorum*. Although the patient survived, he had a 2-week hospital stay complicated by severe neck and chest pain requiring a patient controlled analgesia, weight loss, malnutrition, acute respiratory failure and chest tube placement for empyema. He was eventually discharged home to complete a prolonged course of IV antibiotics. In this report we discuss the epidemiology, pathogenesis, clinical presentation, diagnosis, and treatment of Lemierre's Syndrome, as well as the role of *Fusobacterium necrophorum* in the disease process.

Primary Presenter: **Allison Strauss**

Project Title: *A cross-sectional analysis comparing knowledge, attitudes, and intentions surrounding exclusive breastfeeding between primiparous and multiparous pregnant women at Dhulikhel Hospital, Nepal*

Primary Mentor: Jennifer Bellows

Thematic Area: Global Health

Abstract:

Nepali children have high rates of stunting and wasting. The World Health Organization recommends exclusive breastfeeding (EBF) for the first 6 months of life as a means of promoting good nutrition and decreasing infant/child mortality and morbidity. While breastfeeding is common in Nepal, awareness about EBF and its benefits are lacking. This study was conducted to compare knowledge, attitudes, intentions, and perceived barriers to EBF in a population of pregnant Nepali women receiving antenatal care at Dhulikhel Hospital. A cross-sectional questionnaire, administered between July and August 2016, was completed by 300 participants aged 18 to 38 years-old. 193 participants were expecting their first child (primiparous), with the remaining 107 previously had at least one child (multiparous). While 188 (63%) of those surveyed intend to feed their child only breastmilk for the first six months, only 89 (43%) were familiar with the term "Exclusive Breastfeeding." There were statistically significant differences between primiparous and multiparous participants' knowledge about exclusive breastfeeding, as well as several attitudes and beliefs surrounding infant nutrition. Despite high rates of breastfeeding, the lack of knowledge surrounding exclusive breastfeeding introduces the risk for breastfeeding rates to decrease, and for other risky feeding behaviors to become more prevalent. As the practice of EBF is crucial to addressing stunting and infant mortality, implementing a formal EBF intervention tailored to the Dhulikhel community is recommended. This secondary analysis demonstrates that families may be more easily influenced during the primiparous period.

Primary Presenter: **Mitchell Sungelo**

Project Title: *Interleukin-1 Beta Induces Expression of Bone Morphogenetic Protein 2 in Aortic Valve Interstitial Cells*

Primary Mentor: David Fullerton

Thematic Area: Basic Biomedical Science

Abstract:

Abstract

Background:

Calcific aortic valve disease (CAVD) has been increasingly recognized as an active disease process involving the transformation of the aortic valve interstitial cells (AVICs) into a pro-osteogenic phenotype. An increase in the infiltration of interleukin-1 beta (IL-1b) expressing leukocytes has been observed in CAVD. IL-1b has been shown to play a role in extracellular matrix remodeling as well as the development of calcific lesions, but the mechanism of action is not well understood. In this study, we examined the effect of IL-1b on bone morphogenetic protein 2 (BMP-2) expression in human AVICs and the signaling mechanisms responsible for this effect.

Methods:

AVICs were isolated from valves obtained from the explanted hearts of patients undergoing cardiac transplantation without valvular disease. The cells were treated with IL-1b and phosphorylation of MAPKs and BMP-2 protein levels were assessed by immunoblotting. Specific inhibitors were applied to determine the role of these kinases in mediating BMP-2 expression.

Results:

Treatment of AVICs with IL-1b upregulates the level of BMP-2 and resulted in the activation of p38 MAPK, JNK, and ERK1/2. Inhibition of p38 MAPK abolished BMP-2 expression following treatment with IL-1b, while inhibition of JNK resulted in a moderate decrease in BMP-2 levels. Inhibition of ERK1/2 had no significant effect on BMP-2 levels secondary to IL-1b treatment. In addition, p38 MAPK inhibition had no effect on IL-1b-mediated activation of NF- $\kappa$ B.

Conclusions:

IL-1b elevates the level of the pro-osteogenic factor, BMP-2, in AVICs primarily through the p38 MAPK pathway.

Primary Presenter: **Joelle Takahashi**

Project Title: *Disclosure of religious identity on Catholic Hospital Websites*

Primary Mentor: Maryam Guiahi

Thematic Area: Public Health and Epidemiology

Abstract:

**Importance:** One in six U.S hospital beds are in a Catholic health care facility. Such facilities are expected to abide by the Ethical and Religious Directives for Catholic Health Care Services, which interpret medical care based on the church's moral teachings.

