

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, March 2, 2017

**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**  
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*And*  
**Undergraduate Medical Education Office**

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**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!

Madiha Abdel-Maksoud, MP, MSPH, PhD

David Ammar, PhD

Ilango Balakrishnan, PhD

Carl Barnes, MD

Adria Boucharel, MD

Joseph Brzezinski, PhD

William Cornwell, MD

Colleen Dingmann, R.N., Ph.D.

Michele Doucette, Ph.D.

Charles Edelstein, MD, PhD

Adit Ginde, MD, MPH

Jackie Glover, Ph.D.

Daniel Goldberg, JD, PhD

Maryam Guiahi, MD, MSc

Pearce Korb, MD

Luidmila Kulik, PhD

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Leana May DO, MPH

Jose Mayordomo, Ph.D.

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Niklaus Mueller, PhD

Ram Nagaraj, PhD

Rooban Nahomi, PhD

Matthew Nalty, BA

Kristen Nowak, PhD, MPH

David Orlicky, Ph.D.

David Orlicky, Ph.D.

Clare Paterson, PhD

Karin Payne, PhD

Mark Petrash, PhD

Miriam Post, MD

Allan Prochazka, MD, MSc

Laura Pyle, PhD

Cordelia Robinson Rosenberg, PhD, RN

Joseph Sakai, MD

David Schwartz, MD

Robert Sclafani, PhD

Deb Seymour, PsyD

Nicole Tartaglia, MS, MD

Jean Tsai, MD, PhD

Catherine Velopulos, MD, MHS

Laura Wiley, PhD

Seonghwan Yee, PhD

Zhiying You, PhD

Hongjin Zheng, PhD

Primary Presenter: **Jaleh Akhavan**

Project Title: *Reproductive health, pregnancy risk factors and outcomes among women reporting sex work in Denver*

Primary Mentor: Gretchen Heinrichs

Thematic Area: Public Health and Epidemiology

Abstract:

Reproductive health, pregnancy risk factors and outcomes among women reporting sex work in Denver

Background: Worldwide, sex workers (SW) maintain more poor-health associated risk factors, higher rates of pregnancy, and are less likely to seek medical care than non-sex workers (NSW). There are no published data on the implications of sex work on child and maternal health in Denver.

Purpose: We examine reproductive health outcomes between female SW and NSW within Denver.

Methods: Retrospective review of de-identified Public Health STD Clinic medical records, of females age 12-65 years, collected from 2008-2012. Characteristics (pregnancy, sexually transmitted infections, drug use, and medical comorbidities) were summarized and compared by SW category, using chi-square and two-sample t-test of categorical or continuous measures (SAS 9.4). Pregnant SW and NSW age-matched 1:2 controls were qualitatively compared via chart review.

Results: SWs comprised 336/16,642 (2%) health records. SWs had higher parity (parity 5+ 11.6% vs 3.51%,  $p < 0.001$ ), IV drug use (17.2% vs 1.48%  $p < 0.001$ ), and medical comorbidities (34.4% vs 18.8%,  $p < 0.001$ ) compared to NSW. Qualitative analysis of 18 SW pregnancies matched to 36 NSW pregnancies revealed more lost to followup (88.9% vs 81.3%), later prenatal care, and more homelessness and substance abuse among SW than NSWs. One SW neonate underwent methadone treatment, versus no NSW neonates.

Discussion: Consistent with previously published literature, we show higher rates of pregnancy, health risks, and high loss to follow up among SWs. Obstacles in following SWs longitudinally present unique challenges in reporting pregnancy outcomes in this vulnerable population. Further research could better target care to improve health among Denver's SW population.

Primary Presenter: **Arian Anderson**

Project Title: *Assessing Social Determinants of Health in the Emergency Department*

Primary Mentor: Roberta Capp

Thematic Area: Public Health and Epidemiology

Abstract:

**Background:** The U.S. "Healthy People 2020" campaign highlights the importance of understanding social determinants of health (SDH).

**Objective:** We evaluated the 1) feasibility of conducting socio-health screenings in the ED, 2) prevalence of two types of SDH (economic and health care access), and 3) desire of patients to be linked with community resources.

**Methods:** Cross-sectional study of adults (aged 18-80 years) with public (Medicaid/Medicare) or no insurance, presenting to a large, urban, academic ED. From June to August of 2014, thirteen trained Student Patient Navigators (SPNs) administered socio-health screening surveys in the ED from 11 am – 5 pm, seven days a week. The surveys were designed to identify economic and health care access SDH, as defined by the "Healthy People of 2020". We used a multivariate logistic regression analysis to determine the association between patient characteristics and the presence of one or two SDHs.

**Results:** 454 of 646 patients (70%) agreed to complete the survey. The mean age was 42 years, 246 (54.2%) were females, 279 (61.5%) of patients had  $\geq 1$  chronic diseases, and 89% of patients identified at least one SDH. Approximately 6.5 out of 10 patients with 2 SDH expressed interest in being linked with community resources that could address their needs.

**Conclusions:** It is feasible to conduct socio-health screenings in the ED and a large proportion of patients who use the ED identify at least 1 SDH. A little over half of patients with 2 SDH wanted to be linked with community resources.

Primary Presenter: **Sarah Axelrath**

Project Title: *Strengthening Student Substance Abuse Management Skills Through Development of a Multi-Modal Curriculum Within the Denver Health Longitudinal Integrated Clerkship (DH LIC)*

Primary Mentor: Jennifer Adams

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

**Background:** The Denver Health Longitudinal Integrated Clerkship (DH LIC) was founded in 2014 to train third year medical students to meet the needs of urban-underserved patients. Despite the high prevalence of substance use disorders (SUDs) affecting this population, traditional medical school curricula under-emphasize clinical training in management of SUDs.

**Objectives and Methods:** A needs assessment of students was conducted to evaluate confidence in diagnosis and management of SUDs. Based on these results, a longitudinal, multi-modal curricular thread was developed and woven into the larger LIC curriculum. This curriculum consists of team-based learning sessions, structured didactics, communication workshops, reflective writing sessions, and clinical experiences at a variety of sites where SUDs are managed. In keeping with the structure of the LIC, these components are integrated into the core curriculum, allowing progressive student development across specialties simultaneously.

**Results:** Despite the high prevalence of SUDs among the Denver Health patient population, needs assessment of students and clinical faculty revealed that only 27% of students participating in the DH LIC reported a high level of comfort with management of substance abuse, despite 91% of faculty agreeing that development of this skill is important for clinical trainees. In a pre-curricular survey (N=8) assessing student knowledge and attitudes toward SUDs, 25% of students accurately identified three pharmacologic agents used to treat alcohol use disorder; 40% of students reported satisfaction from treating patients with SUDs. Assessment of student satisfaction with the curriculum is ongoing. When evaluating a dedicated clinical session in addiction medicine, students universally and strongly agreed that the experience positively influenced the way they think about patients with SUDs. At completion of the year-long curriculum, preceptor impressions about student knowledge and follow-up surveys measuring student attitudes and knowledge retention will be used to measure efficacy in reaching curricular goals.

**Discussion:** Despite the high prevalence of SUDs among urban-underserved patients, students lack the knowledge and clinical exposure needed to effectively manage SUDs. Integration of didactic and experiential learning in a longitudinal integrated clerkship may improve students ability to diagnose, treat, and care for this vulnerable population in both primary and acute care settings.

Primary Presenter: **Amy Beeson**

Project Title: *Community Health Workers Facilitate Linkage to HIV Care and ART Initiation Following Integrated, Home-Based Screening in Rural South Africa*

Primary Mentor: Sheela Sheno

Thematic Area: Public Health and Epidemiology

Abstract:

**Background:** In order to reach 90-90-90 targets and decrease morbidity and mortality from HIV, the South African health system must accelerate identification of HIV-positive individuals and early linkage to ART. However, there is no consensus about the most effective delivery model at this crucial step in the cascade of HIV care.

**Methods:** Eleven lay community health workers (CHWs) performed 3516 screenings in traditional Zulu homes, integrating tuberculosis symptom screening, noncommunicable disease screening, and HIV counseling and testing (HCT). CHWs then provided counseling, phone calls, repeat visits, and in some cases accompaniment to local clinics to facilitate linkage to care and ART initiation.

**Results:** CHWs identified 90 participants in need of linkage to care for HIV, including 55 who were unaware of their status and 35 with previously known HIV-positive status. Forty-three (78%) of those newly diagnosed were linked to HIV care with a median time to linkage of 1.5 weeks; of those linked to care, 33 (77%) subsequently initiated ART. Median CD4 cell count at the time of ART initiation was 301 (IQR 235-491.5). Among those with previously known HIV-positive status, 22 (63%) were linked to care and 12 (54%) initiated ART.

**Conclusions:** This pilot study demonstrated high rates of linkage soon after testing with a simple and low-cost, patient-centered intervention. We conclude that CHWs with adequate training and support performing integrated care are effective not only in identifying people living with HIV, but also in linking them to clinic care and well-timed ART. The yield of HCT along the cascade of care is enhanced when CHWs visit households repeatedly, developing relationships of trust with their neighbors. This adds to the growing body of evidence in support of broadening CHW-led delivery, though health system investment lags far behind.

Primary Presenter: **Elida Benitez**

Project Title: *Maternal Mental Health, Environmental Adversity and Behavioral Problems in Children: An Integrated Approach to Care*

Primary Mentor: Ayelet Talmi

Thematic Area: Public Health and Epidemiology

Abstract:

The aim of this study is to understand if there is a relationship between children presenting with behavioral problems and a history of elevated scores on mothers Edinburgh Postnatal Depression Scale (EPDS) between zero to four months postpartum at the Childrens Health Clinic (CHC) at Childrens Hospital Colorado. We hypothesize that mothers who have high EPDS scores (10 or above) at newborn, 2 weeks, 2 months, or 4 months postpartum visits will be more likely to have children who later present with "behavior problem" and require consultation from the Consultation and Liaison in Mental Health and Behavior (CLIMB) team at the CHC. Identifying whether or not children who present to the clinic with behavior problems had mothers with elevated EPDS scores can help in determining the importance of early identification of postpartum depression, and proper referral and treatment for mothers in order to decrease the risk of maladaptive behaviors in their offspring.



Primary Presenter: **Brenna Benson**

Project Title: *The Stressors on the Families of Children with Developmental Disabilities Across Four Age Groups*

Primary Mentor: Laura Pickler

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

Abstract: The Stressors on the Families of Children with Developmental Disabilities Across Four Age Groups. BA Benson, (MD, GS). LL Pickler, Department of Family Medicine, University of Colorado School of Medicine, Aurora, CO.

Numerous studies have been conducted to show that the health-related quality of life for children with disabilities is lower than that of children without disabilities. The literature describes the psychological impact of having a child with a disability and the main factors influencing the lives of these children and their caregivers. However, to our knowledge, a study focusing on how aging of the child may affect the overall quality of life of the entire family has not yet been explored. It was hypothesized that as disabled children age, their families face different challenges, and thus require different support systems. The quantitative data was collected using the PedsQL<sup>®</sup> survey tool (n=78), which included two surveys (parent and family report and child proxy report) and assessed quality of life based on different domains of functioning. The qualitative data was collected through focus groups (n=18) with the caregivers. The participants were stratified based on the age of the child, with four groups in total (2-4, 5-7, 8-12, and 13-18 years of age). Preliminary statistical analysis revealed insignificant differences in question responses between the different age groups ( $p>0.05$ ). However, analysis of the specific domains revealed areas of need across all age groups, with high levels of stress involved in Daily Activities and Family Functioning. The individual age groups also revealed different needs, which were: difficulties in finding access to care, support groups, and resources in the 2-4 year-old group; challenges surrounding transitions into school for the 5-7 year-old group; school-related stresses leading to decreased social and emotional functioning for the 8-12 year-old group; and concerns about transitioning into adulthood for the 13-18 year-old group. Although none of these challenges are new findings in the realm of children with developmental disabilities, isolating the stresses by age of the child could be utilized by policy makers and support groups for more focused care. Further research is needed to further investigate each of these challenges by age group, but the results of this study can contribute to tailoring supports to each individual family's needs. As this study included families living in Colorado, it is the hope that respite care groups in the area can use this data to offer age-specific and whole family resources in the areas of need specified above.

Primary Presenter: **Alyssa Blood**

Project Title: *Risk and Protective Factors Associated with Surgical Infections Among Spine Patients*

Primary Mentor: Brenda Bucklin

Thematic Area: Clinical Science

Abstract:

It is estimated that each year, 1-10% of patients undergoing spine surgery develop a post-operative wound infection, many of which are preventable. Surgical site infections (SSI) are often caused by a complex series of events and a number of patient-associated and surgery-associated risk and protective factors have been proposed as contributing to the overall risk of acquiring a post-operative SSI. A detailed knowledge of these risk and protective factors can lead to decreased rates of infection as providers are better equipped to implement preventative measures and interventions that may minimize a patient's risk of SSI. A systemic review of the current literature on risk and protective factors among patients undergoing orthopedic spine surgery was performed to address this research question. CINAHL, PubMed, Ovid Medline, and Ebsco databases were searched for articles published between January 2003 and October 2015 meeting the review criteria; this search was supplemented by a hand search for remaining articles. Articles were included based on detailed inclusion and exclusion criteria and the search was conducted according to the PRISMA method. 29 studies were selected for full text review. The results of this systemic review lacked consensus regarding risk and protective factors for post-operative SSI among patients undergoing orthopedic spine surgery. There was however consistent evidence that optimization of patient comorbidities, physical status, and nutrition in the pre-operative period contributes to lower risk of post-operative SSI. Modifiable patient-specific risk factors such as smoking and diet should also be addressed prior to scheduled spine surgery. It is less clear how surgery-specific factors affect overall risk of SSI among surgical spine patients. At present, there is no single set of Level I evidence that exists to establish a universally applicable protocol for infection risk amongst orthopedic spine patients and future studies are needed in order to develop an evidence-based set of clinical recommendations to decrease the incidence of surgical site infections in patients undergoing spinal surgery.

Primary Presenter: **Elizabeth Boscoe**

Project Title: *Otolaryngology in the Medical School Curriculum: Current Trends in the United States*

Primary Mentor: Cristina Cabrera-Muffly

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

Objectives/Hypothesis: To identify trends in medical school otolaryngology curriculum requirements.

Study Design: Survey of United States allopathic medical schools.

Methods: A survey was sent to deans of curriculum at allopathic medical schools. We identified opportunities for medical students to learn basic concepts in otolaryngology during their undergraduate medical training. The opportunities were classified into preclinical and clinical as well as elective and mandatory rotations.

Results: Of the schools surveyed, 60% responded. Mean class size was 149 students. Sixty-eight percent of surveyed schools noted that 75% to 100% of their students participated in preclinical otolaryngology experiences, with 59% reporting a mandatory preclinical otolaryngology module for all students. Eighty-nine percent of schools offered otolaryngology as a clinical elective rotation, with a mean of 12 students participating yearly. Only 7% of schools required a mandatory otolaryngology clinical rotation.

Conclusion: Our data suggest that medical students do not receive sufficient exposure to otolaryngology during medical school. Increased requirements for otolaryngology curriculum may be beneficial to all medical students, regardless of their specialty choice.

Key Words: Health policy, otolaryngology, medical school, curriculum, medical education.

Level of Evidence: N/A. Laryngoscope, 00:000-000, 2016.

Primary Presenter: **Amelia Bowman**

Project Title: *Community-Students Together Against Healthcare Racism (C-STAHR):*

*Evaluating Effective Community-Guided Interventions to Address Implicit Bias and Perceived Discrimination in Health Care*

Primary Mentor: Janet Meredith

Thematic Area: Public Health and Epidemiology

Abstract:

C-STAHR (Community-Students Together Against Healthcare Racism) was founded in 2010 by medical students passionate about addressing racial disparities healthcare in collaboration with 2040 Partners for Health. C-STAHRs vision is œFor students and community to work together to better understand perceived discrimination and design a feasible intervention to better equip future healthcare providers and community members to reduce its effects. In pursuit of this vision, the group adheres to a strict Community Based Participatory Research process where decision-making is shared equally between community members and students. C-STAHR developed a problem tree to explore discrimination in healthcare as it is experienced by the Aurora/Denver community. Together, they identified breakdowns in provider-patient communication as well as institutional discrimination as major factors. C-STAHR has implemented several interventions over the past five years:

\* A communication tool to facilitate more effective communication between patients and their providers. This tool was implemented at the Salud Family Health Centers in Colorado (FQHC). Tool evaluation revealed that the most persistent difficulty experienced by patients was too little time with their healthcare provider.

\* HEROES, a youth health education and empowerment experience, began in 2014. The program was designed to increase the representation of individuals from diverse backgrounds in healthcare careers. After completing the curriculum, students expressed a statistically significant increase in their interest to pursue a healthcare career.

\* Focus groups exploring key issues around discrimination and cultural respect that need to be addressed in medical education. We plan to develop a community advisory board to evaluate bias and stereotypes in school of medicine cases and to create an interdisciplinary curriculum that can be implemented for health professional students.

By facilitating community dialogue and developing multi-pronged interventions, C-STAHR is a unique example of how sustainable partnerships can be created between academia and community, hence œcommuniversity.

Primary Presenter: **Robert Brooks**

Project Title: *Survival benefit of Budd-Chiari patients who undergo TIPS as a bridge to transplant  
“ a single center experience*

Primary Mentor: Paul Rochon

Thematic Area: Clinical Science

Abstract:

Purpose:

Budd-Chiari Syndrome (BCS) is a rare liver disorder usually secondary to an underlying cause. However, some cases are due to unknown etiology. Patients can be diagnosed in different stages and treated accordingly. Transplant is regarded as the optimal therapy for patients. However, patients usually have a lengthy time on the transplant list. Creation of a Transjugular Intrahepatic Portosystemic Shunt (TIPS) can aid in patients with this type of veno-occlusive disease as a bridge to transplant.<sup>1</sup> The proposed research seeks to determine if TIPS improves overall survival in patients with BCS, and allows more patients to receive transplant.

Materials and Methods:

A retrospective cohort study performed composed of all patients with BCS treated at the University of Colorado Hospital from 1996 to 2015 after approval by the institutional review board. Data were abstracted from electronic medical records including patient age, sex, comorbidities, relevant procedures received and lab values for bilirubin, creatinine, serum sodium and INR, liver transplant status, and date of transplant (if received).

Descriptive statistics were calculated for patient characteristics including, means, medians, standard deviations, frequencies and percents.

Aim 1: Cox proportional hazards regression was used to evaluate time to death; covariates included age at diagnosis, sex, TIPS placement and receipt of transplant. Kaplan-Meier survival curves were produced for time to death and time to death before transplant by TIPS placement status.

Aim 2: A Fishers exact test was used to evaluate differences in proportions of patients surviving until liver transplantation by TIPS placement. Statistical analyses were conducted with SAS 9.4 and Stata 14.0.

Results:

A total of 63 patients were included in the cohort, ranging from 17 to 74 of age at diagnosis. Overall, 41% of patients had TIPS creation and of these patients, 62% underwent at least one TIPS revision. A total of 32% of patients received a liver transplant and 14% of patients died during the follow-up period, and 10% died before receiving a liver transplant. Survival analysis found a protective effect of TIPS (HR = 0.43), although this effect was not statistically significant ( $p=0.29$ ). The final survival model included sex, transplant receipt and labs (bilirubin, INR, sodium, creatinine) as covariates. The proportion of patients who survived until transplant did not differ by TIPS placement ( $p=0.48$ ). As a post-hoc analysis, we evaluated survival at ten years after diagnosis and found a slightly more protective effect of TIPS (HR=0.36,  $p=0.28$ ). The estimate was nearly identical to the estimate for transplant effect (HR=0.37,  $p=0.35$ ).

#### Conclusion:

TIPS is associated with improved survival after adjusting for patient sex, transplant status and lab values, although this effect was not statistically significant.

Primary Presenter: **Jared Brown**

Project Title: *Physician involvement in life transition planning*

Primary Mentor: Marian Betz

Thematic Area: Public Health and Epidemiology

Abstract:

**Background:** With many information sources for healthy aging and life transitions, it is unknown whether community-dwelling older adults desire physician involvement in future planning decisions. The study aimed to examine older adults experiences and opinions concerning four future planning domains: advance care planning, driving, finances, and housing.

**Methods:** Adults aged  $\geq 55$  years living at a large urban, independent living facility were surveyed with an anonymous, voluntary, paper-based, mailed questionnaire. Survey domains were advance care planning, driving, finances, and housing. For each domain, questions assessed confidence, openness to discussions, information sources, and prior and desired future role of the physician in decision-making by domain. Comparisons across and within domains were determined using Chi-square tests.

**Results:** The response rate was 56 % (N = 457; median age: 75 years; 74 % female). Among advance care planning, driving, and finances, respondents were more confident about what it means to have an advance directive (87 %, 95 % CI 84 ~ 90 %) than alternative transportation options (46 %, 95 % CI 42 ~ 51 %). Nearly two-thirds of respondents (64 %, 95 % CI 59 ~ 68 %) were open to discussing driving cessation, though only one-third (32 %, 95 % CI 28 ~ 37 %) were open to having a family member determine timing of driving cessation. More individuals (44 %, 95 % CI 39 ~ 49 %) were open to a physician deciding about when to stop driving. Past discussions with family or friends about advance care planning or finances were common, although past discussions about driving were less common. Respondents reported personal experience and family as key information sources, which were significantly more common than healthcare providers. While prior involvement by physicians in decision-making was rare across all domains, some respondents expressed desire for future physician involvement in all domains, with advance care planning (29 %, 95 % CI 25 ~ 33 %) and driving safety (24 %, 95 % CI 20 ~ 28 %) having highest levels of support for future physician involvement.