**Objective:** To determine if Catholic hospital websites describe their religious identity, the Ethical and Religious Directives for Catholic Health Care Services, and associated health care restrictions.

**Design:** We performed an analysis of all Catholic hospital websites. To discern whether hospitals reported their Catholic identity, we used a structured data abstraction form that analyzed hospital mission statements, "About Us" webpages, and home pages. We also searched for specific search terms to identify whether medical care restrictions were reported. After two reviewers achieved an inter-rater reliability of 96%, all websites were analyzed between July 2017 and January 2018.

**Setting:** U.S. Catholic hospital websites

**Participants:** All 653 Catholic hospitals listed on the Catholic Health Care Directory of the Catholic Health Association of the United States website. We excluded six duplicates and one website that did not have a mission statement, leaving 646 hospitals for analysis.

**Main Outcome(s) and Measure(s):** The primary outcome was disclosure of Catholic identity. Secondary outcomes included reference to the Ethical and Religious Directives for Catholic Health Care Services, and disclosure of religious restrictions to care. We hypothesized that websites would invariably describe their Catholic identity and report religious restrictions to care.

**Results:** Of 646 hospitals, 507 (78.5%) reported their Catholic identity, 152 (23.5%) specified their practice is based on the Ethical and Religious Directives for Catholic Health Care Services, 95 (14.7%) had a direct link to the directives. Of the 474 hospitals that did not cite the directives, 28 (5.9%) specified limitations to care (all reported end of life care restrictions and 27.6% reported reproductive restrictions).

**Conclusions and Relevance:** More than one in five Catholic hospital websites did not report their Catholic identity and the majority did not specify how their religious identity directly influences patient care. Improving disclosure of religious identity and related restrictions on Catholic hospital websites can better inform patients and may avoid conflicts in care.

Primary Presenter: **Justin Thai**

Project Title: *Community Partnering Against Racial Disparities in Infant Mortality*

Primary Mentor: Janet Meredith

Thematic Area: Public Health and Epidemiology

Abstract:

**Objectives:** The infant mortality rate in the United States is significantly higher among infants born to African American women than infants born to women of other races regardless of educational attainment or socioeconomic status. The purposes of this study were to understand conditions that lead to disparities and to outline best practices for addressing disparities through community perspective.

**Methods:** Researchers conducted 6 focus groups with African American women (n=27) in Denver, CO ranging from 18-80 years old. Women were included if they self-identified as African American and had been pregnant to 20+ weeks at least once. Researchers transcribed and coded the focus groups to perform inductive thematic analysis looking at themes surrounding prenatal care, birth experience, and the interaction between race and health.

**Results:** Major themes included barriers to quality prenatal care, barriers to social and emotional support, and discomfort with healthcare providers during pregnancy. Women perceived that healthcare professionals provided substandard care based on assumptions of marital status, insurance status, and education level. They also felt that they received conflicting advice from family and healthcare providers and feared that asking questions of their providers would lead to loss of autonomy in decision-making.

**Conclusions for Practice:** The quality of prenatal care that women receive is affected by relationships with their healthcare providers and sense of autonomy and support in decision-making. To improve care and decrease chronic stress for African American women, both racism and implicit bias in the healthcare setting must be recognized and effectively addressed.

Primary Presenter: **Nichole Thorne**

Project Title: *Reproductive health care in Catholic facilities: A scoping review*

Primary Mentor: Maryam Guiahi

Thematic Area: Public Health and Epidemiology

Abstract:

**OBJECTIVE:** Given the rise in Catholic ownership of U.S. health care facilities, we aimed to examine reproductive health care provision and patient outcomes. We performed a scoping review, which maps the literature and considers inclusion of studies that are not specifically quantitative.

**DATA SOURCES:** We searched five databases (MEDLINE, EMBASE, Web of Science and Cochrane Library, ClinialTrials.gov) from inception through August 2018 using terms related to reproductive health care and religion.

**METHODS OF STUDY SELECTION:** We screened 2,906 studies. Articles were included if in English, included primary research data, and referenced U.S.-based Catholic facilities. We reviewed the reference lists of included articles. We excluded articles that addressed the relationship of patient or health care provider religion to provision of reproductive services, described reproductive health care services in non-Catholic facilities, or reported legal cases or concerns. Two independent reviewers screened all citations, a third reviewer resolved differences, and all three reviewers categorized included citations.