**Conclusions:** Some older adults desired more physician involvement in future planning for life transitions, especially related to advance care planning and driving compared to finances and housing. Clinical implications include increased patient-centered care and anticipatory guidance by physicians for aging-related life transitions.

Primary Presenter: **Jennifer Case**

Project Title: *Alemtuzumab Use in a Single Center Pediatric Heart Transplant Cohort*

Primary Mentor: Scott Auerbach

Thematic Area: Clinical Science

Abstract:

To describe the use and complications of alemtuzumab (AMB), a CD52 monoclonal antibody, in pediatric heart transplant (HT) patients (pt) facing acute graft rejection.



Primary Presenter: **Vivek Chadayammuri**

Project Title: *A Comparative Analysis of the Mechanical Stability of Carbon-Fiber versus Stainless Steel Locking Compression Plates for Fixation of Proximal Humerus Fractures*

Primary Mentor: Ryan Fader

Thematic Area: Clinical Science

Abstract:

Objectives: Proximal humerus fractures represent one of the leading orthopaedic causes of mortality among the elderly population. Based upon historical data, it is extrapolated that proximal humerus fractures will comprise 245,000 emergency department (ED) visits within the United States alone in 2030. Current surgical methods carry a risk of postoperative complication as high as 40%, in part owing to the mismatch in modulus of elasticity and lack of radiolucency of traditional stainless steel locking plates (SS-LCPs). Carbon-fiber-reinforced polyetheretherketone (CFR-PEEK) represents a novel biomaterial that overcomes several of these shortcomings, but its use remains to be validated. The purpose of this study was to assess the mechanical stability of CFR-PEEK versus SS proximal humerus LCPs.

Methods: CFR-PEEK and SS proximal humerus LCPs were acquired and divided into proximal and distal sections (corresponding to holes with humeral head and diaphyseal fixation, respectively). Screws were inserted using 1.5 Nm of force (per manufacturer recommendations). Stiffness and load to failure, defined as 2 mm of screw displacement, were tested for each of the three experimental conditions: (1) CFR-PEEK vs SS LCP secured by on-axis insertion of locking screws, (2) CFR-PEEK LCP with on-axis screw insertion, removal, and re-insertion, and (3) CFR-PEEK LCP with 10-degree off axis insertion for comparison to on-axis insertion. An Instron servo-hydraulic machine was utilized to simulate cantilever bending at a rate of 1 mm/min using a 6.35 mm diameter steel rod, and load-displacement data was recorded and analyzed.

Results: Load to failure of the distal locking screws was significantly greater in the CFR-PEEK LCPs compared to SS LCP ( $746.4 \pm 89.7$  N vs  $596.5 \pm 32.6$  N,  $p < 0.001$ ). Among CFR-PEEK LCPs, stiffness of distal locking screws was significantly greater when inserted on-axis ( $361 \pm 63.6$  N/mm) compared to 10-degrees off-axis ( $150.5 \pm 36.2$  N/mm), as was load to failure ( $746.4 \pm 89.7$  N vs  $324 \pm 60.5$  N;  $p < 0.001$ ). No catastrophic failures/deformities of the implants were observed.

Conclusion: CFR-PEEK LCPs confer comparable strength and stability of fixation compared to traditional SS LCPs. The use of CFR-PEEK proximal humerus LCPs may enable improved visualization and placement of orthopedic hardware, thereby reducing the high rate of postoperative complications associated with current surgical methods of treatment. Additional studies investigating this promising treatment modality are warranted given the exponentially growing incidence and mortality associated with these fractures within the United States.

Primary Presenter: **Van (Mimi) Chau**

Project Title: *Barriers to Single-Dose Levonorgestrel-only Emergency Contraception Access in Retail Pharmacies*

Primary Mentor: Carol Stamm

Thematic Area: Public Health and Epidemiology

Abstract:

**Objectives:** In February 2014, the FDA updated its regulations to make all single-dose levonorgestrel-only emergency contraception (LNG-EC) available over-the-counter. This study examines the availability and access to LNG-EC shortly after this policy change, and any additional barriers to obtaining LNG-EC in Colorado retail pharmacies.

**Study Design:** Three female interviewers posing as women seeking LNG-EC conducted a telephone survey of 633 Colorado retail pharmacies listed in the The Little Blue Book phone directory from June “ July 2014. Completely accessible was defined as LNG-EC available on store shelves for purchase without presentation of an ID or prescription on the day of the call.

**Results:** Of 633 pharmacies analyzed, 538/633 (85.0%) were in urban settings and 540/633 (85.3%) were chain stores. Eighteen of 64 (28.1%) counties in Colorado did not have a pharmacy listed in phone directory. 86.9% (550/633) of pharmacies had EC in stock on the day of contact but only 23.2% (147/633) of these had EC completely accessible. Of pharmacies with EC in stock, 229/550 (41.6%) kept it behind the counter and 308/550 (56.0%) required additional documentation to purchase. In stock and completely accessible rates were not significantly different between rural, urban, and frontier geographic region within the state ( $p = 0.066$  and  $p = 0.905$  respectively), but were significantly different across independent, chain and 24-hour type stores ( $p < 0.001$  and  $p = 0.008$  respectively).

**Conclusions:** Rates of completely accessible levonorgestrel-only EC are low in Colorado despite high rates of availability. Behind-the-counter status and proof-of-age requirements are identified as the main sources of access restriction in Colorado. Future direction should focus on increasing complete accessibility rates by understanding why pharmacies continue to report outdated regulatory policies and pursuing environmental changes (package labeling) that liberalize LNG-EC access at the consumer level.

Primary Presenter: **Zia Choudhury**

Project Title: *Survey of Parents of Children and Youth with Developmental Disabilities and Behavioral/Psychiatric Diagnoses*

Primary Mentor: Cordelia Robinson Rosenberg

Thematic Area: Public Health and Epidemiology

Abstract:

Project Title: Survey of Parents of Children and Youth with Developmental Disabilities and Behavioral/Psychiatric Diagnoses

Student Investigators: Shamita Punjabi, Erin Hickey, Sterling McLaren, Zia Choudhury

Principal Investigator: Cordelia Robinson Rosenberg, Ph.D., R.N.

1A. Statement about conflicts of Interest: Neither the student investigators nor the principal investigator on this project have any conflicts of interest in regards to this project.

1B. Problem Statement: Children and youth with developmental disabilities and behavioral/psychiatric diagnoses are treated at the emergency department for behavioral crises and the patients/their parents do not feel they get adequate treatments/interventions before discharge.

Question: Do families of children with dual diagnosis of developmental disability and behavioral/psychiatric conditions have access to appropriate medical and behavioral health resources needed to support their children during and following a behavioral crisis?

Hypothesis: Children and youth with developmental disabilities and behavioral/psychiatric diagnoses do not have adequate access to mental health services and are consequently inappropriately treated at the emergency department for behavioral crises.

Specific Aims:

\* To develop a needs assessment to determine gaps in access to treatment after a psychiatric crisis for families of children ages 6 " 17 who live in Colorado and have a dual diagnosis of developmental and psychiatric/behavioral disorders. This assessment will be implemented as a survey via telephone, Internet, and mail.

\* To perform statistical analysis to determine demographic and developmental characteristics impacting access to care and related health outcomes including readmissions, use of emergency services, and patient satisfaction.

\* To develop a sample crisis intervention plan for family members and care providers addressing a solution for comprehensive care in this population.

Primary Presenter: **Zeta Chow**

Project Title: *A Pharmacist-Physician Collaboration to Optimize Benzodiazepine Use for Anxiety and Sleep Symptom Control in Primary Care*

Primary Mentor: Katy Trinkley

Thematic Area: Public Health and Epidemiology

Abstract:

Introduction:

Benzodiazepines are prescribed inappropriately in up to 40% of outpatients. The purpose of this study is to describe a collaborative team-based care model in which clinical pharmacists work with primary care providers (PCPs) to improve the safe use of benzodiazepines for anxiety and sleep disorders and to assess the preliminary results of the impact of the clinical service on patient outcomes.

METHODS:

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Adult patients were eligible if they received care from the academic primary care clinic, were prescribed a benzodiazepine chronically, and were not pregnant or managed by psychiatry. Outcomes included baseline PCP confidence and knowledge of appropriate benzodiazepine use, patient symptom severity, and medication changes.

RESULTS:

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Twenty-five of 57 PCPs responded to the survey. PCPs reported greater confidence in diagnosing and treating generalized anxiety and panic disorders than sleep disorder and had variable knowledge of appropriate benzodiazepine prescribing. Twenty-nine patients had at least 1 visit. Over 44 total patient visits, 59% resulted in the addition or optimization of a nonbenzodiazepine medication and 46% resulted in the discontinuation or optimization of a benzodiazepine. Generalized anxiety symptom severity scores significantly improved (-2.0; 95% confidence interval (CI): -3.57 to -0.43).

CONCLUSION:

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Collaborative team-based models that include clinical pharmacists in primary care can assist in optimizing high-risk benzodiazepine use. Although these findings suggest improvements in safe

medication use and symptoms, additional studies are needed to confirm these preliminary results.

Primary Presenter: **Robin Christian**

Project Title: *Measuring the Health of an Invisible Population: Lessons From the Colorado Transgender Health Survey*

Primary Mentor: Rita Lee

Thematic Area: Public Health and Epidemiology

Abstract:

Background Transgender people, those whose gender identity does not match their birth sex, face social stigma and inequality. Previous work has identified barriers to receiving health care, including discrimination, prohibitive cost, and difficulty finding a provider. The Colorado Transgender Health Survey sought to explore current disparities and their effects on the health of transgender people in Colorado. Methods The Colorado Transgender Health Survey was developed by the Colorado LGBT Health Coalition, the Colorado Department of Public Health and Environment, and transgender community members. The survey was based on the Behavioral Risk Factor Surveillance System (BRFSS). The survey was primarily web-based, using snowball sampling techniques. Targeted outreach included transgender events, LGBT pride festivals, colleges and universities, healthcare providers, and churches. Participation was voluntary and anonymous. Results from participants who identified as transgender or gender-nonconforming, lived in Colorado, and were over the age of 18 were included in the analysis. Results Over 400 respondents met inclusion criteria. In all, 25 distinct gender identities were reported. Social inequalities were apparent, with 42% of our sample reporting a household income under \$25,000, though 61% of respondents hold a college degree. Access to healthcare is a problem, with 40% reporting delaying necessary medical care due to cost, inadequate insurance coverage, and/or fear of discrimination. While the overall health of our sample appeared similar to the general population, mental health outcomes were drastically different. Over half of our sample had been diagnosed with an anxiety disorder, 44% were currently depressed, 36% contemplated suicide in the past year, and 10% reported a suicide attempt in the past year. Respondents with a transgender-inclusive provider reported better overall health. They were more likely to receive wellness exams (76% vs 48%), less likely to delay care due to discrimination (24% vs 42%), and were less likely to be depressed (38% vs 54%) or attempt suicide (7% vs 15%). Conclusions This survey, one of the largest state-based surveys of its kind, found that the transgender community in Colorado continues to face significant disparities. Mental health is highlighted as a critical element in addressing health disparities in this community. The impact of a transgender-friendly provider was found to be a major factor in improving health and health behavior. Limitations include a non-random sampling design, which limits the ability to compare the health of the transgender population to the overall population of our state. Further research and education on transgender health and health care should to be incorporated into national efforts to eliminate health disparities.



Primary Presenter: **Serhiy Chumachenko**

Project Title: *Adolescent females with substance and conduct problems: hypoactivity of the retrosplenial cortical region of the default mode network*

Primary Mentor: Joseph Sakai

Thematic Area: Basic Biomedical Science

Abstract:

Conduct and substance use disorders (CD and SUD) are highly comorbid, and both are characterized by problems of inhibitory control. To date limited research has linked CD and SUD in adolescents to differences in the brain's default mode network (DMN). Because CD and SUD present differently between sexes, we tested for DMN differences in an all-female sample.

Twenty one adolescents with severe substance and conduct problems and 20 healthy controls, all female, aged 14-18 years (mean 16.5) played a risk-taking decision task with interspersed directed trials and periods of rest during fMRI imaging. Independent component analysis was utilized to extract the DMN component, and the component signals intensity was analyzed for group differences.

Patients showed significantly decreased DMN activity bilaterally in the retrosplenial cortex (BA 29 and 30), and this effect remained even after accounting for several potential confounds, including measures of attention-deficit/hyperactivity disorder and major depressive disorder, current medication use, or handedness.

Our findings suggest a replicable functional neurological connection between severe adolescent substance and conduct problems and a brain region involved in episodic memory recall and internal mentation. Such patient-control differences in DMN activity especially in the retrosplenial cortex merit further investigation.

Primary Presenter: **Thomas Clagett**

Project Title: *Next steps from the NLST: Establishing a cohort to evaluate for reliable biomarkers to risk - stratify high risk patients*

Primary Mentor: York Miler

Thematic Area: Public Health and Epidemiology

Abstract:

Background:

Lung cancer continues to be a prevalent and particularly lethal form of cancer and efforts continue in order to reduce both the incidence of the disease and the stage when it is diagnosed. The National Lung Screening Trial (NLST) was completed in 2013 and showed a 20% reduction in lung cancer mortality in patients screened by low-dose CT (LDCT) compared to the standard chest film modality among patients at high risk for developing lung cancer. The feasibility, however, of implementing CT scans to screen high-risk patients for lung cancer is called into question given the limitations of a LDCTs sensitivity and specificity.

Methods:

In 2010 a prospective cohort was established through the Denver VA (VAECHS) and University of Colorado Cancer in an effort to begin the work of identifying biomarkers that may help guide clinicians in decision-making for working up

an indeterminate pulmonary nodule. The characteristics of the cohort were assessed for generalizability to the larger population of patients with indeterminate pulmonary nodules. Additionally, compliance rates for follow-up and specimen acquisition were assessed for feasibility to guide best-practice methods in collecting specimens in a cost-effective manner. The biospecimens were collected over the 3 year time-window of the study as a diagnosis was pursued.

Results:

The VAECHS patients were predominately white former smokers between the ages of 60 and 69. 39% of the cohort ended up being diagnosed with cancer over the study period. Most of the patients diagnosed with lung cancer during the study period were diagnosed at stage 1. Approximately 50% of the lung cancer cases were adenocarcinomas. The successful acquisition of biospecimens at scheduled follow up dates was 25% after 3 years.

Conclusions:

The NLSTs findings and the subsequent recommendations from the United States Preventive Services Taskforce (USPTF) suggests that efforts to identify biomarkers associated with and without lung cancer will provide great utility for the clinician left wondering what to do with an

incidentally found indeterminate pulmonary lung nodule. This cohort's features point to the importance of a diverse and representative sampling of the population. Furthermore, the attrition from deaths, research subject withdrawal and missed opportunities to collect specimens suggests that successful long term specimen acquisition may be the biggest challenge to overcome in order to build a cohort to differentiate cancerous from benign nodules. Modest remuneration would be suggested to better ensure compliance with acquisition and follow-up visits.

Primary Presenter: **Joseph Clere**

Project Title: *Incidence and Predictors of Emergency Department Thoracotomy Performed Outside of Temporal Guidelines for Trauma Arrest*

Primary Mentor: Fredric Pieracci

Thematic Area: Clinical Science

Abstract:

Incidence and Predictors of Emergency Department Thoracotomy Performed Outside of Temporal Guidelines for Trauma Arrest

Fredric M Pieracci MD, MPH, Joseph Clere BS, Denis Bensard MD, Eric Campion MD, Clay Cothren Burlew MD, Charles Fox MD, Ryan Lawless MD, Kevin McVaney MD, Melissa Migliero RN, Mitchell Cohen MD, Gene Moore MD.

Denver Health Medical Center, Denver, CO

**Background:** Emergency department thoracotomy (EDT) is a potentially life-saving procedure, the success of which is dependent upon accurately identifying salvageable patients. Based upon the Western Trauma Association data, most trauma centers have adopted temporal guidelines predicated on the duration of pre-hospital cardiopulmonary resuscitation (CPR) following loss of pulses. The purpose of this study was to examine institutional adherence to said guidelines, as well as identify predictors of deviation.

**Methods:** Trauma arrests who underwent EDT at our level I trauma center were reviewed from 2011-2015. Time of CPR initiation was obtained from the paramedic trip sheet, and time of EDT from nursing records. An EDT was considered to be within window based on the following temporal criteria: Less than 15 minutes of pre-hospital CPR for penetrating torso trauma; < 10 minutes for blunt trauma; < 5 minutes for penetrating extremity trauma. Patients with isolated head trauma, as well as those who underwent EDT for refractory hypotension (without arrest) were excluded. Patients were stratified by mechanism of injury, age, and gender.

**Results:** A total of 243 trauma arrest patients were analyzed; 146 (60.1%) underwent EDT. Overall, 65 EDTs (44.5%) occurred out of window. Deviation from the guidelines was most likely in cases of penetrating extremity trauma (80.0%) and age < 18 years (57.1%), and least likely in

cases of penetrating torso trauma (41.3%) and age > 65 years (40.0%) (Table). Likelihood of deviation was not associated with mechanism of injury, age or gender. Overall, 15 (10.3%) EDT patients survived to hospital discharge; 6/75 (8.0%) for penetrating torso trauma, 7/66 (10.6%) for blunt trauma, and 2/5 (40.0%) for penetrating extremity trauma ( $p=0.07$ ). Survival was 14/81 (17.3%) in the within window group and 1/65 (1.5%) for the out of window group ( $p<0.01$ ). The singular patient who survived following out of window EDT sustained a brachial artery transection, underwent EDT after 6 minutes of pre-hospital CPR, and was discharged home neurologically intact.

Conclusions: Almost one half of EDTs occurred outside of institutional temporal guidelines, and were nearly universally unsuccessful. Efforts to mitigate this finding should target pediatric and penetrating extremity trauma patients. The survival observed herein following EDT performed within the temporal pre-hospital CPR window represents the highest reported to date.

Primary Presenter: **Christine Cliatt Brown**

Project Title: *Evaluation of the identification and treatment of status epilepticus by staff members in the emergency department*

Primary Mentor: Cornelia Drees

Thematic Area: Clinical Science

Abstract:

Background - Status Epilepticus (SE) is a medical emergency requiring rapid identification and treatment. Patients in SE frequently arrive through the emergency department (ED) for initial evaluation and treatment. For this quality improvement project, we set out to determine how well our ED staff identify and treat SE. Then, with a brief education session for the ED providers, we attempted to improve understanding of SE and its treatment in the hope that this would lead to quicker identification and treatment.

Methods - We surveyed ED staff at the University of Colorado Hospital regarding their understanding of and management of SE. After the initial survey, we initiated education on the recommended management of SE. Then, we repeated the survey for comparison. Additionally, we evaluated the effectiveness of the training by evaluating the time to diagnosis, treatment, and resolution of SE in the six months prior to the education and in the six months following the education.

Results - (Data collection remains in progress.)

Conclusion - (The management of and understanding of SE was improved by the initiation of education and training. OR The management of and understanding of SE was not significantly changed by the initiation of education and training.)

Primary Presenter: **Hayley Crossman**

Project Title: *A survey of preclinical medical students at the University of Colorado: an assessment of study habits, resources, attitudes and motivations*

Primary Mentor: John Cohen

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

Background: The United States Medical Licensing Exam (USMLE) Step 1 was created with the purpose to serve as a common evaluation system for applicants for initial medical licensure. Today, the numerical score of this exam is commonly utilized in the selection of candidates for residency positions, with 67% of residency program directors stating that they have a set minimum Step 1 score for selecting which applicants to interview.<sup>1</sup> The medical education community has recently taken interest in how Step 1 has evolved from a licensing exam to an essential component for residency selection. Some have called the Step 1 exam an insufficient tool for the job, and highlighted how its inadvertent role in residency selection has unintended consequences in medical education.<sup>2</sup>

Methods: A cross-sectional, descriptive study designed by two second year medical students in the form of a survey was administered to all first and second year medical students at the University of Colorado in March 2015. The survey inquired about the students study habits, specifically study time allocation and resource utilization. The survey also evaluated students trust in study materials and in the preclinical curriculum in relation to Step 1 preparation. Lastly, the Academic Motivation Scale (AMS) was included to categorize students as intrinsically or extrinsically motivated. The results from the anonymous and voluntary surveys were statistically analyzed between first and second year students for significant patterns.

Results: Of a total of 340 students, 127 surveys were completed. Students prioritize the Step 1 exam during their preclinical years of medical school, with second year medical students spending significantly more time studying for Step 1 (mean 23.8 hours vs 1.39 hours,  $p < 0.0001$ ) and less time on the schools Core Curriculum (mean 25.14 hrs vs. 45.2 hrs,  $p < 0.0001$ ) when compared to first year students. Additionally, 79.1% of MS2s and 41.6% of MS1s indicated that Step 1 was their highest motivational priority. Second year students trusted the Core Curriculum less when it came to preparing them for Step 1 ( $p=0.0133$ ) and trusted external resources more to prepare them for Step 1 ( $p=0.0426$ ). There was no significant difference when it came to study time, study resources, or motivational factor when comparing intrinsically and extrinsically motivated students as categorized by the AMS.

Conclusion: The majority of second year students and a sizable number of first year medical students prioritize Step 1 in their preclinical years. Students clearly value external resources in their Step 1 preparation, citing the qualities of cohesiveness, conceptual frameworks, and simplified organization as reasons these external resources are valued over the schools primary curriculum. As Step 1 retains its importance in the residency selection process and external resources continue to refine their role in test preparation, it will be important to consider solutions for reconciling this pattern of multiple, conflicting curricula: Step 1 preparation pursued largely through external resources and the schools primary preclinical curricula.



Primary Presenter: **Rachel De Andrade Pereira**

Project Title:

Primary Mentor: Darlene Tad-Y

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

SCRIPTING MULTI-DISCIPLINARY ROUNDS ENHANCES EFFICIENT AND PRODUCTIVE  
COORDINATION OF CARE FOR STROKE PATIENTS

Rachel de Andrade Pareira, MS1; Stephen T Groves, MBA3; David Medrano4; Melanie Muszelik3; Megan Ross, MPH5; Madeline Rovira1; Joseph Sweigart, MD6; Read Pierce, MD1; Darlene Tad-y, MD1; Shelly Limon, RN2; Jennifer Simpson, MD1

**Background:** Well-designed multidisciplinary rounds (MDRs) focused on stroke patients can reduce mortality by over 30%. Accordingly, the Joint Commission encourages hospitals seeking certification as stroke Centers of Excellence to implement disease-specific MDRs, in which a team of providers jointly develops patient care plans to enhance the quality and efficiency of patient care. However, inefficient MDRs can pull providers away from other key clinical tasks, negatively impacting length of stay (LOS).

**Purpose:** At University of Colorado Hospital (UCH), an American Heart Association Comprehensive Stroke Center, our group of 6 medical students participating in an advanced systems improvement program collaborated with hospitalists, neurohospitalists, and the UCH neurosciences unit to enhance efficiency and effectiveness of stroke patient MDRs and the quality of discharge preparation for patients.

**Description:** A 360-degree evaluation of existing stroke MDRs was performed via interviews with front line providers who attended or relied upon decisions made at MDRs to develop patient care plans. Simultaneously, a value stream map of inpatient care and discharge planning for stroke patients revealed redundant work, inconsistent attendance, and absence of key decision-makers at MDRs. In addition, MDRs took place in highly trafficked areas, yielded little patient-centered discussion. Lengthy preparation to identify and gather information about stroke patients were required. In the process, patients were spending unnecessary time in the inpatient setting with little insight into their care plan. A multidisciplinary team composed of nursing, social work, case management, physical therapy, occupational therapy, nutrition, and psychiatry met twice weekly to discuss patients. During these MDRs, a standard of work script was used to identify key components of information inside each disciplines expertise. Using this approach, the length of conversation about each patient may vary based on complexity, but can be accomplished in under 5 minutes per patient. Subsequent PDSA cycles focused on enhancing adherence to the script, managing time, improving attendance at MDRs and optimizing the care

planning documentation prior to embedding it in the EHR. These efforts markedly reduced time spent on MDRs, expedited patient access to essential stroke rehab services, and reduced stroke patient LOS by 0.65 days.

Conclusion: While MDRs are a superb tool for optimizing inpatient care, if poorly structured they can increase waste and decrease care efficiency. Utilizing standard QI tools, our team collaborated effectively with hospital-based providers to enhance productivity of MDRs for stroke patients at UCH.

Primary Presenter: **Francis del Rosario**

Project Title: *Performance of a Computer-Aided Digital Dermoscopic Image Analyzer for Melanoma Detection in 1,076 Pigmented Skin Lesion Biopsies*

Primary Mentor: Theodore Alkousakis

Thematic Area: Clinical Science

Abstract:

Abstract:

Background: Digital dermoscopic image analysis of pigmented skin lesions (PSLs) has become increasingly popular, despite its unclear clinical utility. Unbiased, high-powered studies investigating the efficacy of commercially available systems are limited.

Objective: To investigate the diagnostic performance of the FotoFinder® Mole-Analyzer in assessing PSLs for cutaneous melanoma.

Methods: In this 15-year retrospective study, the histopathologies of 1,076 biopsied PSLs among a total of 2,500 imaged PSLs were collected. The biopsied PSLs were categorized as benign or malignant (cutaneous melanoma) based on histopathology. Analyzer scores (0.00-1.00) for these PSLs and were obtained and grouped according to histopathology.

Results: Sensitivity and specificity for this instrument in detecting cutaneous melanomas in a large number of PSLs was 49% and 83%, respectively, at the mean score 0.61 (SD=0.27) of cutaneous melanomas (n=71). Sensitivity falls below 90% for cutoff scores > 0.33 (approximately 1 SD below the mean). The area under the receiver operating characteristics curve was 0.698.

Limitations: The retrospective single-institution study design is a study limitation.

Conclusion: Our study reveals a low sensitivity of the scoring function of this digital dermoscopic image analyzer for detecting cutaneous melanomas. Physicians must apply keen clinical judgment when using such devices in the screening of suspicious PSLs.

Primary Presenter: **Brianna Dix**

Project Title: *Snowboarding Can Be Crushing: Rhabdomyolysis with Compartment Syndrome in a Snowboarder*

Primary Mentor: Lela Mansoori

Thematic Area: Clinical Science

Abstract:

Background: The objectives of this report are to present the case of a snowboarder with acute, atraumatic, exercise-induced bilateral compartment syndrome of the legs. This presentation of acute compartment syndrome (ACS) is uncommonly reported in the literature, especially in those engaged in low-endurance activities and winter sports such as skiing and snowboarding. However, if left untreated lower leg compartment syndrome can lead to footdrop and overall loss of function, requiring major lifestyle changes and should therefore be diagnosed and treated immediately upon presentation.

Case: This previously healthy 42-year-old male with prior snowboarding experience developed bilateral lower leg cramping and pain after only 3 hours of snowboarding. He presented to an outside facility after the pain worsened and noticed his urine to be red in color. He was treated for rhabdomyolysis and evaluated by orthopedic specialists who ruled out compartment syndrome at that time. Upon presentation to our hospital in Denver, he was noted to have extreme pain in his bilateral lower legs with decreased sensation and 3/5 dorsiflexion on physical exam. His compartment pressures were significantly elevated and he required a four-compartment fasciotomy with complete left anterolateral compartment debridement of dead muscle tissue and hyperbaric oxygen treatment. At discharge, the patient had a persistent footdrop that is expected to be permanent.

Conclusions: Although an uncommon cause of leg pain, ACS should be considered in any patient presenting with severe lower leg pain after engaging in physical activity for any duration of time to prevent potential devastating consequences. Although fasciotomy should only be done in those with compartment pressures meeting surgical criteria and under the clinical judgment of surgical specialists, timely diagnosis and treatment is important to prevent patients from long-term consequences including permanent sensory loss, footdrop, and other functional deficits.

Primary Presenter: **Sergei Dmitruk**

Project Title: *Identifying Gaps in Research Prioritization: Global Burden of Pulmonary Disease as Reflected in The Cochrane Database of Systematic Reviews*

Primary Mentor: Robert Dellavalle

Thematic Area: Public Health and Epidemiology

Abstract:

Abstract:

Importance: The global impact of diseases should help guide diagnostic and therapeutic research. Pulmonary diseases (PD) have a major impact on global health and disproportionately affect disadvantaged populations in resource-scarce settings. Availability of synthesized evidence is important to inform policy-makers and help guide the allocation of resources in the future. The aim of the study was to determine whether PD systematic reviews or protocols in the Cochrane Database of Systematic Reviews (CDSR) reflect disease burden.

Objective: To determine whether systematic review and protocol topics in The Cochrane Database of Systematic Reviews reflect pulmonary disease burden, measured by disability-adjusted life years (DALYs) from Global Burden of Disease (GBD) 2015 project.

Design: Two investigators independently assessed 16 GBD categorized pulmonary diseases in The Cochrane Database of Systematic Reviews for systematic review and protocol representation from 12/03/2016 “ 01/16/2017. Systematic reviews and protocols were matched to each PD category if the publication had a clear primary or secondary outcome related to the pulmonary disease discussed in the œmain results section of the reviews or œobjectives section of the protocols. Any discrepancy was solved by consensus with third author who had more expertise in the field.

The pulmonary diseases were then matched with disability-adjusted life year (DALY) metrics from the Global Burden of Disease 2015 Study. Spearman's rank correlation coefficient and associated P values were used to assess for correlation between the number of systematic reviews and protocols and the %2015 DALY associated with each PD.

Setting: The Cochrane Database of Systematic Reviews and GBD 2015 pulmonary disease disability data.

Main Outcome(s) and Measure(s): Relationship of The Cochrane Database of Systematic Reviews topic coverage (systematic reviews and protocols) with % of total 2015 DALY (set to global, World Bank high-income, and World Bank low-income locations), 2015 DALY rank, and DALY % change from 1990-2015 (set to global, World Bank high-income, and World Bank low-income locations) for GBD categorized pulmonary diseases.

Results: All 16 pulmonary disease categories were represented by at least 2 systematic reviews. The PD search terms yielded a total of 1,120 CDSR titles and following abstract screening, 666 CDSR titles were included. Asthma and COPD had the greatest representation in CDSR and mesothelioma and pneumoconiosis had the smallest CDSR representation with 2 publications each. With 40-110 publications per %DALY, CDSR representation of the LRI, COPD, mesothelioma, pneumoconiosis, RSV and bronchiolitis, and ILD and pulmonary sarcoidosis categories was relatively well-matched to disease burden. Representation of URIs, asthma, influenza, and diphtheria was comparatively high relative to DALY metrics. CDSR representation of tuberculosis, lung cancer, pneumococcal pneumonia, Hib pneumonia, measles, and whooping cough was low compared to these diseases respective disability metrics.

Conclusions and Relevance: Prioritization of representation in The Cochrane Database of Systematic Reviews is partly guided by DALY metrics. Another significant factor potentially influencing this allocation of resources is whether burden of disease disproportionately affects disadvantaged populations, thus placing the condition at high public health importance. Other factors include cost, availability and lack of cost-effective interventions, interest-group advocacy, disease transmissibility, public interest, opportunity for scientific innovation, and infrastructure building. Our results provide good quality and transparent data to inform future prioritization decisions.

Primary Presenter: **Jim Do**

Project Title: *Introducing Health Disparities, Health Equity, and Cultural Competency Through Online Learning Module*

Primary Mentor: Dominic Martinez

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

Minority populations have poorer overall health than other U.S. residents which is attributed to lack of access to quality healthcare. Thus it is increasingly important for future healthcare providers to have a basic knowledge of health disparities, health equity, and cultural competency. Despite the interest in better understanding these topics, little time is available to further them during training. Thus, students and faculty hypothesized that a curriculum designed to introduce these topics before involvement in regular medical school curriculum could help them be more aware of issues involving health equity.

To assess and increase their knowledge we have developed a module composed of three units offered to students prior to their arrival on campus. The module is composed of three thematic subunits including an introduction to health disparities research and equity, introduction to the concept of cultural competency, and a case study module to bringing together both topics while also using Kleinmans questions. Outcome measures will be based on comparison of survey data, pre and post, from participants before receiving the modules and after having completed the lessons online. The evaluation instrument will be the National Opinion Survey on Health and Health Disparities (NOSHHD). Statistical testing we will be using is a paired T-test for numeric continuous data using the pre and post data comparison for each participant.

The purpose of this module is to understand if students entering careers in healthcare professions are aware of health disparities and the impact it has on their chosen field of study. This module will be used to assess its efficacy in delivering content through electronic methods. Additionally it will be used as a pre-entrance module to measure whether it is useful as an introduction to these complex topics. By assessing the knowledge base of the students using the module, we will be able to adjust the curriculum to better serve the educational path of the students.

Primary Presenter: **Evan Dupart**

Project Title: *Incidence, Treatment, and Clinical Behavior of Cutaneous Malignancy in a Group of Solid Organ Transplant (Lung) Recipients, A Single Institutions Experience*

Primary Mentor: Adam Terella

Thematic Area: Clinical Science

Abstract:

**BACKGROUND** Immunosuppression after organ transplantation is a well established risk factor for cutaneous malignancy. However, evidence linking lung transplantation to cutaneous malignancies with aggressive features is lacking.

**OBJECTIVE** To assess the incidence and clinical behavior of cutaneous malignancies after lung transplant.

**METHODS** The authors conducted a retrospective chart review of a single institution cohort between the years 2004 and 2014. Patients with a lung transplant and cutaneous malignancy were compared to non-transplanted patients who underwent Mohs surgery. Data on malignancy incidence, aggressive features, and surgical defect size were collected and compared using statistical analysis.

**RESULTS** The transplant group experienced a much higher number of cutaneous malignancies (mean = 12.44) than the control population (mean = 3.80). Metastatic events and loss of LRC were significantly higher in transplant patients vs. controls: (26.3% vs. 0%,  $p=0.02$ ) and (42.1% vs. 10%,  $p=0.031$ ) respectively. Angiolymphatic invasion, perineural invasion, positive lymph nodes, and greater than one non-negative surgical tumor margin were all more frequent in the transplant patients than in the controls. In all but one instance, pre-Mohs measurement underestimated the final defect size.

**CONCLUSION** Lung transplant patients have increased risk of developing aggressive cutaneous malignancies and may benefit from pre-operative imaging to guide treatment.



Primary Presenter: **Lauren Egelston**

Project Title: *The Role of Simulation in Anesthesia Education for Third Year Medical Students*

Primary Mentor: Alison Brainard

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

Background: The traditional educational strategy for residents and medical students in the field of anesthesiology is composed of œapprentice-style learning in the clinical setting. For medical students, this training in anesthesiology is often limited. Anesthesiology rotations at the University of Colorado School of Medicine are one to two and a half weeks long. It is during these rotations that students have the opportunity to learn important skills that are essential to medical education and practice, including bag-mask ventilation, tracheal intubation, and mechanical ventilation. Students often share opportunities to learn these skills with residents, and may be moved into an observational role, thereby minimizing their opportunities to partake in these educational experiences. Additionally, in the interest of time and patient safety, supervisors may assist with these tasks more than students realize, and important steps of these procedures can be neglected. Simulation is a promising adjunct to modern clinical training in anesthesiology and may have the potential to address these gaps in education. To assist students in acquiring these important skills in anesthesiology, we evaluated an existing curriculum in the Operative/Perioperative Care (OPC) clerkship with surveys to determine the effectiveness of the simulation in improving the students confidence when approaching a patient requiring anesthesia.

Methods: During the OPC orientation, students completed a survey that evaluated their experience with anesthesia and airway management, as well as their confidence when approaching a patient requiring general anesthesia. Then, they participated in an airway workshop in which they were taught bag-mask ventilation and endotracheal intubation on mannequins. After rotating in anesthesia for one to two and a half weeks, students participated in a simulation exercise. Immediately prior to the simulation exercise, students completed the same survey that they completed at orientation. After completing the simulation exercise once, students debriefed with an attending or senior medical student, then repeated the simulation exercise. After students completed two rounds of the simulation exercise, they filled out the same survey that they completed at orientation.

Results: A total of 60 students were able to complete all three surveys and both rounds of the simulation exercise. Two-tailed t-tests demonstrated statistically significant increases in the students confidence when approaching patients requiring general anesthesia, their ability to

attach standard monitors, their knowledge of medications used for induction of anesthesia, their ability to perform an anesthetic induction, their ability to provide bag-mask ventilation, their ability to select equipment for intubation, their ability to successfully intubate a patient, their ability to manage ventilator settings, and their ability to use the anesthesia machine after their rotations. Our analysis revealed that students experienced additional increases in confidence in these areas after two rounds of the simulation exercise.

Conclusions: Our findings highlight the utility and value of the simulation exercise alone to improve students confidence in approaching a patient requiring general anesthesia and their ability to perform the associated skills. The magnitude of these improvements do not compare to the degree of improvement observed after the students completed their clinical rotations. Our findings therefore suggest that the simulation is a useful adjunct to, but not a replacement for, clinical education in anesthesiology. Subjective feedback from the medical students was overwhelmingly positive, and the students indicated that they would appreciate the opportunity to participate in additional simulation exercises in the future.

Primary Presenter: **Sheldon Edwards**

Project Title: *Nontuberculous Mycobacterial Infections of Bone, Joint, Tendon and Bursa*

Primary Mentor: JoAnn Zell

Thematic Area: Clinical Science

Abstract:

Nontuberculous mycobacteria (NTM) cause indolent, difficult to diagnose chronic infections that are equally difficult to manage, often requiring both surgery and prolonged combination antimicrobial treatment. Few studies have focused on identification of risk factors, improvement of clinical and microbiological recognition, and treatment of NTM infections of bone, joint, tendon and bursa. We conducted a systematic review of 468 published case reports yielding 579 cases of musculoskeletal NTM infections. The mean age at presentation was 45.1 years. The average time to diagnosis was 11.5 months (0.5 " 264). The most common sites of involvement were the hand (26.8%), followed by the vertebrae (13.8%), knee (13.6%), and wrist (12.8%). Osteomyelitis was the most common diagnosis, present in 40.6% of cases, followed by tenosynovitis (24.9%). The most common isolate was MAC, present in 29.9% of cases, followed by *M. kansasii* (13.1%) and *M. marinum* (13.0%). Precipitating trauma was present in 34.7% of cases. HIV was the most common underlying disease, present in 12.3% of cases. Antibiotic use was reported in 97.0% of cases, and the mean number of antimicrobials used was 3.3, with an average duration of therapy of 10.2 months. Surgery was performed in 61.8% of cases. In those without disseminated disease, surgery was performed in 77.6% of cases. Complete recovery was documented in 68.8% of cases, persistent disease in 6.1%, relapse in 4.7%, and death in 14.5%, though NTM infection was rarely the clear cause of death. Outcomes in these diseases remain poor, with extended time to diagnosis and high morbidity. Surgery is often essential in achieving cure, in conjunction with prolonged antimicrobial therapy.

Primary Presenter: **Ian Eisenhauer**

Project Title: *Estimating Risk of Water Source Contamination Following Precipitation Events*

Primary Mentor: Beth Carlton

Thematic Area: Public Health and Epidemiology

Abstract:

Climate change is expected to increase precipitation extremes, threatening water quality. We hypothesized that the relationship between rainfall events and drinking water quality is variable and depends on water source type, upstream watershed size and the presence of contamination hazards (e.g. latrines, domestic animals). Using an approach that integrates hydrological models, precipitation measures and field-based surveys of 59 shallow household wells, we tested this hypothesis in southwestern Guatemala, where heavy rainfall is frequent and access to safe water is limited. Interaction models were used to estimate  $\hat{\beta}^2$ , the change in log E. coli concentration when recent rainfall had occurred vs. not, under different conditions. Estimates of  $\hat{\beta}^2$  were variable, with the strongest association between rainfall and contamination at wells with a large catchment area and where domestic animals were present. Due to the small sample size, these findings should be considered preliminary, but provide a model to evaluate climate vulnerability.

Primary Presenter: **Andrew Eitel**

Project Title: *Proximal Pulmonary Artery Mechanics and Vascular Smooth Muscle Changes in Hypoxia-Treated and Hypoxia-Recovery Rat Model*

Primary Mentor: John Walker

Thematic Area: Basic Biomedical Science

Abstract:

Recent studies suggest that proximal pulmonary artery impedance, area strain and vascular capacitance play a major role in the pathology of Pulmonary Hypertension (PH), especially in the development of right heart failure. The proximal pulmonary artery is known to remodel and undergo mechanical stiffening in PH. However, the changes in active vessel mechanics during and in recovery from PH are not as well understood. This study examines changes in proximal pulmonary artery mechanics during the development of and recovery from PH, induced by chronic hypoxia in Sprague-Dawley rats. We studied five conditions, distinguished by exposure to varying lengths of normoxia (elevation=5285 ft, PB=632 mmHg, pO<sub>2</sub>=132.5 mmHg), hypoxia (simulated elevation=17,000 ft, PB=410 mmHg; pO<sub>2</sub>=85.9 mmHg), or hypoxia followed by normoxia (3 Week Normoxic, 3 Week Hypoxic, 6 Week Hypoxic, 3 Week Hypoxic±6 Week Normoxic, 9 Week Normoxic). We found the maximum contraction of the cannulated pulmonary artery (30.4±5.2 mmHg) was severely diminished following 3 weeks of hypoxia (p<0.001) and was fully restored (p<0.001) in the recovery group. The artery wall compliance ( $\frac{\Delta D}{\Delta P}$ ) decreased dramatically with hypoxic exposure (p<0.001). Upon recovery, compliance was increased but did not fully resolve (p<0.001). At any given pressure, the proximal artery diameter decreased with hypoxic exposure and was restored to normal levels in the recovery group. Wall stress and modulus of elasticity were decreased as well.

Primary Presenter: **James Engeln**

Project Title: *Community Based CPR Education Provided by Medical Students on Rural Rotations: A Novel Approach to Improve CPR Training in Rural Communities Across Colorado*

Primary Mentor: Camilla Sasson

Thematic Area: Public Health and Epidemiology

Abstract:

Abstract:

Research has demonstrated that people living in rural areas are not only less likely to receive bystander CPR in the event of an out-of-hospital cardiac arrest but also are less likely to receive CPR training. Novel community-based CPR training programs are needed in these rural areas to increase awareness, improve skill retention and widen the scope of CPR education in rural communities. The objective of this study is to determine the feasibility of a community-based CPR training program implemented by medical students on rural rotations in rural communities across Colorado to increase awareness and education surrounding cardiac arrest and bystander CPR.

Methods:

Thirty-seven first-year medical students from the University of Colorado School of Medicine Rural Track Program were enrolled from 2014 to 2016. Prior to starting a summer rural rotation, participating students received a group-based hands-only CPR training course using CPR Anytime Kits and then completed a five-question survey to assess retention of hands-only CPR knowledge. Each student received a CPR-Anytime Kit to take with them on their rotation and they were asked to train family/friends/community members at their site. Following the completion of the Rural Summer Preceptorship, students were asked to report the number of individuals they trained during their rural rotation.