**TABULATION, INTEGRATION, AND RESULTS:** We included 27 studies. Investigators most commonly focused on the provision of emergency contraception (n59) or other contraceptive and sterilization methods (n57); few focused on a range of family planning

methods (n53), natural family planning (n52), ectopic pregnancy management (n52), abortion care (n52), miscarriage management (n51), and infertility care (n51). The most common study designs were crosssectional (18/27 [67%]) and qualitative investigations

(6/27 [22%]). Common data collection approaches included surveys, interviews, and mystery caller designs. Two studies involved authors with Catholic hospital affiliations and one of these reported patient outcomes; no other patient outcome reports were

found. Studies cited restrictions to care in comparison with non-Catholic settings and multisite studies demonstrated variable rates of provision of reproductive health services across Catholic sites.

**CONCLUSIONS:** Despite the significant proportion and recent growth of Catholic health care within the U.S. health care sector, little is known about reproductive health outcomes in these settings and in comparison with other settings.

Primary Presenter: **Reade Tillman**

Project Title: *Breathing Easier: Improving COPD Screening and Diagnosis at Evans Army Community Hospital*

Primary Mentor: Jaime Baker

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

### Introduction

Chronic Obstructive Pulmonary Disease (COPD) is a severe cause of morbidity and mortality in the aging military veteran population. Studies have shown that COPD is underdiagnosed or improperly diagnosed, and often not formally evaluated until irreversible pulmonary damage is present. Emerging data suggests that COPD progression occurs most rapidly at the beginning of the disease, and early identification and intervention could alter the disease course and improve patient outcomes. We endeavored to determine the adherence to the GOLD criteria of COPD diagnosis in the Evans Army Community Hospital (EACH) Internal Medicine Clinic as well as assess the utilization of COPD screening criteria for early identification of COPD.

### Methods

We conducted a retrospective chart review in the AHLTA electronic medical record on 100 patients seen between October 2016 and September 2017 using several ICD codes related to COPD. We collected data on gender, age, spirometry history, existing COPD diagnosis, and smoking history. Patient records were evaluated for COPD screening appropriateness adherence to the GOLD Criteria of COPD diagnosis, including PFTs. In a smaller subset of patients, PFTs were more closely evaluated.

### Results

Less than 50% of patients meeting COPD screening criteria - ever-smokers with one respiratory symptom - received spirometry for work up of COPD. Of the patients with COPD, 75% diagnoses had no record of confirmatory spirometry €“ a key component of GOLD Criteria. Of the subset of patients whose spirometry results were more closely evaluated, 25% had misinterpreted pulmonary function tests.

### Discussion

COPD is a severe cause of morbidity and mortality in the patient populations seen regularly in VA and military outpatient clinics. Although our study was limited to only 100 patients over a one-year period, our data suggests that there are significant barriers preventing patients with, or at risk of developing, COPD from receiving best standard of care. One obvious barrier, both to our study and to patient care, is

the AHLTA electronic medical record, where it is difficult to locate spirometry results or even an accurate smoking history. In order to overcome this barrier, we instituted a systematic procedure change to track smoking history and spirometry results in the preventative medicine section of AHLTA. Since this section is already utilized to track aspects of care such as diabetic foot screening, colonoscopies, and influenza vaccines, our goal is to make smoking history and PFT results significantly more accessible, helping to improve adherence to the GOLD criteria, and to expedite workup, diagnosis, and ultimately treatment of COPD.

Primary Presenter: **Krystal Tran**

Project Title: *Engaging Teens in Weight Management Conversations*

Primary Mentor: Janet Meredith

Thematic Area: Clinical Science

Abstract:

Background: In Aurora, CO, childhood obesity rates are higher (36-41%) than both Colorado (21.9%) and national (30%) averages. To address this disparity, we conducted a community-based participatory research project to explore and compare the perspectives of teenage patients and healthcare providers about interactions regarding obesity and weight-related issues. Methods: Teenagers (n=47) participated in gender-separated focus groups about weight-related conversations with providers. Sessions were recorded and transcribed. Data were analyzed by open coding. A subsequent survey investigated providers' perspectives on weight management conversations with teens. Local teenagers formed an advisory board and were actively involved throughout the project. Results: From focus groups, four themes arose: (1) get to know the teen before talking about weight and then avoid using Body Mass Index (BMI) to start this conversation; (2) ask about the teen's motivations in health; (3) provide specific, personalized goals; and (4) include frequent follow-up and encouragement. Meanwhile, provider survey findings included that most providers: (1) were comfortable starting the weight management conversation; (2) used BMI to open the conversation; (3) felt ineffective in achieving positive weight change; and (4) saw a need to improve communication. Conclusion: A teen-approved methodology for weight management counseling can inform providers on how to better approach these conversations.