Results:

All participants (100.0%) had received previous CPR training and all participants (100.0%) felt comfortable providing hands-only CPR after the group-based training. The mean number of questions on hands-only CPR knowledge answered correctly was  $4.43 \pm 0.75$ . Enrolled students rotated in 24 different communities across Colorado with populations ranging from 391 (Lake City, CO) to 89,919 (Longmont, CO), with a median population of 2,727. Information was returned by 10 students (27 %) and a total of 34 community members were trained in five different communities across Colorado. Considering only the students who used their CPR Anytime Kit an average of 6.8 community members were trained per training kit at a cost of \$5.14 per community member trained.

Conclusion:

Implementing a program for medical students on rural rotations to provide community-based CPR training is a feasible method to increase bystander CPR education in rural communities. However, without buy-in from medical student participants, the effectiveness of this type of programming is limited.

Primary Presenter: **Jacob Entin**

Project Title: *Depression and Anxiety Among Patients with Lateral Epicondylitis and Ulnar Sided Wrist Pain*

Primary Mentor: Frank Scott

Thematic Area: Clinical Science

Abstract:

**Purpose:** The purpose of our study was to quantify the prevalence of depression and anxiety among patients with lateral epicondylitis (LE) and/or ulnar sided wrist pain (UWP), to determine if these patients report higher levels of pain upon presentation and are more likely to require physical and/or occupational therapy (PT/OT), and to quantify psychiatric medication use among these patients.

**Methods:** We used a retrospective review identifying patients with LE, UWP, history of a mood disorder, and use of mood disorder medications.

**Results:** Our final analysis included 97 patients: 57 had LE, 34 had UWP, and 6 had both. The prevalence of a mood disorder was 34.0%. The most common mood disorder was 'depressive disorder not elsewhere classified', while the most common medication was alprazolam. Pain scores averaged 1.2 points higher in subjects with a history of a mood disorder. Older age and female sex were significantly associated with a history of a mood disorder. After adjusting for age and sex, there was no significant difference in the likelihood of a patient requiring PT/OT regardless of a history of a mood disorder.

**Conclusions:** Thirty four percent of patients presenting with a first time diagnosis of LE or UWP had a history of a mood disorder. These patients also had significantly higher pain scores than their non-mood disorder counterparts. Older age and female gender were significantly associated with the presence of a mood disorder.

**Clinical Relevance:** Patients with LE/UWP and a mood disorder may be less likely to improve with traditional treatments. Future investigations are warranted focusing on the value of a multidisciplinary team consisting of a hand surgeon, behavioral therapist, and/or psychologist to optimize treatment responses.

**Study Type/Level of Evidence:** Level III, Prognostic



Primary Presenter: **Adam Esch**

Project Title: *Point of Care Ultrasound in Rural Primary Care*

Primary Mentor: Mark deutchman

Thematic Area: Clinical Science

Abstract:

Point-of-care ultrasound (POCUS) is the use of diagnostic ultrasound technology at the bedside by a clinician who is seeking an answer to a specific question or to guide an invasive procedure needed for immediate patient care. The process of learning and implementing POCUS in primary care has not been well-studied, probably because it is complicated by not being limited by organ system or practice environment and may involve a very wide range of ultrasound applications. This study examines 1.) the potential utility of focused point of care ultrasound in primary care settings, particularly in rural settings and 2.) what, if any, of the educational methods employed to develop proficiency with POCUS, resulted in physician confidence and implementation of POCUS in their practice. In this study, loaned hand-held ultrasound devices were utilized by rural primary care providers in their practice after receiving training in the modalities they wished to utilize the ultrasound. Data collection and recruitment is currently ongoing for the study.

Primary Presenter: **Jeff Ferrier**

Project Title: *Quality of TMS Sham Techniques*

Primary Mentor: Benzi Kluger

Thematic Area: Clinical Science

Abstract:

A modified systematic review was conducted to examine the effect of sham techniques in studies of depression using the HAMD scale to measure outcome. 25 studies were identified that had clearly described sham protocols and numerical outcomes. Studies using active sham coils held at 45 or 90 degree angles from the subjects heads, shielded active sham coils, and shielded active sham coils with electrical stimulation. Differences in mean changes in HAMD scores among studies of each sham technique revealed a trend towards different effect sizes depending on the type of sham used. Part of the source of these differences was possibly due to the unpredictable effects of low level magnetic fields produced by the sham coils. Further appropriately powered studies of sham effects are needed in order to develop shams that are true placebos and eliminate magnetic fields completely.

Primary Presenter: **Daniel Fisher**

Project Title: *Cervical Spondylolisthesis and Adjacent Segment Disease Management Following 3-Level Anterior Cervical Discectomy and Fusion*

Primary Mentor: Frank and Jamaluddin Dr. Scott and Dr. Moloo

Thematic Area: Clinical Science

Abstract:

Abstract

**STUDY DESIGN:** The study was designed to be a case report and literature review.

**BACKGROUND CONTEXT:** Spondylolisthesis following 4-segment cervical fusion requiring subsequent fusion of 6 vertebrae has never been reported in literature.

**OBJECTIVE:** To report two cases of adjacent segment disease with spondylolisthesis following 4 segment fusion, and the difficulty in treatment. Herein, we discuss mechanisms of disease and current standard of practice.

**SETTING:** Worcester, MA at UMass Memorial Medical Center

**METHODS:** Two separate patients with histories of 3 level anterior cervical discectomy and fusions presented symptomatically years later and were diagnosed via radiographic imaging as having spondylolisthesis at an adjacent segment. Non-operative treatment showed no improvement of symptoms and it was determined that both would need revisional surgery.

**RESULTS:** Both patients underwent surgical removal of original ACDF hardware and surgical reduction of spondylolisthesis by extension of cervical fusion to one segment above and below the original 3 levels. Both patients treatment resulted in rigid fusion from C3 to T1.

**CONCLUSIONS:** Adjacent segment disease may be an unavoidable truth following multilevel cervical fusions. The current surgical standard for treatment for spondylolisthesis in these cases involves the further extension of fixation, and the long-term prognosis in these cases is unknown.

**KEYWORDS:** Anterior Cervical Discectomy and Fusion (ACDF), spondylolisthesis, adjacent segment disease (ASD), cervical fusion, complications, prognosis

Primary Presenter: **Tess Fitzpatrick**

Project Title: *Sacroiliac Joint Morphology and its Predisposition to Sacroiliac Joint Pain Syndrome*

Primary Mentor: Mary Kristen Jesse

Thematic Area: Clinical Science

Abstract:

ABSTRACT

BACKGROUND

Establish reference and understanding of normal sacroiliac joint morphology through the utilization of 3D surface rendered imaging of the SI joint as well as investigate morphologic trends in SI pain syndrome patients.

METHODS AND MATERIALS

3D surface rendered images of the SI joint were acquired in 223 normal controls. Morphologic 3D assessment of the articular surface morphology, and measurements of sacral tilt, inclination and sacral and iliac surface area were performed. SI joint morphologies were further classified into three types based on shape (Types 1, 2 and 3).

Thirty-four pain patients were analyzed in a similar fashion as above with emphasis on SI articular surface area and surface morphology.

RESULTS

Average sacral tilt, inclination and surface areas were established in the control group. Visual morphologic assessment revealed a dominance of the Type 2 morphologic variant. Significant association was found between Type 3 morphology and the development of pain (p-value 0.04) as well as lower mid and caudal inclination and the development of pain (p-values 0.01 and 0.049).

CONCLUSION

Our study provides a new look at SI joint morphology with insight into visual morphologic differences in articular surface shape and variability in articular surface area and determines an association between that morphology and the development of pain.

Primary Presenter: **Zebulon Friedly**

Project Title: *Gratitude in a future physician*

Primary Mentor: Tracy Price-Johnson

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

My objective is to write a humanities piece describing my own struggles with injury / illness, accompanied by a literature review including elements of physician impairment touched upon. In a practice climate of increased emphasis on physician and practitioner wellness, the purpose of this humanity supporting literature review is to survey recent research and commentary publications on physician impairment, in order to garner some insight on how this might influence their lives and practice.

Primary Presenter: **Robert Garcia**

Project Title: *PTSD as a Risk Factor for Cardiovascular Disease in Veterans: Implications for Screening*

Primary Mentor: Sridharan Raghavan

Thematic Area: Public Health and Epidemiology

Abstract:

There is a growing base of evidence behind the association between PTSD and cardiovascular disease. In this review we explore the link between psychological trauma and medical co-morbidities in general, and examine the evidence behind combat exposure and cardiovascular disease in particular. Possible physiological mechanisms underlying the association between combat-related psychiatric disease and cardiovascular disease are also discussed. Finally, we explore the implications of the association between PTSD and cardiovascular disease for targeted screening and intervention in not only our current veteran population, but also combatants currently deployed and others exposed to grave psychological trauma.

Primary Presenter: **Clayton Garthe**

Project Title: *Diabetes Causes Sick Sinus Syndrome by Altering Intrinsic Sinoatrial Node Automaticity via the Transiently Outward Potassium Current*

Primary Mentor: Catherine Proenza

Thematic Area: Basic Biomedical Science

Abstract:

We used a genetically homogenous group of mice and created a test and control group. Their blood glucose was monitored and we determined the intrinsic and maximal heart rates for all mice. We next harvested the sinoatrial region of the mice and extracted and identified individual pacemaker cells. Using an inverted microscope, we patch-clamped the pacemaker cells and measured action potential voltages and ionic currents, specifically potassium (K) and calcium (Ca) currents.

Compared to controls, we found that the test group had decreased intrinsic and maximal heart rates, consistent with other studies showing bradycardic effect of DM, indicative of SSS. At the cellular level, the sinoatrial pacemaker cells of the diabetic mice showed profoundly decreased transient outward potassium current ( $I_{to}$ ) and a modest effect on L-type Ca current. The overall effect of this electrical remodeling was a prolongation of the repolarization phase of the action potential, with a paradoxical increase in the diastolic rate, though the net effect was a decrease in heart rate.

Primary Presenter: **Samuel Gordon**

Project Title: *The Value of Practical Projects in Interprofessional Education: A Qualitative Attitude Analysis of Interprofessional Student Leaders Creating a Student-Run Free Clinic Using Participatory Action Research Methodology.*

Primary Mentor: Lynn Vanderwielen

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

Providing interprofessional education opportunities to health program trainees has demonstrated clear value to promoting more effective team-based clinical care. Programs limited to classroom-based, didactic education sessions could be enhanced by the addition of real world projects. From May 2014 to March 2015, a group of interprofessional students from the University of Colorado Denver Anschutz Medical Campus created a student-run free clinic (SRFC) in the local community of Aurora, Colorado. These student teams were each assigned to a specific task necessary to start the clinic, such as supply procurement, volunteer provider recruitment, community networking, etc. Post-implementation of the SRFC, student leaders were surveyed regarding their perspective and understanding of interprofessional teams. Qualitative analysis revealed common themes of a deepened respect and understanding of interprofessional collaboration, enhanced knowledge of other professionals roles, and increased confidence in their ability to work within an interprofessional healthcare team in the future. Interprofessional education can be improved by incorporating practical, faculty-guided service-learning projects.



Primary Presenter: **Justin Greene**

Project Title: *Does Ultrasonographer Experience Impact the Odds of False Positive TIPS US Studies: Real Substitutes for Experience?*

Primary Mentor: Reza Rajebi

Thematic Area: Clinical Science

Abstract:

Ultrasonography (US) is used for evaluation of transjugular intrahepatic portosystemic shunts (TIPS). US can yield false-positive and false-negative results. This study aims to determine the predictors of a false positive TIPS US.

Data were retrospectively collected on TIPS patients who underwent US followed by TIPS venography from 2003-16. Age, gender, and BMI were recorded for every patient. US and venography results, as well as indication for the TIPS procedure and stent type were extracted from electronic medical records. A peak shunt velocity (PSV) <90 or >190 cm/sec, a decrease in PSV >40 cm/sec, an increase in PSV >60 cm/sec or main portal vein velocity <30 cm/sec is considered positive.

The experience of ultrasonographers, number of days from TIPS procedure to US, stent length, and presence of ascites on the odds of normal venographic results following an abnormal US ("false positive" US) were analyzed, while controlling for age, gender, and BMI of the patient within a logistic regression framework.

Of the 173 patients reviewed, 99 were not included due to missing values of either the response or explanatory variables, for a final sample size of 84 patients with mean age of 51.60 years, 22.64% female, and mean BMI of 29.33.

No significant association was observed between odds of a false positive US and ultrasonographer experience. The odds of a false positive US was 4.63 times higher (95% CI: 1.41 to 15.17,  $p=0.0115$ ) in patients with the presence of ascites. The odds of a false positive US was 3.80 times higher (95% CI: 1.30 to 11.096,  $p=0.0009$ ) for patients with a stent length of <10cm. The odds of a false positive ultrasound was 0.787 times lower (95% CI: 0.620 to 0.999,  $p=0.0486$ ) for each year that passed between the TIPS stent placement and the ultrasound evaluation. No significant association was observed between odds of a false positive US and other factors.

Ultrasonographer experience was not significantly associated with the odds of a false positive TIPS US. In addition, a longer follow-up interval after TIPS placement is associated with decreased odds of a false positive US. The presence of ascites as well as a stent length less than 10 cm increased the odds of a false positive ultrasound. Considering these findings when a positive TIPS US is obtained may decrease the number, risks, and costs of unnecessary procedures.

Primary Presenter: **Laura Grigereit**

Project Title: *Immunohistochemical Analysis of Human Vallate Taste Buds*

Primary Mentor: Tom Finger

Thematic Area: Basic Biomedical Science

Abstract:

The morphology of the vallate papillae from postmortem human samples was investigated with immunohistochemistry. Microscopically, taste buds were present along the inner wall of the papilla, and in some cases in the outer wall as well. The typical taste cell markers PLC $\beta$ 2, GNAT3 (gustducin) and the T1R3 receptor stain elongated cells in human taste buds consistent with the Type II cells in rodents. In the human tissue, taste bud cells that stain with Type II cell markers, PLC $\beta$ 2 and GNAT3, also stain with villin antibody. Two typical immunochemical markers for Type III taste cells in rodents, PGP9.5 and SNAP25, fail to stain any taste bud cells in the human postmortem tissue, although these antibodies do stain numerous nerve fibers throughout the specimen. Car4, another Type III cell marker, reacted with only a few taste cells in our samples. Finally, human vallate papillae have a general network of innervation similar to rodents and antibodies directed against SNAP25, PGP9.5, acetylated tubulin and P2X3 all stain free perigemmal nerve endings as well as intragemmal taste fibers. We conclude that with the exception of certain molecular features of Type III cells, human vallate papillae share the structural, morphological, and molecular features observed in rodents.

Primary Presenter: **Samuel Grossman**

Project Title: *Evaluation of Out-of-Hospital EMS Cardiac Alert Protocols*

Primary Mentor: Fred Severyn

Thematic Area: Clinical Science

Abstract:

ABSTRACT:

Background:

Current guidelines support Emergency Medical Systems initiation of cardiac catheter lab activation for ST-segment elevation myocardial infarction. There are few studies, however, that address the optimal criteria for cardiac catheter lab activations from the field. We hypothesized that by retrospectively analyzing specific electrocardiogram (EKG) voltage criteria for cardiac alert protocols in the Aurora, CO Emergency Medical Services (EMS) system we could identify criteria to improve the fidelity of activations.

Methods:

This was a retrospective review of EMS initiated cardiac catheter lab activations (CCLAs) at University of Colorado Hospital (UCH), a STEMI-receiving center in Aurora, CO. Current voltage criteria for field CCLA requires 1 mm ST-segment elevation (STE) in two contiguous leads. All CCLAs between May 1, 2014 - April 30, 2016 were identified and analyzed. EMS-obtained EKGs were over-read and CCLAs were characterized as false activations (based on current institutional cardiac alert criteria), True STEMI (based on results of PCI) and No STEMI present. The same cohort of patients was then analyzed using a modified ST-elevation voltage criteria (2 mm STE in two contiguous leads) and the same endpoints were evaluated. The same analysis was repeated using walk-in UCH-initiated CCLAs as a control.

Results:

From May 2014 “ April 2016 there were 38 complete entries of EMS CCLAs. There were 35 appropriate EMS CCLAs and 51 walk-in UCH CCLAs that met current EMS criteria/guidelines. In the EMS cohort, 34/35 (97%) were shown to be True STEMI by PCI. Of the UCH cohort, 46/51 (90%) were shown to be True STEMI by PCI. When the EMS cohort was analyzed using a 2 mm STE voltage criteria, 25/35 met criteria for activation. 25/25 (100%) were shown to be True STEMI on PCI. In the UCH cohort, 32/51 met modified activation criteria and 29/32 (91%) were shown to be True STEMI on PCI. Of the 10 EMS patients who were initially activated, but did not meet modified criteria for activation, 9/10 (90%) were True STEMI. Of the 19 UCH patients that did not meet modified criteria, 17/19 (89%) were shown to be true STEMI. Additionally, we found that 3/38 (8%) original EMS activations were inappropriate (did not satisfy cardiac alert criteria based on prehospital EKG overread).

## Conclusion:

Overall, local EMS is able to perform field CCLA with a high degree of fidelity and with a low false positive activation rate. Post-hoc modification of the voltage criteria from 1 mm STE to 2 mm STE would result in a 100% true positive activation rate, but would lead to non-activation of a significant number of True STEMIs. More restrictive CCLA protocols preclude field activation in a high percentage of STEMI patients, and are likely inconsistent with well-established goals of reducing door-to-balloon time in these patients.

Primary Presenter: **Andrew Hagar**

Project Title: *Use of Patient Reported Outcome Measures in Lower Extremity Orthopedic Trauma: current trends and future directions.*

Primary Mentor: Cyril Mauffrey

Thematic Area: Clinical Science

Abstract:

Abstract:

Study Design: Bibliometric analysis

Objective: To determine current trends regarding the use, frequency and distribution of patient reported outcome measures (PROMs) in lower extremity orthopedic trauma in the past ten years.

Methods: All published articles in the Journal of Orthopedic Trauma for the last ten years were reviewed. Titles and abstracts were screened and studies involving lower extremity trauma and PROMs were included. Articles were then reviewed for specific PROM instruments used and categorized by anatomic location and injuries included.

Results: 1914 articles were published in the Journal of Orthopedic Trauma from 2006-2015. Of these, 133 used at least one PROM as a major outcome measure and were included in the analysis. Overall, there were 35 different PROMs used by these studies, 29 of which were disease-specific measures. Of these different measures, 21 were used in only one study.

Conclusions: There is an extremely wide variety of PROMs available for clinical use in the field of orthopedic trauma. There is a need for a consensus on which instruments are to be used and standardization of how these tools are used. The adoption of PROMIS and Computerized Adaptive Testing may provide this much needed regulation.

Primary Presenter: **Emily Hause**

Project Title: *Effect of medical student anxiety on USMLE Step 1 scores and contributing factors: a systematic review*

Primary Mentor: Tai Lockspeiser

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

**Objective:** Assess the existing literature for the effect of medical student anxiety on USMLE Step 1 performance, and assess common factors that impact student anxiety.

**Methods:** Research articles were identified through the PubMed and ERIC Education databases. All study types discussing the U.S. medical undergraduate students taking USMLE Step 1 were included. Articles were limited to those published in English between 2006 and 2016. Further eligibility based on relevance to the objective was assessed through review of the abstracts by the two authors.

**Results:** Sixteen articles were selected for full-text review, and eight studies met inclusion criteria. Two of these studies showed a correlation between lower medical student anxiety and higher USMLE Step 1 score. Four of the studies did not find a significant correlation between differences in anxiety and Step 1 score. The remaining two studies showed qualitative effects of various stress mitigation strategies that improved the subjective experience of stress and test anxiety.

**Conclusions:** Despite, or perhaps due to, the high stakes of the USMLE Step 1 exam, there is no clear consensus in the literature about how test anxiety affects Step 1 scores. Indeed, even the effect of such common interventions as test preparation seminars and switching to pass/fail grading have produced mixed results for medical student anxiety and Step 1 scores. What is clear is that this important area of medical education needs further research to guide evidence-based interventions for optimizing student performance.

Primary Presenter: **Daniel Hecht**

Project Title: *HEROES: Health Esteem futuRe pOwer Encouragement Speak up- Establishing, Analyzing, and Modifying a Minority Youth Leadership & Advocacy Program in order to Combat Racial Disparities in Healthcare*

Primary Mentor: Tillman Farley

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

Abstract

Introduction: Issues related to social injustice have become a popular topic of conversation and area continuing to need intervention. CSTAHR (Community-Students Together Against Healthcare Racism) created and implemented the HEROES program to expose underserved adolescents to healthcare careers with the end goal of increasing diversity within the healthcare field. Research shows that certain methods and techniques used in teaching within pipeline and school programs improve outcomes related to student performance and involvement. CSTAHR continues to seek opportunities to improve the HEROES program and increase the effect it has on its participants. This project aims to evaluate and elucidate the effectiveness of the 2014 and 2015 HEROES Program in achieving its goals, outlined in the CSTAHR survey questionnaire, and the changes made to the program each year in order to better reach those goals.

Methods: CSTAHR sought to effectively evaluate and modify the 2014 and 2015 HEROES program using CBPR methodology and current research. We utilized two types of program evaluations, presentations at conferences and meetings, and community feedback and dialogue to evaluate the effectiveness of the 2014/2015 programs at achieving its goals and elicit feedback for possible changes for the 2016 and future programs. During this time, literature review, community/medical partnerships, and face to face program hand-off guided the implementation of these changes and helped focus the modification of the 2014 and 2015 HEROES program using evidence based approaches.

Results: The 2014 HEROES program had six sessions over three weeks that focused on different areas of healthcare and incorporated some hands-on activities for the participants. The CSTAHR created survey showed a significant increase in participants feeling confident in my ability to achieve my dreams. ( $p < .05$ ). Feedback from the student surveys, community feedback, and one-on-one meetings with the students led to changes that were implemented by the leaders

of the 2015 HEROES program, namely an increase in hands-on activities, increased healthcare exposure, and learning CPR techniques. The 2015 HEROES pre/post-program surveys showed no statistically significant changes, although there was a statistically significant increase in participants feeling comfortable going to the doctor. Between the 2014 and 2015 post-program surveys ( $p < .05$ ). The participants and community members continued to ask for more time for hands-on activities in the 2016 HEROES program along with increasing the breadth of healthcare careers that were discussed. Utilizing the aforementioned feedback led to the 2016 HEROES Program, which was completed during the summer of 2016.

Conclusion: The 2014 and 2015 HEROES Programs were well received by the community and the Vickers Boys & Girls Club. The participants gave informative feedback on how to improve the program each year and, utilizing the methods outlined above, we have been able to increase the continuity and number of participants each year. Continuing to work on having the same participants for all of the sessions and increasing the number of participants in the program will likely lead to statistically significant change in our evaluations. Also, diversifying the healthcare professions that are discussed and focusing on current healthcare issues in adolescents are topics that we hoped to implement in the 2016 program and in future HEROES programs. Because of the results of the program surveys, community feedback, and participant input we will continue to utilize the methods outlined above to evaluate and modify the HEROES program each year.



Primary Presenter: **Margaret Heerwagen**

Project Title: *Placental lipase activity, independent of maternal BMI, strongly associated with infant adiposity at birth.*

Primary Mentor: Linda Barbour

Thematic Area: Clinical Science

Abstract:

Background: Placental lipase activity is thought to contribute to fetal lipid exposure, which may have important implications in the developmental origins of metabolic disease. However, this activity has never been measured in combination with infant outcomes.

Objectives: To examine whether placental lipoprotein lipase (LPL) activity is associated with infant adiposity at birth, and to identify possible maternal metabolic determinants of this activity.

Study Design: Normal weight and obese mothers (n = 13 and 7, respectively) were metabolically characterized over the course of gestation, and their placentas immediately analyzed for lipoprotein lipase activity after term, labored delivery. Infant body composition was assessed by skinfold measurement within 24 hrs of delivery.

Results: Placental LPL activity was strongly associated with infant percent body fat at birth ( $r = 0.59$ ,  $p = 0.006$ ), and this association was strengthened with correction for infant sex ( $r = .75$ ,  $p = 0.001$ ). Interestingly, maternal metabolic status, including BMI and late gestation measures of blood lipids and insulin resistance, were not associated with placental LPL activity. Additionally, LPL gene expression, while modestly associated with enzymatic activity, was not associated with infant adiposity.

Conclusion: This is the first study to show a strong, positive association with placental LPL activity and infant adiposity. More studies measuring placental LPL activity are needed to clarify whether placental LPL could be a target for dysregulation in pregnancies complicated by obesity, diabetes, fetal overgrowth and excess infant adiposity.

Primary Presenter: **Calvin Ho**

Project Title: *Protein Energy Malnutrition and Interventions in Haiti*

Primary Mentor: Joel Friedlander

Thematic Area: Global Health

Abstract:

The nation of Haiti has faced a prolonged systemic food shortage persisting since the 1950s Duvalier regime<sup>1</sup>. Inadequate food distribution is the cause of modern famines. In the developing world, malnutrition has been implicated in a significant number of deaths from diarrheal diseases, pneumonia, measles, and malaria. In the developed world malnutrition is associated with chronic conditions such as cystic fibrosis, renal failure, childhood malignancies, congenital heart disease, and neuromuscular diseases<sup>11</sup>. More concerning is the in utero effect that maternal malnutrition plays on mammalian gene expression with its long term effects<sup>19</sup>. This literature review will examine the long term effects of malnutrition on a child's protein energy metabolism, immune system function, and neurological effects. Despite this dire outlook, there are several promising interventions with successful track records in Haiti to address these issues including Immunizations, vitamin A supplements, prompt anti-diarrheal and respiratory infection treatments, prenatal care, trained delivery personnel, and family planning services, and delivery of micronutrient packets to susceptible populations.

Primary Presenter: **Janine Hoerauf**

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: Jamaluddin Moloo

Thematic Area: Public Health and Epidemiology

Abstract:

**BACKGROUND:** Since 1997, over 5,000 refugees from Burma (Myanmar) have fled violence and persecution in their homeland to settle in Colorado. Many refugees face difficulties accessing and understanding healthcare services. Thus, the development of novel programs and partnerships to help refugees gain access to essential healthcare services must be a priority among communities, local non-profits, and providers.

**METHODS:** 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 from Burma, have guided this project. The YAB selected risky alcohol use as the priority health issue facing their community. Formative information was then gathered by speaking with community leaders, local refugee organizations, healthcare providers, and informal surveys were conducted in order to guide future research tools. The project is currently in Phase 2, Intervention Mapping, which involves seeking IRB approval to conduct a formal, publishable needs assessment. We will conduct audio-recorded key informant interviews and administer surveys within the community of refugees from Burma to better understand problematic alcohol use. The results of the key informant interviews will be analyzed using standard qualitative research methods, while the results of the community surveys will be analyzed quantitatively. Phase 2 involves strengthening our community partnership and discussing potential interventions through a series of meetings funded by the Colorado Clinical and Translational Sciences Institute (CCTSI)s Community Partnership Development grant. 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 nineteen meetings with the YAB and over fourteen meetings with local organizations. Nineteen formative community surveys were collected and three key informant interviews were held. 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: Using a CBPR approach, this project has made enormous strides in establishing a strong relationship with a local underserved community, and has identified a key health issue (alcohol abuse) on which to focus the partnership. Challenges of the project include the intense time commitment of CBPR, language and literacy barriers, and difficulties in gaining IRB approval for the unique study design fashioned for a population that communicates best through trusted, in-person conversations. Ultimately, this partnership will lead to sustainable, culturally effective treatment options for the refugee community from Burma.

Primary Presenter: **Torbjorg (Tori) Holtestaul**

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: Jamal Moloo

Thematic Area: Public Health and Epidemiology

Abstract:

**BACKGROUND:** Since 1997, over 5,000 refugees from Burma (Myanmar) have fled violence and persecution in their homeland to settle in Colorado. Many refugees face difficulties accessing and understanding healthcare services. Thus, the development of novel programs and partnerships to help refugees gain access to essential healthcare services must be a priority among communities, local non-profits, and providers.

**METHODS:** 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. Formative information was then gathered by speaking with community leaders, local refugee organizations, healthcare providers, and informal surveys were conducted in order to guide future research tools. The project is currently in Phase 2, Intervention Mapping, which involves seeking IRB approval to conduct a formal, publishable needs assessment. We will conduct audio recorded key informant interviews and administer surveys within the community of refugees from Burma to better understand problematic alcohol use. The results of the key informant interviews will be analyzed using standard qualitative research methods, while the results of the community surveys will be analyzed quantitatively. Phase 2 involves strengthening our community partnership and discussing potential interventions through a series of meetings funded by the Colorado Clinical and Translational Sciences Institute (CCTSI)s Community Partnership Development grant. 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 19 meetings with the YAB and over 14 meetings with local organizations. Nineteen formative community surveys were collected and three key informant interviews were held. 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:** Using a CBPR approach, this project has made enormous strides in establishing a strong relationship with a local underserved community, and has identified a key health issue (alcohol abuse) on which to focus the partnership. Challenges of the project include the intense time commitment of CBPR, language and literacy barriers, and difficulties in gaining IRB approval for the unique study design fashioned for a population that communicates best through trusted, in-person conversations. Ultimately, this partnership will lead to sustainable, culturally effective treatment options for the refugee community from Burma.

Primary Presenter: **Meghan Hurley**

Project Title: *Assessment of ECG Curriculum of Denver Health Longitudinal Integrated Clerkship*

Primary Mentor: Jennifer Adams

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

A student participating in the Denver Health Longitudinal Integrated Clerkship curriculum spends 4 weeks of dedicated inpatient time on internal medicine, and completes the rest of their internal medicine requirements in outpatient clinic. ECG curriculum is formally covered during noon conference during 8 weeks of inpatient time for traditional students. While LIC students have many opportunities to go over ECGs during their outpatient clinics, they were potentially getting as little as half of the formal ECG training when compared to their traditional counterparts. A formal ECG curriculum was therefore developed for the LIC, and it was added to their weekly didactic lectures. The curriculum, although intentional, was loosely structured. The goal of this MSA project is to write a set of learning objectives for the LIC ECG curriculum, to evaluate the current students, CUSOM DH LIC class of 2018, regarding their ECG proficiency at the end of their MS3 year. The CUSOM DH LIC class of 2019 will also be surveyed through pre and post-coursework evaluations.

Primary Presenter: **Brian Hurt**

Project Title: *Cancer-Promoting Mechanisms of Tumor-Associated Neutrophils*

Primary Mentor: Carlton Barnett

Thematic Area: Clinical Science

Abstract:

Importance: Neutrophils have classically been considered to mount a defensive response against tumor cells, yet recent evidence suggests tumors modulate neutrophil function to support tumor growth and progression.

Objective: Known as tumor-associated neutrophils (TANs) are phenotypically distinct from circulating neutrophils. Although TANs have been shown to both promote and inhibit tumor advancement the preponderant activity augments tumor progression. This review discusses these cancer-promoting molecular pathways, relevant diagnostic studies in patients, and subsequent treatment modalities.

Evidence Review: Web searches for numerous keywords including, but not limited to œtumor-associated neutrophils, œneutrophils AND œcancer, œneutrophils AND œmetastasis yielded most of the papers cited, which are generally from the mid-2000s and later. A few seminal papers for classical molecular mechanisms are also reviewed.

Findings: The tumor promoting mechanisms of TANs include dampening of CD8+ response via Arginase-1; a neutrophil-secreted neutrophil elastase (NE) upregulation of tumor cellular proliferation pathways; degradation of basement membrane and ECM via NE and MMP-9; upregulation of angiogenesis by VEGF, Bv8, and HGF; and ICAM-1 dependent tumor intravasation, immune protection in circulation, and extravasation into distant, metastatic tissue beds. These findings will support surgical application of loco-regional therapies to specifically target TANs-mediated tumor progression.

Conclusions: TANs modulate the tumor microenvironment promoting tumor progression. Mechanistic understanding of TANs role in tumor progression will provide unique therapeutic alternatives.



Primary Presenter: **Gregory Ingolia**

Project Title: *"Immunoglobulin A Antibodies to Cyclic Citrullinated Protein Predominate in Individuals at-Risk for Future Rheumatoid Arthritis"*

Primary Mentor: Kevin Deane

Thematic Area: Basic Biomedical Science

Abstract:

Background/Purpose: Immunoglobulin A (IgA) autoantibodies (Abs) to citrullinated proteins (ACPs) are present in the preclinical period of RA development, a finding that suggests a mucosal site of Ab generation (Kokkonen 2011). IgA ACPAs have also been found in subjects at-risk for future RA based on a family history of disease (Arlestig 2012; Barra 2013). In addition, we have identified apparent local lung mucosal generation of IgA RA-related Abs in at-risk subjects (Willis, Demoruelle 2013). Additional findings that serum IgA ACPA predominates during the early natural history of RA would further support initial mucosal generation of RA-related autoimmunity.

Methods: Three groups from the Studies of the Etiology of RA (SERA) project were evaluated: 77 AtRisk subjects who were firstdegree relatives of patients with RA or subjects identified through health fair screening and all were serum positive for  $\geq 1$  Ab including CCP2 (IgG, Axis-Shield), CCP3.1 (IgG/IgA, INOVA) and rheumatoid factor IgA/M/G (INOVA) without inflammatory arthritis, 53 subjects with seropositive RA (1987 criteria), and 71 blood donor controls. Each subject was tested for ACPA IgA/M/G using CCP3 antigen ELISAs (research use only; donated by INOVA), and by a technician blinded to group status. Positivity for CCP isotypes was mean levels +2 standard deviations in a separate set of 70 random blood donors. Shared epitope (SE) status was determined in AtRisk and RA subjects using published methods (Kolfenbach 2009).

Results: When comparing isotype proportions, IgA-CCP was positive in a higher number of AtRisk subjects than IgM (46.8% vs. 27.3%,  $p=0.03$ ) (Table), and the prevalence was higher than IgG, although this was not statistically significant (46.8% vs. 39.0%;  $p=0.33$ ). In contrast, in RA IgG-CCP was more common than IgA and IgM (86.8% vs. 69.8% and 47.2%, respectively;  $p \leq 0.03$ ). In Controls, IgA-CCP was also positive in a higher number of subjects than IgM or G (12.7% vs. 2.8% and 1.4%, respectively;  $p \leq 0.03$ ). In AtRisk, smoking was associated with positivity for  $\geq 1$  CCP isotype; this was not seen in RA, however, RA subjects were more likely to be current smokers than AtRisk. In AtRisk and RA there was no association between CCP isotypes the SE.

Conclusion: The high IgA ACPA positivity in AtRisk and high IgG ACPA in RA suggest that mucosal processes may be an early feature of RA-related autoimmunity that later transition to an IgG-dominant process. IgA ACPA positivity in controls also suggests that IgA-CCP is present in wider populations and perhaps related to non-disease-specific immune responses. These findings as

well as the association of smoking with ACPA isotypes in AtRisk subjects and current smoking with RA status need exploration in larger studies that examine the genetic, environmental and mucosal factors that may be involved in the evolution of ACPA isotypes in transition from preclinical to clinically apparent RA.

Primary Presenter: **Rachael Janoso**

Project Title: *Gynecological Practices of Greco-Roman Antiquity: A Midwives Perspective*

Primary Mentor: Therese Jones, PhD

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

The purpose of this essay is to discuss the role of a midwife during pregnancy and delivery in the Roman Empire as well as the unique perspective of medicine and womens health. I approach this topic uniquely because I chose to write a first-person narrative by creating a character for myself. I will take on the identity of a midwife named Coelia Hagne, who lived during the second century CE in a small coastal town on the Italian peninsula. I created a personality for my character as she practices gynecological medicine as a midwife. I follow the cases of four women in particular to highlight all aspects of pregnancy and childbirth. Through the observations of my character, I will discuss the recommended treatments by established opinions regarding the female body by Hippocrates and Galen as well as guidelines for gynecologic practice by Soranus. I will insert my own opinions of their efficacy and discuss the standard procedural techniques in a normal delivery, the implication of unwanted children, the treatment and prevention of miscarriage, and the surgical methods of abortion.

I chose to pursue a topic relating to gynecology and childbirth because it is a topic of special interest to me. I am pursuing a degree in obstetrics and gynecology beginning in the summer of 2017 after graduation from medical school. I studied Classics as an undergraduate and thoroughly enjoyed learning about ancient Greek and Roman society, art, culture, language, history and medicine. I wanted to unite my interest in medicine and classical studies, and therefore, chose to work on a project relating to ancient midwifery and childbirth.

Primary Presenter: **Kyle Jasper**

Project Title: *Characterization of MJN110: A Novel Monoacylglycerol Lipase Inhibitor*

Primary Mentor: Erik Oleson

Thematic Area: Basic Biomedical Science

Abstract:

Carbamates are a class of serine-hydrolase inhibitors that inhibit the natural degradation enzymes of the endocannabinoids 2-AG and Anandamide, which are Monoacylglycerol Lipase (MAGL) and Fatty Acid Acyl Hydrolase (FAAH), respectively. A previously developed carbamate, JZL184, exhibited a full cannabimimetic profile, (as does THC) however, inhibited both MAGL and FAAH, producing undesirable effects of Catalepsy and drug dependence, thereby reducing its clinical utility. A newly developed carbamate, MJN110, is selective for MAGL in vivo and in vitro, and may possibly uncouple some the undesirable cannabimimetic effects (e.g. hypomotility) from beneficial ones (e.g. analgesia, increased motivation for food).

Primary Presenter: **Teresa Johnson**

Project Title: *Hospital Readmissions from the Perspective of Medicaid and Uninsured Patients*

Primary Mentor: Greg Misky

Thematic Area: Public Health and Epidemiology

Abstract:

Background: Hospital readmissions are common and costly. Few studies have utilized the perspective of the Medicaid or uninsured patient to understand reasons they seek hospital care again.

Methods: We enrolled 18 patients with Medicaid or no insurance during a hospital readmission. We conducted semi-structured qualitative interviews exploring patients experiences utilizing a grounded theory approach.

Results: Five themes contributed to readmission: 1) therapeutic alliance; 2) patient accountability; 3) social instability; 4) access failures; and 5) disease behavior. Medical conditions were complicated by social influences and insufficiently addressed by our health system. Patients understood their own role managing health, but struggled effectively executing care plans due to competing life demands and compromised provider relationships.

Conclusions: Hospital readmissions were caused by complex illnesses and complicated by decision-making, social instability and health system failures. Improved patient-provider trust and shared decision-making appear essential to improving care for at-risk patients.

Primary Presenter: **Chris Johnson**

Project Title: *Short-term results of percutaneous treatment of acetabular fractures: functional outcomes, radiographic assessment and complications*

Primary Mentor: Cyril Mauffrey

Thematic Area: Clinical Science

Abstract:

Abstract

**Purpose:** Our purpose was to assess functional outcomes, radiographic characteristics and complications in patients who underwent fixation of acetabular fracture using percutaneous means only.

**Methods:** This was a retrospective cohort study of adult patients with an acetabular fracture admitted to a level 1 trauma centre and treated with closed reduction and percutaneous fixation. Nineteen patients were identified, and mechanism of injury, radiologic classification of fracture, complications and functional outcomes were analysed. Outcome measurements included Patient Reported Outcomes Measurement Information System (PROMIS) and Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) scores, which are validated patient questionnaires assessing functional outcome. They are scored as a point range on a per-question basis, with a combined range possibility of 0–96 for WOMAC and 5–75 for PROMIS.

**Results:** Nineteen patients over a two year period were reviewed. Fracture displacement improved following surgery from a mean 7.3 mm (range 0–33 mm) to 2.6 mm (range 0–12 mm). Complications included one post-operative death from non-ST-segment elevation myocardial infarction, sciatic nerve injury, malpositioned screw and deep infection. There were no vascular injuries, pulmonary emboli or deep venous thromboses. Of the 19 patients eligible for the study, seven completed both PROMIS mobility and WOMAC osteoarthritis questionnaires at a mean follow-up of 572 days (1.57 years), with a range of 435–862 days. The average WOMAC score was 7.4 (range 0–30) and mean PROMIS score 66.4 (range 50–75).

**Conclusions:** Functional outcomes in this study are comparable with other published studies and support percutaneous management of acetabular fractures as an effective alternative to open reduction and internal fixation.

Primary Presenter: **Bailey Johnson**

Project Title: *Relationship between Soft Tissue Musculoskeletal Injury and Menstrual Cycle Phase*

Primary Mentor: Jonathan Bravman

Thematic Area: Clinical Science

Abstract:

Abstract

**Purpose:** To explore whether or not menstrual phase plays a role in effecting the incidence of musculoskeletal injury in females through a multi-patient retrospective chart review. It has been proven that female non-contact ACL tears are significantly higher during the pre-ovulatory phase of the menstrual cycle [1, 3, 5-15]. It was hypothesized that incidence of soft tissue musculoskeletal injury in females requiring orthopedic consult and/or surgery would be increased during the pre-ovulatory phase of the menstrual cycle.

**Methods:** 121 menorrhagic women who had experienced an injury requiring orthopedic consult at the University of Colorado Sports Medicine Clinic in Boulder, CO were included. Standard intake questionnaire data were retrospectively reviewed including date of initial injury and date of last menstrual period (LMP). The 9 types of injury reviewed included overall shoulder injuries, shoulder dislocation and/or tear, overall knee injuries, overall ACL injuries, ACL injury only, ACL and meniscus injury, ACL and other knee ligament injury, overall soft tissue injuries, or overall fracture. Injury date was compared with menstrual cycle phase at time of injury to assess for correlation. The pre-ovulatory phase (phase 1) was defined as days 1-14 and post-ovulatory phase (phase 2) was defined as days 15 -28 of the menstrual cycle. Self-reported LMP date was assigned as day 1 of the 28-day cycle.

**Results:** None of the injury types reviewed showed prevalence significantly associated with either phase 1 or phase 2 of the menstrual cycle. The most closely associated injury type was overall fracture with an alpha level of 0.06.

**Conclusion:** Our failure to demonstrate a correlation between shoulder, bony, or knee injury and menstrual phase may indicate inaccuracies in self-report data as our study was adequately powered. As the correlation between ACL tears and menstrual phase has been previously demonstrated, further inquiry is needed.

Primary Presenter: **Laura Kahn**

Project Title: *Was Flint Inevitable? Lead, Poverty, and Confronting the Predictable*

Primary Mentor: Madiha Abdel-Maksoud

Thematic Area: Public Health and Epidemiology

Abstract:

Background: Flint, Michigan, was the focus of national attention in 2015-2016 for reports of elevated lead levels in the water supply, and public officials are now being examined for potentially criminal negligence. Lead exposure has historically been associated with disenfranchised groups, and the city of Flint has a legacy of industrial contamination, racial segregation, and economic disparity. The purpose of this analysis was to examine the exposure of Flint's residents to elevated lead levels in a historical context.