Primary Presenter: **Theodora Tran**

Project Title: *A Simple yet Innovative Quality Improvement Project to Increase Patient Engagement in their Care via Use of the In-Room Whiteboard*

Primary Mentor: Patrick Kneeland

Thematic Area: Clinical Science

Abstract:

### Introduction

Patient experience is one of three central pillars of quality in healthcare. A central facet to improving experience is to actively engage patients in their healthcare decisions and to facilitate communication between patients and their healthcare team. At the University of Colorado Hospital, a quaternary care referral center, the in-room whiteboard is designed to be a communication tool between physicians, nurses, and patients. When rounding on patients, hospital medicine physicians check the whiteboard for messages, questions, or other concerns that patients and families may have left for them. Our needs assessment, however, revealed that the whiteboard is a resource that is underutilized: only 10% of patients actively engaged with their whiteboards, and only 25% of patients understood that they were even allowed to be active users of the whiteboard.

### Purpose

To increase patient engagement in their plan of care from 10% to 40%, as measured by the percentage of patients who used their in-room whiteboard to communicate concerns to their healthcare team.

### Methods

Our intervention involved internal medicine patients on a unit which had Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) scores in the 40th percentile nationally. We relied heavily on human centered design, with methods including: 1) a review of patient satisfaction assessments, using HCAHPS scores on the internal medicine units; 2) structured interviews with patients and physicians; 3) focus groups with nurses.

Motivated by the key insight that patients believe the whiteboard is “doctor-owned” and to be utilized strictly by healthcare professionals, two rapid improvement cycles were implemented to reframe specific sections of the whiteboard to clearly direct patients to engage with the tool. Before our intervention, the whiteboard section of interest was open to interpretation and read: “Family messages.” After our intervention, the whiteboard read: “Patients, please write questions for your healthcare team below.” The primary metric of innovative success was the percentage of patient rooms in which patients had populated the appropriate section of their white board with questions or comments, before and after the intervention.

### Results

Patients’ use of in-room whiteboard increased from 10% to 30% after our intervention. Prior to our intervention, one patient commented that he was afraid to be scolded if he wrote on the “doctor-

owned whiteboard. After our intervention, however, the same patient's son wrote a question about his father's upcoming CT scan and received a prompt answer from the attending physician.

#### Conclusion

Re-framing the whiteboard headings to explicitly invite patients to share their questions and concerns with the healthcare team can elicit patient engagement in their care. In order to further increase utilization, a next step would be to engage nurses in helping bedridden and immobile patients to visualize their concerns on the whiteboard. Such a simple yet innovative change is likely to improve patient satisfaction and overall quality of care.

Primary Presenter: **Robert Ungerer**

Project Title: *The doriTBI Tool*

Primary Mentor: Joe Adragna

Thematic Area: Public Health and Epidemiology

Abstract:

The doriTBI Tool and Student TBI Protocol

Abstract

Introduction:

Everyone would agree that providing aide to students who have suffered a traumatic brain injury (TBI) should happen while the student is reintegrating into the classroom. So why does the current system allow one, two, even three months to pass before aide is provided? The doriTBI Tool and Student TBI Protocol strives to speed up the timeline by providing tools to teachers and introducing a protocol that increases efficiency of the school district's Brain Injury Team (BrainSTEPS).

Problem:

Students are not receiving timely support following a TBI due to an unstructured and inefficient workflow between the students' schools and the BrainSTEPS Team.

Methods:

An investigation of BrainSTEPS CO program led to finding areas of potential improvement in efficiency. A TBI symptom-screener was used to link the deficits to appropriate accommodations. The results were given to the website developers.

Results:

The doriTBI Tool and Student TBI Protocol together act as a fully functional system. Teachers should now be able to use this system immediately upon the student returning to class following a TBI. When used correctly the system should target the areas in which the student is struggling by creating a list of personalized accommodations. If further assistance is needed, the system will also act to expedite the BrainSTEPS referral process and can identify a student's need for medical reevaluation relating to their TBI.