Methods: A non-systematic narrative literature review of academic journals, public documents, and media coverage was performed.

Results: The United States has struggled to regulate lead exposure, due in part to the strong voice of industry in shaping policy and public perception. The residents of Flint are particularly vulnerable to environmental injustice due to the city's history, built environment, and economic decline.

Discussion: The exposure of Flint's residents to elevated lead levels was part of a larger pattern that has consistently affected vulnerable populations. Underlying elements of social disempowerment, racially shaped landscapes and policies, and lack of regulatory enforcement all played a role in creating the crisis. Incidents of environmental injustice are likely to recur unless we address underlying inequities.



Primary Presenter: **Sean Kalra**

Project Title: *SMAD4 loss promotes lung cancer formation but increases sensitivity to DNA topoisomerase inhibitors*

Primary Mentor: Stephen Malkoski

Thematic Area: Basic Biomedical Science

Abstract:

Non-small-cell lung cancer (NSCLC) is a common malignancy with a poor prognosis. Despite progress targeting oncogenic drivers, there are no therapies targeting tumor-suppressor loss. Smad4 is an established tumor suppressor in pancreatic and colon cancer; however, the consequences of Smad4 loss in lung cancer are largely unknown. We evaluated Smad4 expression in human NSCLC samples and examined Smad4 alterations in large NSCLC data sets and found that reduced Smad4 expression is common in human NSCLC and occurs through a variety of mechanisms, including mutation, homozygous deletion and heterozygous loss. We modeled Smad4 loss in lung cancer by deleting Smad4 in airway epithelial cells and found that Smad4 deletion both initiates and promotes lung tumor development. Interestingly, both Smad4<sup>-/-</sup> mouse tumors and human NSCLC samples with reduced Smad4 expression demonstrated increased DNA damage, whereas Smad4 knockdown in lung cancer cells reduced DNA repair and increased apoptosis after DNA damage. In addition, Smad4-deficient NSCLC cells demonstrated increased sensitivity to both chemotherapeutics that inhibit DNA topoisomerase and drugs that block double-strand DNA break repair by non-homologous end joining. In sum, these studies establish Smad4 as a lung tumor suppressor and suggest that the defective DNA repair phenotype of Smad4-deficient tumors can be exploited by specific therapeutic strategies.

Primary Presenter: **Cenea Kemp**

Project Title: *A 19 Year-Old Male with a GSW Presenting with Arterial Transection with a Delayed Presentation: A Case Report*

Primary Mentor: N/A N/A

Thematic Area: Clinical Science

Abstract:

This case report is an important contribution to the literature as it is the first of its kind to be reported. A 19-year-old male presented with a GSW to the right upper extremity and axilla. Initial physical exam demonstrated some deficits in the distribution of the median and ulnar nerves but was otherwise not concerning for significant neurovascular compromise. The patient left the hospital AMA before more advanced imaging could be completed. On post-injury day #5, the patient re-presented with physical exam findings and imaging concerning for right brachial artery occlusion and/or transection. Intra-operative findings included transection of the brachial artery with thrombosis on the proximal and distal ends of the artery. This case of delayed presentation of arterial transection is significant, as it demonstrates the need for clinicians to have a high index of suspicion in patients with traumatic limb injuries who present with increasing pain and worsening of initial physical exam findings.

Primary Presenter: **Sonia Khatter**

Project Title: *Anti-CCP3.1 and Anti-CCP3-IgA Antibodies Are Associated with Increasing Age in Subjects Without RA*

Primary Mentor: Kristen Demoruelle

Thematic Area: Clinical Science

Abstract:

Background/Purpose: Serum anti-CCP antibodies are highly specific for RA in the setting of inflammatory arthritis (IA) and can be elevated for several years prior to the onset of IA during the preclinical period of autoimmunity in RA. Understanding the origins of anti-CCP is critical to understanding the etiology of RA. Prior studies demonstrate that positivity of autoantibodies (e.g. RF and ANA) increase with increasing age. Similar associations have not been reported for anti-CCP. We sought to further evaluate the association of age and anti-CCP3.1 that detects IgG and IgA reactivity in subjects without RA.

Methods: From the Studies of the Etiology of RA (SERA) cohort, we included 1037 RA-free first-degree relatives (FDRs) of probands with RA, and from the dental assessment (DA) validation cohort, we included 330 subjects. Serum was tested by ELISA for CCP2 (IgG, Axis-Shield) and CCP3.1 (IgG/IgA, Inova) with positivity based on manufacturers recommendations. The DA group and random subset of 279 FDRs also had serum testing by ELISA on a CCP3 substrate using isotype-specific IgA (CCP-IgA) and IgG (CCP-IgG) secondary reagents (Inova, for research only) with positivity based on a cut-off level that was positive in <5% of 154 anonymous blood donors. Analyses included logistic regression and McNemars test.

Results: FDRs were 81% female, 76% white, 40% ever smokers and 53% shared epitope (SE) positive. DA subjects were 40.0% were female, 72.4% were non-Hispanic white, 46.6% were ever-smokers, 26.4% had periodontal disease, and 39.4% were SE positive. In FDRs, anti-CCP3.1 positivity was more prevalent than CCP2 (8.2 v. 2.7%,  $p<0.01$ ), and anti-CCP-IgA was more prevalent than CCP-IgG (10.0 vs. 5.7%,  $p=0.08$ ). There was an association between increasing age and anti-CCP3.1 (OR=1.03 95% CI 1.02-1.05) and CCP-IgA positivity (OR=1.04 95% CI 1.02-1.07) that remained significant after adjusting for sex, race, ever smoking and SE. There was no association of age and anti-CCP2 ( $p=0.78$ ) or CCP-IgG ( $p=0.24$ ). The higher prevalence of anti-CCP3.1 was significant in FDRs after age 50 years (Figure). FDRs  $\geq 50$  years had higher anti-CCP-IgA positivity than CCP-IgG (17.3 v. 8.3%,  $p=0.04$ ). In DA subjects  $\geq 50$  years, anti-CCP3.1 positivity was more prevalent than CCP3 (76.0 v. 45.5%,  $p<0.01$ ). Anti-CCP-IgA positivity was also more prevalent than CCP-IgG in this group (78.9 v. 42.9%,  $p<0.01$ ).

Conclusions: This is the first study to demonstrate increasing anti-CCP3.1 positivity with increasing age in subjects without RA. This association appears to be driven by IgA reactivity, and may reflect an ongoing mucosal immune process. Additional studies are needed to determine potential pathogenicity or other phenotypic associations of anti-CCP-IgA in older adults, but these findings have important clinical and research implications. Age should be considered in the clinical interpretation of anti-CCP3.1 in subjects without IA, and identifying mechanisms of anti-CCP-IgA generation in older adults could provide insight into the etiology of RA.

Primary Presenter: **Kayleigh Kirk**

Project Title: *Epidemiology of Lacrosse injuries treated at the United States emergency departments between 1997 and 2015.*

Primary Mentor: Morteza Khodaei

Thematic Area: Public Health and Epidemiology

Abstract:

ABSTRACT

Epidemiology of Lacrosse injuries treated at the United States emergency departments between 1997 and 2015.

Kayleigh J. Kirk<sup>1</sup>, Lauren A. Pierpoint<sup>2</sup>, and Morteza Khodaei<sup>3</sup>

<sup>1</sup>University of Colorado School of Medicine, Aurora, USA

<sup>2</sup>Department of Epidemiology, Program for Injury Prevention, Education, and Research, Colorado School of Public Health, University of Colorado Anschutz, Aurora, USA

<sup>3</sup>Department of Family Medicine, University of Colorado School of Medicine, Aurora, USA

**Purpose:** Both mens and womens Lacrosse have gained popularity in the past few decades. Mens and womens Lacrosse are not considered gender comparable sports since the rules and equipment differ substantially. The purpose of this study was to investigate Lacrosse-related injuries presented to the United States Emergency Departments (EDs).

**Methods and Study Design:** A retrospective descriptive epidemiologic study using the National Electronic Injury Surveillance System (NEISS) from 1997 to 2015. Our main outcome measurements were injury incidence and characteristics.

**Results:** From 1997-2015, 7,587 Lacrosse-related injuries were treated at U.S. EDs. Males accounted for 76% of injuries. Average age was  $16.0 \pm 5.0$  years (males  $16.1 \pm 5.2$ ; female  $15.7 \pm 4.1$ ). Sprains/strains (24.3%), contusion/abrasion (21.5%), and fractures (18.7%) were the most common diagnoses. Females sustained a higher proportion of sprains/strains (35.0%) than boys (21.0%) ( $p < 0.01$ ), while males sustained a higher proportion of fractures (21.4% vs. 9.9%,  $p <$

0.01). Head and face (27.9%), shoulders (10.2%), and fingers (9.2%) were the most commonly injured body parts. Males had more shoulder injuries (12.3%) compared to females (3.5%), while females had more ankle injuries (17.0%) compared to males (7.1%) ( $p < 0.01$ ). The majority of patients were treated and discharged (96.2%).

**Conclusions:** This study determined common Lacrosse injuries, their patterns and severity over a 19-year period. Interestingly, most injuries did not require hospitalization. There are major differences in injury patterns between male and female Lacrosse players.

**Significance of Findings:** Understanding the epidemiology of injuries presenting to EDs can help guide prehospital care and medical care allocation for team physicians covering Lacrosse events, and identify areas for targeted injury prevention efforts.

Primary Presenter: **Madeline Koerner**

Project Title: *Effect of Interdisciplinary Rounding on Nursing Satisfaction*

Primary Mentor: Elizabeth Harry

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

EFFECT OF INTERDISCIPLINARY ROUNDING ON NURSING SATISFACTION

Madeline R. Koerner (MD-MBA candidate)<sup>1</sup>, E Harry (MD)<sup>2</sup>, J Manheim (MD)<sup>3</sup>, MJ Dally<sup>4</sup>,  
Department of Medicine, Presbyterian-St. Lukes Medical Center, Denver, CO.

\* University of Colorado School of Medicine, University of Colorado Denver Business School

\* Brigham and Womens Hospital

\* University of Colorado Denver, Presbyterian-St. Lukes Medical Center

\* Colorado School of Public Health

Background:

Interdisciplinary patient care reduces preventable adverse events, lowers nursing resignation rates, and increases nursing satisfaction with teamwork and collaboration. Both geographic rounding and Accountable Care Unit (ACU) models have shown increased nursing satisfaction. To compare the effect of these two interventions on nursing satisfaction, the Hospitalist group at Presbyterian-St. Lukes Medical Center in Denver, CO implemented both models on separate hospital floors. The group hypothesized that there would be a greater increase in nursing satisfaction with an ACU than with geographic rounding.

Methods:

This study utilized a longitudinal design to survey nursing satisfaction at three points: prior to intervention, following conversion of Unit 5A to geographic rounding and Unit 9A to an ACU, and finally following conversion of Unit 5A to an ACU. The survey used was based on the Healthcare Team Vitality Instrument (HTVI) with additional questions to assess demographics and was collected via Survey Monkey through both e-mail distribution list and in-person collection. Three nursing groups were compared: intervention Unit 5A, intervention Unit 9A, and non-intervention nurses from other floors who served as a control group for the hospital. Analysis was limited to a generalized summary of results and a visual analysis of trends as the

anonymity guaranteed by the survey limited the ability to ensure the same population was sampled at each of the three time points.

#### Results:

Between the three surveys, 128 usable responses were collected “ 42 in the initial survey, 60 in the mid-way survey, and 26 in the final survey. HTVI questions were scored using a five-level Likert scale with 1 being “Strongly Disagree and 5 being “Strongly Agree. Average overall satisfaction at the initial, mid-way, and final surveys for Unit 5A nurses were 3.50 (0.48), 3.45 (0.37), and 3.60 (0.44); for Unit 9A nurses were 3.20 (0.51), 3.03 (0.88), and 3.19 (0.63); and for other nurses were 3.49 (0.52), 3.82 (0.59), and 3.53 (0.54). In response to the question on the likelihood of seeking new employment in the next 12 months, the percentages of nurses looking for a new job at the initial, mid-way, and final surveys for Unit 5A nurses were 27%, 18%, and 25%; for Unit 9A nurses were 50%, 36%, and 60%; and for other nurses were 43%, 42%, and 75%.

#### Conclusions:

Satisfaction scores for nurses on both Units 5A and 9A dropped at the mid-way survey and returned to baseline at the final survey. The average likelihood of nurses on all floors to seek new employment increased from the initial to final surveys. A decrease in nursing satisfaction at six months combined with the increased likelihood to seek new employment may reflect change fatigue “ a perception of too much change that is associated with exhaustion, burnout, decreased commitment, and higher likelihood of turnover. Studies of change fatigue offer leadership lessons for future work in this area and suggest that staff involvement in the creation of change may increase involvement and thereby improve nursing satisfaction. The data fails to suggest that nursing satisfaction is improved more by geographic rounding or by an ACU but rather likely reflects other influences on satisfaction that were not controlled for in this study.



Primary Presenter: **Amelia Kreienkamp**

Project Title: *Vizki: Visualizing the Kinome*

Primary Mentor: Aik-Choon Tan

Thematic Area: Basic Biomedical Science

Abstract:

Motivation: Kinases play an important role in many cancer signaling pathways. In order to better characterize the cancer genome, we have developed an interactive computational tool designed to visualize the kinome, the protein kinase subset of the human genome. Visualization of the kinome makes it easier to see relationships between kinases and can help explain similarities in behavior among kinases, making it an important step in understanding cancer signaling pathways. Because kinases are frequently used as therapeutic anti-cancer targets, we have additionally mapped inhibition data onto these kinases to better understand the specificity of kinase inhibitors among different kinase families. We additionally provide a functionality for users to upload and visualize their own compound profiling data. Our web-based tool, VIZKI (Visualizing the Kinome), currently still in development, is open access, searchable and easily downloadable.

Results: We developed VIZKI, an online web tool that is capable of visualizing the human protein kinome including individual kinases, kinase groups and kinase families along with comprehensive kinase inhibition data. To date we have used 514 kinases and 8000+ inhibitor compounds.

Availability: VIZKI is available as a web tool at:

[[tanlab.ucdenver.edu/vizki/](http://tanlab.ucdenver.edu/vizki/)](<http://tanlab.ucdenver.edu/vizki/index.html>).

Primary Presenter: **Michelle Kuei**

Project Title: *Factors Affecting Time to Diagnosis and Treatment of Surgical Breast Cancer Patients at a Safety-Net Hospital*

Primary Mentor: Kshama Jaiswal

Thematic Area: Clinical Science

Abstract:

Background: Time to diagnosis and treatment of breast cancer has been shown to impact survival. A variety of factors, including patient-, provider-, and system-related, have been found to affect timely detection and treatment. The purpose of this study was to evaluate if the arrival of a dedicated breast surgeon and additional breast radiologist at Denver Health hospital affected time to diagnosis and treatment of breast cancer patients treated at Denver Health hospital.

Objective: Determine if system-related changes, specifically, arrival of additional breast specialists affected time to diagnosis and treatment of patients with breast cancer at Denver Health hospital.

Methods: A retrospective review of patients diagnosed and treated at Denver Health, a safety-net hospital, for breast cancer. Interval times to diagnosis and treatment were compared before and after the arrival of the additional breast specialists using logistic regression.

Results: work in progress

Conclusion: work in progress

Primary Presenter: **Regina Kwon**

Project Title: *The Effect of Cost Information on Treatment Decisions: An Experimental Survey*

Primary Mentor: Daniel Matlock

Thematic Area: Public Health and Epidemiology

Abstract:

**Background:** Regulators hope price transparency will reduce health-care spending by the public. Most resources, however, publish total charges rather than out-of-pocket costs, and whether that information changes behavior is poorly understood. The purpose of this exploratory study was to examine the effect of total cost data on a hypothetical treatment decision.

**Methods:** In February 2016, we used the online marketplace MTurk to recruit U.S. adults 18 years and older to a brief online survey. Participants were paid \$0.70. The survey randomized respondents to one of four scenarios. Each scenario described heart failure and a risky treatment, but varied by patient identity (Self/Other) and display of total cost. When cost was shown, we stated insurance would cover almost all of it. Respondents chose whether the patient should get the treatment and provided demographics and free-text comments. Data were analyzed using logistic regression and inductive coding.

**Results:** We received 1,192 valid responses. The mean age was 38.3 years ( $\pm 12.8$ ); 53.4% were female and 84.5% white. Respondents were more likely to say "Yes" when shown the cost (OR 1.44,  $p=0.0023$ ) or deciding for another (OR 1.62,  $p<0.0001$ ). Being female or married with children increased the likelihood of answering "Yes", while older age decreased it. Yes responders wanted to extend survival (52%) while No responders feared poor quality of life (57%).

**Conclusion:** This experimental survey generated surprising results that call into question the efficacy of current price-transparency regulations. Although information on out-of-pocket costs could help control health-care spending, providing total costs could worsen it.

Primary Presenter: **Jaren LaGreca**

Project Title: *Patients without Intraoperative Neuromonitoring (IONM) Alerts During VEPTR Implantation did not Sustain Neurologic Injury during Subsequent Routine Expansions: a Retrospective Multi-Center Cohort Study*

Primary Mentor: Sumeet Garg

Thematic Area: Clinical Science

Abstract:

**Background:** The purpose of this study was to determine the rate of IONM alerts and neurologic injury during VEPTR treatment and evaluate the utility of IONM during VEPTR expansion procedures in patients who have not previously had neurologic injury or IONM alerts.

**Methods:** After institutional review board approval, VEPTR procedures and IONM records were reviewed at 17 institutions for patients treated with VEPTR from 2005-2011. All consecutive cases in patients with minimum 2 years follow-up were included. Patients with prior history of growing rods or other invasive spine-based surgical treatment were excluded. Surgeries were categorized into implant, revision, expansion, and removal procedures. Cases with IONM alerts or neurologic injury had additional detailed review. Descriptive statistics were used for data analysis.

**Results:** 2,355 consecutive VEPTR procedures (352 patients) consisting of 299 implant, 377 revision, 1587 expansion, and 92 removal procedures were included. 620 VEPTR procedures had IONM, and 539 of those had IONM records available for review. IONM alerts occurred in 9/539 procedures (1.7%): 3/192 implants (1.6%), 3/58 revisions (5.2%), and 3/258 expansions (1.2%). New neurologic injury occurred in 3/2,355 procedures (0.1%), 3/352 patients (0.9%). All 3 injuries were in implant procedures, only one had an IONM alert. All 3 had upper extremity motor deficits (one had sensory deficit also). All had full recovery at 17, 30, and 124 days post-injury. One patient without prior neurologic injury or IONM alert had an IONM alert during expansion that resolved after an increase in blood pressure. The remaining IONM alerts during expansions were all in children with prior IONM alerts during implant, revision, or exchange procedures.

**Conclusions:** The highest rate of neurologic injury in VEPTR surgery was found for implant procedures. There were no instances of neurologic injury during VEPTR expansion, revision, or removal procedures. IONM did not identify new neurologic injuries in patients undergoing VEPTR expansion who did not previously have a history of IONM signal change or neurologic injury.

**Level of Evidence:** Diagnostic Study, Level IV

Primary Presenter: **Benjamin Leon**

Project Title: *Nonobstructive Coronary Artery Disease and Risk of Myocardial Infarction*

Primary Mentor: Thomas Maddox

Thematic Area: Clinical Science

Abstract:

IMPORTANCE:

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Little is known about cardiac adverse events among patients with nonobstructive coronary artery disease (CAD).

OBJECTIVE:

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To compare myocardial infarction (MI) and mortality rates between patients with nonobstructive CAD, obstructive CAD, and no apparent CAD in a national cohort.

DESIGN, SETTING, AND PARTICIPANTS:

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Retrospective cohort study of all US veterans undergoing elective coronary angiography for CAD between October 2007 and September 2012 in the Veterans Affairs health care system. Patients with prior CAD events were excluded.

EXPOSURES:

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Angiographic CAD extent, defined by degree (no apparent CAD: no stenosis >20%; nonobstructive CAD:  $\geq 1$  stenosis  $\geq 20\%$  but no stenosis  $\geq 70\%$ ; obstructive CAD: any stenosis  $\geq 70\%$  or left main [LM] stenosis  $\geq 50\%$ ) and distribution (1, 2, or 3 vessel).

MAIN OUTCOMES AND MEASURES:

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The primary outcome was 1-year hospitalization for nonfatal MI after the index angiography. Secondary outcomes included 1-year all-cause mortality and combined 1-year MI and mortality.