## Conclusions:

The doriTBI Tool and Student TBI Protocol will act synergistically with the existing program (BrainSTEPS CO) and should allow students to receive rapid classroom assistance. This can reduce the wait time from 1-2 months down to a few days. A study should be conducted to measure the reduction in the reintegration-to-accommodation timeline. The Aurora Public School district BrainSTEPS consult team has expressed interest learning more about the system and potentially participating.

Primary Presenter: **Charles Ventriglia**

Project Title: *Retrospective study: Analysis of THC-COOH/Creatinine ratios to determine new cannabis use*

Primary Mentor: Joseph Sakai

Thematic Area: Clinical Science

Abstract:

Nationwide, cannabis is the most used illicit drug. States with decriminalized cannabis laws harbor an even greater prevalence of cannabis use, however, federal facilities within these states continue to observe federal laws regarding cannabis use. This becomes particularly problematic for patients receiving residential Post Traumatic Stress Disorder (PTSD) treatment at Veteran Affairs (VA) facilities in decriminalized states. Patients must abstain from illicit drug use prior to treatment and throughout the duration of treatment at the risk of disqualification from the program. Cup based Urine Drug Screen (UDS) is commonly used as the primary screening form of cannabis detection. However, the utility of UDS is limited in differentiating novel cannabis use from chronic use. Cannabis excretion can be prolonged up to eight weeks in chronic users, making urine drug screen ineffective as it does not stratify drug use over time. The information gathered from a positive UDS may result in expulsion from treatment programs at VA facilities if patients have used cannabis up to 8 weeks before screening.

By using creatinine (Cr) clearance as a marker for renal excretion, we can then measure urine 11-nor-9-carboxy- $\Delta^9$ -tetrahydrocannabinol (THC-COOH) to create a ratio that more accurately measures cannabis excretion. This retrospective analysis aims to evaluate the usefulness of the THC-COOH/Cr ratio to detect acute cannabis use among veterans who completed the DVAMC PTSD residential rehabilitation treatment program. Clinical outcomes were collected by UDS, clinician interview, UA, and PCL-5 to monitor treatment response. Data will be analyzed using statistical analysis to determine relationship of Cr and THC-COOH excretion. We hypothesize that the urine THC-COOH/Cr ratio may be used to qualitatively differentiate acute from chronic cannabis use. The THC-COOH/Cr ratio can lead to the more accurate identification of current cannabis users versus chronic users. The understanding of this ratio may lead to improved clinical practice and reduce barriers to care presented to VA patients seeking PTSD treatment.

Primary Presenter: **Lauren Walden**

Project Title: *Patient vs Physician Perceptions of Frailty: Clinical Frailty Scores of Older Adults in the Emergency Department*

Primary Mentor: Marian Betz

Thematic Area: Clinical Science

Abstract:

Introduction:

Frailty is a multidimensional state of vulnerability to physical and cognitive impairments. It is common in older adults and predicts poor outcomes such as functional decline, institutionalization, and death. The objectives of this study were to determine if emergency physicians and older adults differ in their perceptions of frailty, and if those perceptions of frailty were related to disposition from the Emergency Department (ED).

Methods:

This is a cross sectional study of community-dwelling older adults age 65 and older seen in the ED. The Clinical Frailty Scale (CFS) was reported by the patient and also by the treating emergency physician (EP). Patient-reported CFS and physician-assigned CFS were compared using Cohen's Kappa. Differences in CFS score by anticipated disposition from the ED was compared using chi squared tests.

Results: 272 patients were enrolled and completed the survey. Patients were significantly more likely to self-report CFS scores of 1-2 (very fit-well), while physicians were more likely to assign CFS scores of 3 (managing well) or 6-8 (moderate-very severe frailty). There was poor agreement ( $\kappa=0.188$ ) of frailty between physicians and patients. At a physician-reported frailty score of 6 (moderate frailty) or greater, physicians were more likely to plan to admit patients than discharge them. There was no clear pattern of planned disposition based on self-reported frailty.

Conclusion: For older adults in the ED, patient-reported CFS and physician-assigned CFS had poor agreement. Physician-reported CFS was more closely associated with hospital admission or transfer to skilled nursing facility than self-assigned CFS.