RESULTS:

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Among 37,674 patients, 8384 patients (22.3%) had nonobstructive CAD and 20,899 patients (55.4%) had obstructive CAD. Within 1 year, 845 patients died and 385 were rehospitalized for MI. Among patients with no apparent CAD, the 1-year MI rate was 0.11% (n%o=%o8, 95% CI, 0.10%-0.20%) and increased progressively by 1-vessel nonobstructive CAD, 0.24% (n%o=%o10, 95% CI, 0.10%-0.40%); 2-vessel nonobstructive CAD, 0.56% (n%o=%o13, 95% CI, 0.30%-1.00%); 3-vessel nonobstructive CAD, 0.59% (n%o=%o6, 95% CI, 0.30%-1.30%); 1-vessel obstructive CAD, 1.18% (n%o=%o101, 95% CI, 1.00%-1.40%); 2-vessel obstructive CAD, 2.18% (n%o=%o110, 95% CI, 1.80%-2.60%); and 3-vessel or LM obstructive CAD, 2.47% (n%o=%o137, 95% CI, 2.10%-2.90%). After adjustment, 1-year MI rates increased with increasing CAD extent. Relative to patients with no apparent CAD, patients with 1-vessel nonobstructive CAD had a hazard ratio (HR) for 1-year MI of 2.0 (95% CI, 0.8-5.1); 2-vessel nonobstructive HR, 4.6 (95% CI, 2.0-10.5); 3-vessel nonobstructive HR, 4.5 (95% CI, 1.6-12.5); 1-vessel obstructive HR, 9.0 (95% CI, 4.2-19.0); 2-vessel obstructive HR, 16.5 (95% CI, 8.1-33.7); and 3-vessel or LM obstructive HR, 19.5 (95% CI, 9.9-38.2). One-year mortality rates were associated with increasing CAD extent, ranging from 1.38% among patients without apparent CAD to 4.30% with 3-vessel or LM obstructive CAD. After risk adjustment, there was no significant association between 1- or 2-vessel nonobstructive CAD and mortality, but there were significant associations with mortality for 3-vessel nonobstructive CAD (HR, 1.6; 95% CI, 1.1-2.5), 1-vessel obstructive CAD (HR, 1.9; 95% CI, 1.4-2.6), 2-vessel obstructive CAD (HR, 2.8; 95% CI, 2.1-3.7), and 3-vessel or LM obstructive CAD (HR, 3.4; 95% CI, 2.6-4.4). Similar associations were noted with the combined outcome.

#### CONCLUSIONS AND RELEVANCE:

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In this cohort of patients undergoing elective coronary angiography, nonobstructive CAD, compared with no apparent CAD, was associated with a significantly greater 1-year risk of MI and all-cause mortality. These findings suggest clinical importance of nonobstructive CAD and warrant further investigation of interventions to improve outcomes among these patients.

Primary Presenter: **Xiaomeng Li**

Project Title: *Corpus Callosum Damage in Traumatic Brain Injury: Incidence and Role in Short-term Outcome*

Primary Mentor: Robert Kowalski

Thematic Area: Clinical Science

Abstract:

Background: Traumatic brain injury (TBI) is a major public health issue, leading to 2.2 million U.S. emergency department visits annually. The corpus callosum is a known frequent site of injury. Less understood are effects of corpus callosal damage on outcomes.

Objective: To evaluate magnetic resonance imaging (MRI) evidence of injury to the corpus callosum following TBI, and its impact on short-term outcome.

Methods: The study was an analysis of MRI findings for a prospective cohort of patients with moderate to severe TBI enrolled in the Traumatic Brain Injury Model Systems (TBIMS) Database at an inpatient rehabilitation hospital. Outcome measures were incidence of corpus callosum (CC) injury; duration of post-traumatic amnesia (PTA); Functional Independence Measure (FIM<sub>7</sub>), and Disability Rating Scale (DRS), at times of inpatient rehabilitation admission and discharge.

Results: Between April 2005 and March 2013, 392 patients with TBI and available MRI imaging were enrolled in the TBIMS database. Median age was 33 years (range 16-71), 76% were male, and 85% white. One hundred and thirty (33%) had corpus callosal injury. In univariate analysis, patients with CC damage more often had higher velocity TBI causes (72% higher velocity vs. 27% lower velocity, OR 2.3, 95%CI 1.475-3.665,  $p < 0.001$ ), were less likely to follow commands on initial presentation (15% CC damage vs. 85% no CC damage; OR 4.367, 95%CI: 2.262-8.430,  $p < 0.001$ ), were younger (median age 25 years, CC injury vs. 36 years, no CC injury,  $p < 0.001$ ), and were more likely to have intraventricular hemorrhage (44%, CC injury vs. 22%, no CC injury, OR 2.854, 95%CI: 1.801-4.522,  $p < 0.001$ .) All factors associated with CC damage in univariate tests independently predicted this damage when compared in a multivariable analysis. In multivariable analyses controlling for age, sex, injury severity (GCS Motor score  $< 6$ ) and injury cause velocity, corpus callosum injury independently predicted poorer outcome by most measures assessed. In these models, at the time of rehabilitation admission, CC injury accounted for 14-point reduction in FIM<sub>7</sub> Total score (95%CI: -20 to -9,  $p < 0.001$ ) and a 3-point increase in DRS score (95%CI: +2 to +4,  $p < 0.001$ ). At time of rehabilitation discharge, CC injury accounted for a 10-point reduction in FIM<sub>7</sub> Total score (95% CI: -17 to -3,  $p = 0.007$ ), but did not

predict DRS score. Presence of CC injury also predicted a 19-day increase in PTA (95%CI: +5 days to +33 days,  $p=0.008$ ).

**Conclusions and Relevance:** Corpus callosum injury is observed acutely in 33% of moderate to severe TBI patients who received inpatient rehabilitation. Risk for CC damage is associated with higher velocity TBI causes, younger patient age, lower initial GCS Motor score, and concurrent intraventricular hemorrhage. Presence of CC injury independently predicts worse functional and cognitive outcomes. Further study of CC injury in TBI and its possible treatment are warranted.



Primary Presenter: **Nicole Look**

Project Title: *Radiographic and plantar pressure assessment of pes planus severity in children with cerebral palsy*

Primary Mentor: Frank Chang

Thematic Area: Clinical Science

Abstract:

Background: Many children with cerebral palsy (CP) have planovalgus feet that functionally exhibit an unusually flexible lever-arm, more commonly known as a flexible flatfoot. Although treatment may consist of orthotics or surgery depending on severity, no standard clinical measurement objectively quantifies the severity of the flexible flatfoot. The objective of this study was to formulate a method for quantitatively classifying flexibility in pes planus based on radiographic and/or plantar pressure measurements that align well with qualitative clinical evaluations.

Methods: We conducted a retrospective review of ambulatory pediatric subjects with CP, who underwent an instrumented gait analysis including plantar pressure measurement and received weight-bearing foot x-rays prior to any bony foot surgery.

Quantitative measurements included radiographic measurements and pedobarographic ratios calculated using a custom MATLAB program to segment the foot. Previous qualitative clinical evaluations separated feet into 4 categories of flatfoot severity: no diagnosis, mild, moderate, and severe. Alignment of quantitative measurements with severity categories was determined using one-way ANOVA.

Results: A total of 395 feet were included in this study; 136 with no diagnosis, 116 mild, 100 moderate, and 43 severe. Radiographically, 6 measurements had significant differences between 1 or more of the 6 severity comparisons (none:mild, none:moderate, none:severe, mild:moderate, mild:severe, moderate:severe). The anterior-posterior talonavicular coverage and lateral Meary's angle distinguished between each clinical severity. Pedobarographically, the medial index, arch index, and

center of pressure index were found to have significant variation between several severity categories. The medial index could distinguish between every category except mild:moderate.

Conclusions: Measurements related to the collapse of the longitudinal arch and forefoot abduction most strongly distinguish between severities, particularly between worsening severities. AP measurements of hindfoot valgus may be more useful for determining no diagnosis from any severity category. From plantar pressure measurements, increased medial pressure in the midfoot is most useful to differentiate severity, though not between mild and moderate cases. Further analysis can present specific thresholds for a definitive quantitative classification of severity, which may aid in determining the most appropriate treatment of pes planovalgus.

Level of Evidence: III

Primary Presenter: **Elizabeth**

**Malik**

Project Title: *Cricothyrotomy: an inexpensive training model*

Primary Mentor: Mark Deutchman

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

Cricothyrotomy: An inexpensive training model

Research in constructed versus animal models in teaching cricothyrotomy procedure to airway-naïve trainees

Malik, Elizabeth N., Deutchman, Mark E, M.D.

Introduction/Background

Cricothyrotomy is a rarely used procedure that requires operator competence in critical situations. Trainees are rarely exposed to this procedure in the clinical setting, which necessitates simulated practice to prevent a potentially negative impact on patient care. Tightening residency budgets often make the use of expensive, commercially-available models cost-prohibitive. Here, we present a re-usable, inexpensive task trainer to address this gap in medical training.

Educational Objectives

- To present an inexpensive task trainer for the education and practice of cricothyrotomy
- To compare the effectiveness of teaching with this constructed model against sheep trachea

Curricular Design

Ten task trainers were constructed from a Styrofoam head, ribbed garden hose with a cut hole for the cricothyroid space, electrical tape as the cricothyroid membrane, zip-ties to signify the laryngeal prominence and cricoid cartilage, and foam sheets with Tegaderm to represent the subcutaneous layers (Fig. 1). Twenty second-year medical students were given a 10 minute lecture on the standard, surgical cricothyrotomy and then randomly divided into two groups for practice on either the constructed model or the sheep trachea. After 10-15 minutes of practice, students were given a pristine airway of the same model type and evaluated on their ability to correctly perform a cricothyrotomy using a procedural checklist.

## Impact/Effectiveness

There was no significant difference in trainee scores on the procedural checklist using the constructed model (mean 18.5; SD 1.6) compared to the animal model (mean 18.0; SD 2.9) ( $p = 0.64$ ) (Fig. 2). Students completed the procedure faster on the constructed model (mean 84.1 s; SD 17.8 s) than on the sheep trachea (mean 117.5 s; SD 54.3 s) ( $p = 0.038$ ). These results suggest that learning the procedural steps of cricothyrotomy on our model is equivalent to learning on animal tissue. Students ability to complete the steps more quickly on the constructed model may be due the lack of subcutaneous tissue to dissect, simplifying the anatomy. Our model allows trainees to perform many iterations of a cricothyrotomy without the expense or difficulties in procurement and storage of animal or commercially available models. Overall, this model addresses the need for increased access to cheap, hands-on practice in cricothyrotomy for medical trainees.

Primary Presenter: **Owori Mang'eni**

Project Title: *PRESCRIPTION PATTERNS OF INTRAVENOUS IMMUNOGLOBULIN (IVIg) WITHIN UNIVERSITY OF COLORADO HOSPITAL (UCH) AND THE ETHICAL IMPLICATIONS FOR IVIg RATIONING*

Primary Mentor: Jackie Glover

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

**Objective:** To describe IVIg use stratified by indication at the UCH neuroscience unit from the period of July 2010 to June 2014 and to determine if there was an exponential increase in usage as compared to other hospital departments. Having so characterized IVIg usage, to discuss if there is an ethical basis for IVIg rationing.

**Method:** Retrospective study analyzing pharmacy data and data in Epic Medication Administration Records from July 2010 to June 2014 with the aim of describing IVIg use at the UCH neuroscience unit. IVIg usage for 508 patients was described with a further analysis of the principal ICD 9 diagnosis of 15 patients on the neuroscience unit.

**Results:**

The Poisson Regression Analysis result suggests a significant positive trend for the number of monthly IVIg prescription from 2011 to 2014. The regression coefficient for Year is 0.051 (SE = 0.021, Z-statistic = 2.402, P-value = 0.0163), which is significantly greater than 0 thus indicates a positive linear trend. Thus the log scaled number of IVIg prescription per month is increased by 0.051 each year from 2011 to 2014; and the incident rate of IVIg prescription is increased by 5.2% each year from 2011 to 2014.

The pair-wise comparisons for log IVIg Quantity were conducted for Neuroscience unit versus each of, Transplant unit, Pulmonary unit, Medical ICU, Infusion Center, and BMT Oncology departments. Meanwhile, a contrast comparing log IVIg Quantity usage between the Neuroscience unit and the average of the other 5 aforementioned units were conducted. The robust standard error estimate from HC4 and Bonferroni adjusted alpha levels of .008 per test (.05/6) were used for these a priori hypotheses. Results indicated that the average log quantity of IVIg usage was significantly higher in the Neuroscience Unit (Mean = 4.53, SE = 0.13) than were those in the Transplant Unit (Mean = 4.03, SE = 0.07),  $t = -3.01$ ,  $p = .006$ . The pairwise comparisons of the Neuroscience Unit with Pulmonary unit, Medical ICU, Infusion Center, and BMT Oncology departments were non-significant. The average log quantity of IVIg usage in Neuroscience Unit comparing with all other 5 units ( $M = 15.2$ ,  $SD = 6.32$ ) was not significant.

**Conclusion:** IVIg usage at the UCH neuroscience unit was not significantly more than other similar hospital departments. There was however a significant increase in IVIg usage from 2010 to 2014 at UCH hospital. While a case can be made for evidence based usage of IVIg, it seems at

this time the facts do not support the institution of rationing as the shortage is not yet critical. A discussion is however warranted on the circumstances that would trigger IVlg rationing.

Primary Presenter: **Bryan Mark**

Project Title: *Does Strict Adherence to the Ponseti Method Improve Isolated Clubfoot Treatment Outcomes? A Two-institution Review*

Primary Mentor: Nancy Miller

Thematic Area: Clinical Science

Abstract:

Background: Despite being recognized as the gold standard in isolated clubfoot treatment, the Ponseti casting method has yielded variable results. Few studies have directly compared common predictors of treatment failure between institutions with high versus low failure rates. Questions/purposes: We asked: (1) is the providers rigid adherence to the Ponseti method associated with a lower likelihood of unplanned clubfoot surgery, and (2) at the institution that did not adhere rigidly to Ponsetis principles, are any demographic or treatment-related factors associated with increased likelihood of unplanned clubfoot surgery?

Methods: After institutional review board approval, a consecutive series of patients with a diagnosis of isolated clubfoot who underwent treatment between January 2003 and December 2007 were identified. At Institution 1, 91 of 133 patients met the eligibility criteria and were followed for a minimum of 2 years compared with 58 of 58 patients at Institution 2. At Institution 1, 16 providers managed care using a conservative casting approach based on the Ponseti method. However, treatment was adapted by the provider(s). At Institution 2, one orthopaedic surgeon managed care with strict adherence to the Ponseti method. Surgical indications at both institutions included the presence of a persistent equinovarus foot position while standing. A chart review was used to collect data related to proportion of patients undergoing unplanned additional treatment for deformity recurrences after Ponseti casting, demographics, and treatment patterns.

Results: The proportion of subjects who underwent unplanned major surgical intervention was greater (odds ratio [OR], 51.1; 95% CI, 6.8–384.0;  $p < 0.001$ ) at Institution 1 (60 of 131, 47%) compared with Institution 2 (two of 91, 2%). There was no difference ( $p = 0.200$ ) in the proportion of patients who underwent additional casting, repeat tendo Achilles lengthening, and/or anterior tibialis tendon transfer only (minor recurrence) at Institution 1 (nine of 131, 7%) compared with Institution 2 (11 of 91, 13%). At Institution 1, an increase in the number of revision casts (multiple vs no casts, hazard ratio [HR] = 3.9; 95% CI, 2.0–7.6;  $p < 0.001$ ) and an increase in the number of cast-related complications (multiple vs no complications, HR = 2.8; 95% CI, 1.2–6.7;  $p = 0.019$ ) were associated with increased risk of major surgery in the multivariate analysis.

Conclusions: Rigid commitment to the Ponseti method in the conservative treatment of patients with isolated clubfoot was associated with a lower risk of subsequent unplanned surgical intervention. In addition, clubfoot treatment programs that use a care model that

prioritizes continuity in care and dedication to the Ponseti method may decrease the proportion of patients who undergo unplanned surgical intervention.

Level of Evidence: Level III, therapeutic study.



Primary Presenter: **Sarah Markus**

Project Title: *Point-of-Care Ultrasound Use in Rural and Critical Access Hospital Emergency Departments in Colorado: Current Practices and Barriers to Use*

Primary Mentor: Mark Deutchman

Thematic Area: Public Health and Epidemiology

Abstract:

ABSTRACT

Background: Emergency medicine use of point-of-care ultrasound has been shown to improve the safety of procedures and can be used to provide rapid answers to clinical questions. This skill is now taught during all emergency medicine and some family medicine residencies and is widely utilized in urban and academic emergency departments. However, rural and critical access hospitals face unique challenges in implementing and maintaining point-of-care ultrasound programs and prior studies have shown lower rates of adoption in community emergency departments.

Objective: This study sought to characterize current use of point-of-care ultrasound in rural and critical access hospital emergency departments in Colorado compared to prior studies, as well as identify barriers to use.

Methods: Rural and critical access hospital hospitals in Colorado were identified. An approximately ten-minute survey was administered to representatives of these emergency departments via phone or email. Statistical analysis was performed using univariate analysis and chi-squared tests.

Conclusions: Point-of-care ultrasound use has increased in rural Emergency Departments in Colorado compared to prior studies. Use is correlated with >5,000 annual Emergency Department patient visits. Among departments not using ultrasound, a lack of provider training was most frequently cited as a barrier. Among departments using ultrasound, provider preference and maintenance of trauma designation were most frequently cited as encouraging ultrasound use.

Primary Presenter: **Kevin McAllister**

Project Title: *Fingerstick vs. Venipuncture Sampling for Dried Blood Spots to Measure Cumulative Adherence to Tenofovir Therapy*

Primary Mentor: Jose Castillo-Mancilla

Thematic Area: Clinical Science

Abstract:

Fingerstick vs. Venipuncture Sampling for Dried Blood Spots to Measure Cumulative Adherence to Tenofovir Therapy Authors: Kevin J. McAllister, Stacey Coleman, Lane R. Bushman, Samantha MaWhinney, Jia-hua Zheng, Peter L. Anderson, Jose Castillo-Mancilla Background: Sustained drug exposure and adherence to antiretroviral therapy are critical to achieving viral suppression and preventing HIV transmission. Tenofovir-diphosphate (TFV-DP) in dried blood spots (DBS) is a useful biomarker for cumulative adherence due to its 17-day half-life and approximately 25-fold accumulation to steady state with daily dosing. Currently, TFV-DP has been mostly measured in DBS collected from venipuncture. However, capillary blood obtained from fingerstick is a potential sampling strategy for this matrix that is easy to obtain at a low cost and requires minimal processing. In this study, we investigated the linear relationship between DBS TFV-DP levels obtained by fingerstick versus venipuncture. Materials & Methods: HIV infected adults  $\geq 18$  years old who were taking any TFV based regimen for any duration of time were enrolled in an observational cohort that involved up to 3 visits over 48 weeks. During one of the three visits, a sample of whole blood was collected by venipuncture into an EDTA tube and later spotted on a 903 protein saver card in 25 $\mu$ l aliquots. A second sample was obtained at the same time where five drops of blood were spotted on a protein saver card from a capillary puncture on the distal tip of the index, ring, or middle finger using a lancet. DBS fingerstick and DBS venipuncture samples were extracted from the protein saver cards in 3mm punches for analysis. TFV-DP was measured in DBS using a previously validated LC-MS/MS method. Fingerstick and venipuncture TFV-DP levels were compared using linear regression and Bland-Altman plots (MS Excel). The alpha level was set at 0.05. Data are mean (95% CI), unless noted otherwise. Results: Thirty participants with a median age of 49 years (range 26 to 63) contributed one fingerstick sample and one venipuncture sample, for a total of 30 paired samples. The mean fingerstick TFV-DP was 1531 fmol/punch (1264 to 1797), whereas the mean venipuncture TFV-DP was 1612 fmol/punch (1329 to 1896). The correlation of TFV-DP between the two sampling methods was defined by a linear relationship where venipuncture =  $1.03 \times \text{fingerstick} + 30.4 \text{ fmol/punch}$  with an  $r^2 = 0.94$  (p

Primary Presenter: **Sarah McLeroy**

Project Title: *Surviving Fatal Acidemia:*

*A case of extreme acidosis in a patient with an arterial pH of 6.25 who survived*

Primary Mentor: Allan Prochazka

Thematic Area: Clinical Science

Abstract:

Metformin associated lactic acidosis (MALA) in the setting of impaired renal function may result in severe acidosis with an array of detrimental consequences on human physiology. The often-quoted mortality rate of MALA hovers around 50% although improving recognition may soon affect this statistic. We present a case of what we believe to be the lowest reported arterial pH in a patient who survived. This case demonstrates many of the adverse consequences believed to be attributable to severe acidosis in addition to demonstrating acidosis survivability at levels previously believed to be universally fatal. We exhibit the case of a 61-year-old African American female who presented with hypothermia, altered mental status, and an arterial pH of 6.25, believed to be secondary to Metformin Associated Lactic Acidosis. During admission she suffered cardiac arrest, acute respiratory distress syndrome, and a prolonged state of unresponsiveness, but ultimately recovered to the extent that she was discharged home. We support this case with a literature review that seeks to develop a current and broad understanding of severe acidosis that includes causes, physiologic consequences, and discussion on current treatment options. The clinical significance of severe acidosis has been poorly studied in humans despite its common appearance in critically ill patient populations. Ongoing research on pathophysiology and treatment of severe acidosis is needed.

Primary Presenter: **Mia McNulty**

Project Title: *The diabetic joint: effects of hyperglycemia on osteoarthritis's progression in a mouse model*

Primary Mentor: Karen King

Thematic Area: Basic Biomedical Science

Abstract:

### **Purpose**

Recently published studies have identified an association of diabetes with an increased incidence and severity of osteoarthritis (OA). However, while there are a number of potential mechanisms through which diabetes may accelerate OA, very little is known about the metabolic consequences of the diabetic environment in cartilage. The aims of this study are to determine if and how hyperglycemia affects cellular phenotype to promote increased OA progression.