Primary Presenter: **Emily Warnock**

Project Title: *Advancing Alcohol and Other Drug Education among Social Work Faculty*

Primary Mentor: Paula Riggs

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

This study is an educational evaluation of participants (N = xx) in the second iteration of a 4-day immersion training program funded by the National Institute on Alcohol Abuse and Alcoholism (NIAAA). Using a pretest–posttest design, clinical social work faculty participants showed/did not show statistically significant/insignificant ( $p < xxx$ ) improvement in overall alcohol and other drug-related knowledge (baseline M = xxx, SD = xxx; postintervention M = xxx, SD = xxx) in the domains of screening and assessment, brief intervention, medication assisted treatment, and recovery and relapse prevention. Corresponding increases were/were not observed for faculty confidence in teaching clinical skills to students in the domains of alcohol and other drug screening, assessment, and treatment. This article focuses on Student Doctor Warnock’s role in the development of two of the six modules presented at the conference.

Primary Presenter: **Sharon White**

Project Title: *Primary Bladder Carcinoid Tumor: A Case Report*

Primary Mentor: Rodrigo Donalisio Da Silva

Thematic Area: Clinical Science

Abstract:

Transitional cell carcinoma is the most common type of bladder cancer in the United States (US). This case report discusses the finding of primary bladder carcinoid tumor (also called well-differentiated neuroendocrine tumor) in a woman with gross hematuria. With only 15-20 reported cases, primary bladder carcinoid is rare and the approach to treatment is unclear. There have been two muscle-invasive cases reported which required more extensive treatment plans. The patient presented in this case underwent complete transurethral resection (TUR) of the tumor with the recommendation of surveillance cystoscopy every 3 months.

Primary Presenter: **Evan White**

Project Title: *Cardiac screening prior to spinal fusion or growing device insertion in patients with neuromuscular scoliosis: a retrospective review*

Primary Mentor: Mindy Cohen

Thematic Area: Clinical Science

Abstract:

Abstract

**Background:** Neuromuscular scoliosis (NMS) is an abnormal, lateral curvature of the spine that occurs due to irregularities in the neuromuscular system. It™s indicated that children with NMS and congenital scoliosis are at higher risk for cardiac abnormalities, and there is a negative correlation between scoliosis severity and cardiopulmonary function. These children commonly require Vertical Expandable Prosthetic Titanium Rib (VEPTR) insertion or Posterior Spinal Fusion (PSF) to prevent progression of scoliosis; however, the optimum pre-operative cardiac evaluation prior to spine surgery remains unclear.

**Objective:** The goal is to characterize the types of pre-operative cardiac evaluation patients with NMS or congenital scoliosis undergoing VEPTR insertion or PSF are receiving, and whether these evaluations influence intra-operative or post-operative management.

**Purpose:** Determining the optimum pre-operative cardiac evaluation for children with NMS or congenital scoliosis undergoing VEPTR insertion or PSF.

**Methods:** A single-center retrospective chart review of 126 children with NMS or congenital scoliosis, who had a VEPTR insertion or PSF between January 2012 and May 2018. The data collected included scoliosis type, age, gender, Cobb angle, past medical history, type of pre-operative cardiac evaluation, and intra-operative or post-operative management changes or complications. Statistics were generated summarizing overall data using REDCap software.

**Results:** Of the 126 children, 78.4% underwent pre-operative cardiac evaluation; 44.8% received echocardiography. There was a higher rate of pre-operative cardiac diagnosis in patients with congenital scoliosis than other types of scoliosis while those with congenital scoliosis had lower rates of echocardiography. Those that had previous documented cardiac disease, 2.6% had cardiac anesthesia recommendation. €œLower risk€œ patients (no documented cardiac disease and Cobb angle <70 degrees) have lower rates of post-operative echocardiography (7.8% vs 15.4%), receive intra-operative vasopressors other than phenylephrine or ephedrine (12.5% vs 21.2%), or receive intra-operative chest compressions (0% vs 3.8%).

**Conclusion:** The results suggest that, in the absence of previously documented cardiac disease or severe Cobb angle, pre-operative echocardiography may not change intra-operative or post-operative management.

**Significance:** Altering pre-operative management strategies could conserve resources and lessen patient discomfort with unnecessary testing.

## 2019 Capstone Presentations

Session A: 1:00-2:00		Session B: 2:15-3:15		Session C: 3:30-4:30	
#	Name	#	Name	#	Name
1	Meryl Colton	52	Nikolas Johs	103	Jennifer Gile
2	Nathan Cutshall	53	Luis Escobedo	104	Sierra Crowe
3	Paul Eigenberger	54	Bryan Nycz	105	Kaitlyn Biernacki
3	Nathan Fischer	55	Mitchell Sungelo	106	Justin Thai
3	Arian Khorshid	56	Matthew Dillon	107	Krystal Tran
4	Robin Harland	57	Danielle Pite	108	Hania Flaten
5	Matthew Minturn	58	Saikripa Radhakrishnan	109	Katie Berenbaum
6	Hannah Schara	59	Phuong Nguyen	110	Srinidhi Radhakrishnan
7	Kyle Buchwalder	60	Joelle Takahashi	111	Amanda Glickman
8	Catherine Ard	61	Nichole Thorne	112	Jakob Gamboa
9	Kelsey Spaur	62	Laurel Dang	113	Tessa Harland
10	Robert Ungerer	63	Benjamin Fitzgerald	114	Eric Haaland
11	Jeffrey Lee	64	Aarti Prasad	115	Alexander Rajic
12	Madhav Narayan	65	John Hallett	116	Justin Allsop
13	Olivia Charlier	67	Alex Kretowicz	117	Joshua Mares
14	Paul Pelletier	68	Kevin Kim	118	Kaily Baer
15	Aya Angstadt	69	Kathleen Raskob	119	Katy Lehenbauer
16	Kara Blaisdell	70	Nicholas Anderson	120	Benjamin Saccomano
17	Abbas Mulla	71	Matthew Fioravanti	121	Ryan Davenport
18	Kelly Stewart	72	Judas Kelley	122	Taylor Lynch
19	Reade Tillman	73	Carolyn Ho	123	Emily Warnock
20	Adlei Carlson	74	Ding Ding	124	Eric Achatz
21	Andrew Flynn	75	Abhinav Gupta	125	Queenter Kisang
22	Richard Fuld	76	Blake Snyder	126	Sara Dryden
23	Nicholas Fling	77	Derek Marlor	127	Eric Sasine
24	Brandon Sklar	78	Blake Volkmer	128	Janet Kim
25	Leah Kellogg	79	Kelly Crane	129	Bijan Ghaffari
26	Allison Strauss	80	Nicholas Nguyen	130	Charles Ventriglia
27	Robert Fineberg	81	Rima Baliga	131	Sarah Black
28	Lauren Walden	82	Elizabeth Bloemen	132	Heather Caulkins
29	Noah Goldstein	83	Hogan Slack	133	Catharina Giudice
30	Eitan Halper-Stromberg	84	Emily Bressan	134	William Kromka
31	Stephan Papp	85	Ross Crandall	135	Anirudh Madabhushi
32	Garrett Prince	86	Katie Gorman	136	Nina Ball
33	Evan Manning	87	Michael Dittmar	137	Sara Schuster
34	Halley Flammer	88	Fred Gonzales	138	Christine Burton
35	Alexander Clinkenbeard	89	Derek Nhan	139	Jake Gadbaw
36	Lorena Rincon-Cruz	90	David Nguyen	140	Vivianne Andersen
37	Theodora Tran	91	Caleb Liberman	141	Britni Beagley
38	Evan White	92	Jacob Mago	142	Jennifer Butler
39	Carrie Keffler	93	Indira Sriram	143	Mai Nguyen
40	Phillip Ross	94	WAFIK SEDHOM	144	Matthew Cataldo

## 2019 Capstone Presentations

Session A: 1:00-2:00		Session B: 2:15-3:15		Session C: 3:30-4:30	
#	Name	#	Name	#	Name
41	Johnny Hoang	95	Andrew Jacobsmeyer	145	Nicholas George
42	Mikal Achnert	96	Christina Spandler	146	Travis Barlock
43	Tyler Reinking	97	Daniel Harter	147	Taylor Goodstein
44	Michaela Barbera	98	Shane Nau	148	Madison Lyon
45	Daniel Paz de Araujo	99	Caroline Nguyen	149	John Koopman
46	Gina Lee	100	Andrew Dabasinskas	150	Kevin Lee
47	Allison Rippy	101	Jess Coulter	151	Carl Dernell
48	Ellen Snyder	102	Alexander Dang	152	Brian Walsh
49	Erin McGonagle				
50	Kristina Barber				
51	Sharon White				