### **Methods**

The destabilized medial meniscus (DMM) model of OA was applied to a mouse model of type 2 diabetes. Seven male mice with hyperglycemia (KKAy, blood glucose > 300 mg/dL) and 3 male mice without (KKaa, glucose < 250) underwent DMM at 12 weeks of age. At 8 weeks post-DMM mice were euthanized; their knee joints were isolated and processed for histology. Coronal sections were stained with safranin O/fast green and examined for differences in morphology. After an increase in osteophytes was noted, a follow up experiment was performed in which serial sections were stained with BMP-2 polyclonal antiserum or type X collagen antibodies. To further test phenotypic changes due to hyperglycemia, primary porcine chondrocytes were isolated from hyaline articular cartilage of 3-5 year old pigs with serial trypsin and overnight collagenase treatment. Within 24 h of plating at high density ( $4 \times 10^5/\text{cm}^2$ ), cells were incubated in serum-free monolayer culture for 6 days in iso-osmolar DMEM with normal (5 mM) or high (25 mM) glucose (DMEM, 0.35 mg BSA/ml, 1% PSF). Alkaline phosphatase activity was measured in the cell layer. This experiment was repeated 3 times with similar results (N=3 pigs).

### **Results**

The blood glucose of the hyperglycemic group at the time of DMM was 111% greater than the control group ( $441 \pm 56$  vs.  $209 \pm 29$ ,  $P < 0.001$ ), and body mass was 10% greater ( $34.5 \pm 1.6$  vs.  $31.3 \pm 2.7$ ,  $P = 0.01$ ). Histological analysis found that the percentage of mice with osteophytes was significantly greater in the hyperglycemic group (Table). Osteophytes were primarily located in the medial tibial articular cartilage. Both BMP-2 and type X collagen were located in or near osteophytes (Figure 1). Chondrocytes cultured *in vitro* under hyperglycemic conditions produced greater cellular alkaline phosphatase activity than normal glucose controls (Figure 2).

## Conclusion

Alkaline phosphatase, BMP-2, and type X collagen production are all characteristic of hypertrophic chondrocytes and may contribute to excess mineralization in OA joints. Taken together, our data suggest that high glucose conditions favor a change towards the hypertrophic phenotype. Ample evidence supports a similar change in human that is characteristic of OA chondrocytes. Our findings are in agreement with the recent clinical studies demonstrating accelerated OA progression in patients with diabetes. The limitations of this study are 1) the hyperglycemic mice were slightly heavier than controls which may add mechanical effects (adipose levels were not measured), and 2) higher noise-to-signal background was present with the type X collagen antibody. These are balanced by the strengths of this study which include 1) animals were verified hyperglycemic prior to DMM, and 2) phenotypic change was tested in two model systems (*in vivo* rodent and *in vitro* large mammal). In summary, this study suggests the hypothesis that accelerated hypertrophy of articular chondrocytes is a result of hyperglycemia and may contribute to the progression of OA as previously seen in patients with diabetes.

Primary Presenter: **Meara Melton**

Project Title: *Using a Positive Deviance Framework to Inform Provider-Family Communication on Geriatric Inpatient Units*

Primary Mentor: Ethan Cumbler

Thematic Area: Public Health and Epidemiology

Abstract:

Using a Positive Deviance Framework to Inform Provider-Family Communication on Geriatric Inpatient Units

Meara A. Melton, MBA, Ethan Cumbler, MD, FHM, FACP

## Background

Family members often play a significant role in the care of geriatric patients during and after hospitalization. Both patients and families have expectations for communication with the provider team, but navigating expectations and the flow of medical information across the family unit is challenging with current care models. Pediatric medicine recognizes that family involvement in communication is critical to effective care and has long emphasized the importance of sharing information with caregivers. Experience derived from pediatric hospitals may suggest methods for ensuring communication with a patient's social support network relevant for inpatient geriatric care. This study used a positive deviance approach to identify and define communication structures and processes utilized in pediatric hospitals to communicate with family.

## Methods

We used a semi-structured interview tool with open-ended questions surrounding communication processes, routes, timing, behaviors and measurement, and team structure. The interview was internally validated and modified. Eleven top-performing pediatric institutions as reported by U.S. News and World Reports were contacted and asked to identify an individual who could speak to communication structures and processes used on best performing pediatric teams. The semi-structured interviews were completed and transcribed via phone. Qualitative analysis was then performed to characterize the best practices within general pediatric units.

## Results

Eight of the top eleven institutions elected to participate in this work. Interviews were conducted with hospitalists on general pediatric academic units and lasted 38 minutes on average. Qualitative analysis focused on identifying common themes across institutions, areas

identified for improvement and key communication innovations. Common themes included 1) deliberate use and labeling of family-centered rounds; 2) significant role played by learners in communication with families; 3) identification of patient and family preferences with respect to communication; 4) use of care conferences to communicate complex information; and 5) focus on discharge goals and criteria at time of admission. Areas for improvement focused on 1) setting expectations for communication; 2) determining who to contact and sharing contact information across providers; 3) tracking preferences for information sharing; 4) written communication via whiteboards; 5) discharge communication; and 6) behaviors surrounding communication. Key innovations focused within the areas of information sharing, rounding, care conferences, discharge, and feedback and evaluation.

### Conclusions

For many elderly patients, family members are often relied upon to provide support with decision-making and caregiving. As this role becomes more common for families, it is a critical time to assess how to best communicate in the acute setting. Our positive deviance research identified the current best practices in top-performing pediatric hospitals with respect to communication with family, highlighting that deliberate communication practices, such as family-centered rounds and exploring patient and family preferences, are key to involving family in the care plan. Adaptation of some of the structures, processes and behaviors identified through our work can inform next steps to enhance communication with families in the inpatient geriatric setting.

Primary Presenter: **Lauren Miller**

Project Title: *Control of creatine metabolism by HIF is an endogenous mechanism of barrier regulation in colitis*

Primary Mentor: Sean Colgan

Thematic Area: Basic Biomedical Science

Abstract:

Mucosal surfaces of the lower gastrointestinal tract are subject to frequent, pronounced fluctuations in oxygen tension, particularly during inflammation. Adaptive responses to hypoxia are orchestrated largely by the hypoxia-inducible transcription factors (HIFs). As HIF-1 $\alpha$  and HIF-2 $\alpha$  are coexpressed in mucosal epithelia that constitute the barrier between the lumen and the underlying immune milieu, we sought to define the discrete contribution of HIF-1 and HIF-2 transactivation pathways to intestinal epithelial cell homeostasis. The present study identifies creatine kinases (CKs), key metabolic enzymes for rapid ATP generation via the phosphocreatine-creatine kinase (PCr/CK) system, as a unique gene family that is coordinately regulated by HIF. Cytosolic CKs are expressed in a HIF-2-dependent manner in vitro and localize to apical intestinal epithelial cell adherens junctions, where they are critical for junction assembly and epithelial integrity. Supplementation with dietary creatine markedly ameliorated both disease severity and inflammatory responses in colitis models. Further, enzymes of the PCr/CK metabolic shuttle demonstrate dysregulated mucosal expression in a subset of ulcerative colitis and Crohn disease patients. These findings establish a role for HIF-regulated CK in epithelial homeostasis and reveal a fundamental link between cellular bioenergetics and mucosal barrier.



Primary Presenter: **Julio Montejano**

Project Title: *Magnetic Resonance Imaging on Tumor Associated Macrophages in Postpartum Mouse Mammary Tumors Using Iron Oxide Nanoparticles*

Primary Mentor: Natalie Serkova

Thematic Area: Basic Biomedical Science

Abstract:

It has been recently shown that pro-inflammatory stromal milieu with resulting tumor-associated macrophage (TAM) infiltration correlates with poor prognosis in breast cancer. Increased levels of TAMs have been reported in postpartum pregnancy associated breast cancer (PPABC), a very aggressive variant, arising up to 5 years in a postpartum involuting mammary gland. TAM levels are usually assessed in breast tissue biopsies using *ex vivo* assays. Iron is a known MRI contrast, which decreases T2 relaxation times if it accumulates in the tissue. Since the primary function of macrophages is phagocytosis and iron metabolism, this study was conducted to establish quantitative T2-weighted MRI (qT2MRI) for non-invasive assessment of the inflammatory microenvironment in PPABC after injection of superparamagnetic iron oxide nanoparticles (SPION, Ferumoxytol). For this study, D2.A1 murine mammary tumor cells were inoculated into the mammary fat pads of wild-type, immunocompetent, female mice (nulliparous or involution groups). Two additional involution groups were treated with ibuprofen as an anti-inflammatory drug. Two qT2MRI sessions were performed—once the tumor reached 200 mm<sup>3</sup> (Cycle 1) and by the end of the study (Cycle 2 up to 800 mm<sup>3</sup>). Each qT2MRI session consisted of two scans – (i) one pre-contrast MRI followed by 30 mg/kg Ferumoxytol injection and (ii) second post-contrast MRI, with changes for  $\Delta T_2$  relaxation times (RT) reported as  $[T_{2\text{post}} - T_{2\text{pre}}]$ . All MRI results were compared with tissue *ex vivo* assays (flow cytometry, immunohistochemistry and iron calorimetry). The growth of D2.A1 cells was faster in the involution group than nulliparous tumors. In cycle 1, the decrease in T2 was significantly higher in involution tumors vs. nulliparous (-18 vs. -5 ms,  $p < 0.0001$ ) indicating high iron accumulation and TAM levels. The involution group also revealed an incomplete recovery of the pre-contrast T2 RT between Cycle 1 and 2 (-7 ms,  $p < 0.001$ ) suggesting prolonged retention of residual iron by TAMs from the first injection. When the tumors got large in Cycle 2, the infiltration of TAMs in nulliparous tumors increased while SPION delivery to the involution group decreased, resulting in identical  $\Delta T_2$  in both groups (around -8 ms, n.s.). The iron levels were higher in the involution group *ex vivo*, and iron deposits were co-localized with the TAMs histologically. Ibuprofen treatment reduced  $\Delta T_2$  changes in involution tumors only to a limited extent. In conclusion, our study shows that Ferumoxytol is an appropriate SPION contrast agent for the non-invasive assessment of inflammation in PPABC; however, large tumor sizes impair both TAM biology as well as pharmacokinetics of the contrast agent.

Primary Presenter: **Joann Mueller**

Project Title: *Discontinuation of Disease Modifying Therapy in Older Adults with MS*

Primary Mentor: Enrique Alveraz

Thematic Area: Clinical Science

Abstract:

Disease modifying therapy (DMT) in older MS patients with limited disease activity is thought to have little efficacy. This retrospective chart review looks at four different outcome measures in a cohort of MS patients who discontinued DMT and compares the average ages of those who had outcomes to those who did not. It is hypothesized that younger patients who discontinued would be more likely to have one of the observed outcomes. The primary outcome of having to restart medications because of disease activity after discontinuing was significant ( $p=0.016$ ) for age being younger than those who continued off DMT. Observationally 3 of the 4 outcome measures looked at did show a younger age in those who had the outcome. This preliminary data is consistent with previous studies as well as clinical observations that older MS patients off DMT do not have as much active disease as younger patients and suggests that DMTs are not helpful in this population

Primary Presenter: **Amy Nelson**

Project Title: *Enhancing Access to Primary Care Through Innovative Scheduling and Health Information Technologies*

Primary Mentor: Cathy Battaglia

Thematic Area: Public Health and Epidemiology

Abstract:

Abstract:

Background: With increasing demand for primary care, clinics across the United States are searching for effective means to enhance patient access without increasing number of providers or hours worked.

Purpose: To report the effect of innovative scheduling, clinic flow management, and health information technologies on patient access in primary care.

Methods: A critical systematic review of the existing literature through PubMed.

Results: Though research driven by outcomes data remains sparse, some transformations have emerged as best practices. Scheduling must be informed by the patient panel and robust inquiry of supply and demand variations. Clinic flow transformation requires increased staff but clearly increases productivity and efficiency. Health Information Technologies (HIT) provide billable alternatives to the traditional office visit but the platform must be carefully reviewed before selection to ensure efficiency and accessibility.

Discussion: A multitude of approaches exist for each of these areas of interest and there are still limited outcomes data regarding cost-effectiveness and clinic efficiency. With the many options available for practice transformation, each clinic must consider its resources and patient population before attempting any intervention. A unifying theme, however, is that any clinical change requires buy-in from practice leadership at all levels.

Primary Presenter: **Sonny Nguyen**

Project Title: *Orexin and Sleep Mediated Pathology in Alzheimer's Disease*

Primary Mentor: Jean Tsai

Thematic Area: Basic Biomedical Science

Abstract:

The orexinergic system is a key regulator of wakefulness and the sleep-wake cycle. Sleep-wake disturbances are commonly observed in Alzheimers disease (AD) patients with increasing severity with disease progression. More recently, these disturbances have been implicated in A $\beta$  deposition and AD pathogenesis. AD patients with sleep disturbances exhibit measurable changes in CSF orexin suggesting orexin signaling is an important pathway in sleep mediated AD pathogenesis. In this review, we discuss the specific role of orexins in the sleep-wake cycle, their link to AD pathology, and potential role of orexin receptor antagonists in AD treatment.

Primary Presenter: **HoanVu Nguyen**

Project Title: *Primary Effusion Lymphoma in a HIV Positive Male with a History of Kaposi Sarcoma*

Primary Mentor: Allan Prochazka

Thematic Area: Clinical Science

Abstract:

Kaposi Sarcoma (KS) is an AIDS-defining illness traditionally seen in HIV patients with low CD4 counts and high viral loads. Fortunately, with the success of antiretroviral therapy, most HIV-infected patients remain only marginally immunosuppressed and never develop AIDS. However, these patients can still be at risk for developing AIDS-associated cancers, including KS and non-Hodgkins lymphomas such as Primary Effusion Lymphoma. Primary Effusion Lymphoma (PEL) is a HHV-8-associated malignancy accounting for 1-4% of all HIV-associated lymphomas. Herein a case of Primary Effusion Lymphoma in and HIV positive male on HAART with a history of KS is presented. The patient presented to the local hospital with complaints of øchest heaviness, decreased exercise tolerance, and constipation, and was found to have a large circumferential pericardial effusion. Immunohistochemical analysis and flow cytometry of the pericardial fluid confirmed the diagnosis of PEL. Human herpesvirus-8 plays a causative role in PEL and is important for differentiating PEL from other lymphomas. Current treatment of PEL is largely based off of consensus option and small case studies, and is and active area of research. While many patients with PEL often show response to treatment, remissions are often short in duration and prognosis remains poor, ranging from 2-3 months median survival without treatment to 5-6 with chemotherapy and antiretroviral therapy.

Primary Presenter: **Huong Nguyen**

Project Title: *Characteristics and Patterns of Guatemalas Health Status: Maternal and Child Health in the Guatemalans Health System*

Primary Mentor: Sarojini Budden

Thematic Area: Public Health and Epidemiology

Abstract:

Guatemala is one of the most populous country in Latin America. However, despite its growing population, the health care system remains insufficient in addressing the needs of its people. This is especially evident when evaluating maternal and child health in the current Guatemalan medical system. This paper will address the healthcare delivery systems of Guatemala and patterns in health as underscored by the major health indicators affecting the Guatemalan mothers and children.

Primary Presenter: **Mindy Nguyen**

Project Title: *Transgender Care 101: A Primer for the Primary Care Physician*

Primary Mentor: Rita Lee

Thematic Area: Public Health and Epidemiology

Abstract:

A very brief overview of the basics of transgender health issues that primary care physicians should be familiar with, including hormone therapy, health maintenance screening, and mental health screening.

Primary Presenter: **Phuong Nguyen**

Project Title: *Hypertension: where is it now?*

Primary Mentor: Allan Prochazka

Thematic Area: Clinical Science

Abstract:

Hypertension is one major factor stroke and cardiovascular disease. This paper presents the impacts of HTN, the current recommendations, and suggestions for changes moving forward.



Primary Presenter: **Samantha Nino**

Project Title: *Smartphone Based Thermal Imaging: A Valid New Modality for Tissue Temperature Measurement in Hand and Upper Extremity Surgeries*

Primary Mentor: Kyros Ipaktchi, MD

Thematic Area: Clinical Science

Abstract:

Smartphone based thermal imaging technology allows for real-time digital temperature measurements, though clinical validity to date has not been studied. This study compares smartphone based thermal image (TI) temperature measurements against standard infrared temperature scanners (TS). A standard infrared thermal scanner was compared to a smartphone-based thermal imaging camera using 2 groups of measurement: a warm fluid inside a thermos container (group 1); a point at the palmar intersection of Kaplans cardinal line and the radial border of the ring finger (group 2). 20 measurements each were obtained using TS and TI resulting in 2 groups of paired measurements. Data was analyzed using a paired student T test with significance set as  $p < 0.05$ . Paired measurement of the warm water (group 1) showed comparable mean temperature readings of TS: 32.535, TI: 32.215 and Standard Deviations TS of 0.497, TI: 0.165 (p-value: 0.0030). Paired measurements of a standardized palmar region (group 2) demonstrated mean temperature measurements of TS: 34.670, TI: 34.860 and Standard Deviation of TS: 0.439, TI: 0.167 (p-value: 0.0164). In addition to pure temperature measurements, thermal imaging allowed documentation of whole hand temperature distribution. Smartphone based thermal imaging devices offer reliable temperature measurements compared to conventional infrared thermal scanners. Thermal images of injured hands offer additional information and documentation in the acute trauma setting. Documentation of thermal images can be a valuable resource assessing microvascular patients in the pre-hospital as well as the postoperative recovery environment.

Primary Presenter: **William ODonnell**

Project Title: *Evaluation of Out-of-Hospital EMS Cardiac Alert Protocols*

Primary Mentor: Fred Severyn

Thematic Area: Clinical Science

Abstract:

ABSTRACT:

Background:

Current guidelines support Emergency Medical Systems initiation of cardiac catheter lab activation for ST-segment elevation myocardial infarction. There are few studies, however, that address the optimal criteria for cardiac catheter lab activations from the field. We hypothesized that by retrospectively analyzing specific electrocardiogram (EKG) voltage criteria for cardiac alert protocols in the Aurora, CO Emergency Medical Services (EMS) system we could identify criteria to improve the fidelity of activations.

Methods:

This was a retrospective review of EMS initiated cardiac catheter lab activations (CCLAs) at University of Colorado Hospital (UCH), a STEMI-receiving center in Aurora, CO. Current voltage criteria for field CCLA requires 1 mm ST-segment elevation (STE) in two contiguous leads. All CCLAs between May 1, 2014 - April 30, 2016 were identified and analyzed. EMS-obtained EKGs were over-read and CCLAs were characterized as false activations (based on current institutional cardiac alert criteria), True STEMI (based on results of PCI) and No STEMI present. The same cohort of patients was then analyzed using a modified ST-elevation voltage criteria (2 mm STE in two contiguous leads) and the same endpoints were evaluated. The same analysis was repeated using walk-in UCH-initiated CCLAs as a control.

Results:

From May 2014 “ April 2016 there were 38 complete entries of EMS CCLAs. There were 35 appropriate EMS CCLAs and 51 walk-in UCH CCLAs that met current EMS criteria/guidelines. In the EMS cohort, 34/35 (97%) were shown to be True STEMI by PCI. Of the UCH cohort, 46/51 (90%) were shown to be True STEMI by PCI. When the EMS cohort was analyzed using a 2 mm STE voltage criteria, 25/35 met criteria for activation. 25/25 (100%) were shown to be True STEMI on PCI. In the UCH cohort, 32/51 met modified activation criteria and 29/32 (91%) were shown to be True STEMI on PCI. Of the 10 EMS patients who were initially activated, but did not meet modified criteria for activation, 9/10 (90%) were True STEMI. Of the 19 UCH patients that did not meet modified criteria, 17/19 (89%) were shown to be true STEMI. Additionally, we found that 3/38 (8%) original EMS activations were inappropriate (did not satisfy cardiac alert criteria based on prehospital EKG overread).

## Conclusion:

Overall, local EMS is able to perform field CCLA with a high degree of fidelity and with a low false positive activation rate. Post-hoc modification of the voltage criteria from 1 mm STE to 2 mm STE would result in a 100% true positive activation rate, but would lead to non-activation of a significant number of True STEMIs. More restrictive CCLA protocols preclude field activation in a high percentage of STEMI patients, and are likely inconsistent with well-established goals of reducing door-to-balloon time in these patients.

Primary Presenter: **Tyler Okland**

Project Title: *Somatization and the Review of Systems*

Primary Mentor: Scott Mann

Thematic Area: Clinical Science

Abstract:

Importance: Somatization is a condition in which psychological distress is manifested by medically unexplained symptoms (MUS), and is prevalent in all medical specialties. Patients with MUS are frequent utilizers of the health care system and account for up to one-third of all primary care evaluations. A community survey demonstrated æENT symptoms were the third most common MUS. Recognition of somatization as the cause of MUS can provide significant benefit for patients and prevent unnecessary or invasive testing. Even with extensive workups, these patients often perceive their physicians have given insufficient medical explanation or treatment options, and this ambiguity perpetuates a cycle of distress and worsening of the somatic complaint. Prolonged somatization may result in debilitating symptoms refractory to treatment. Accumulating evidence suggests early recognition and intervention with cognitive behavioral treatment regimens can lead to significant improvement or remission.

Objective: To determine whether patients with somatization respond differently to the Review of Systems (ROS) portion of the patient interview, and whether the ROS can be used to identify patients with somatization.

Design: We performed a retrospective chart review of otolaryngology patients at Denver Health Hospital to compare how the ROS of patients with chief complaints associated with somatization (globus sensation, dizziness, tinnitus) differs from those with complaints more often associated with objective findings (nasal obstruction, hoarseness, hearing loss). Objective clinical findings after physical exam and related testing were reviewed and classified as either significant, marginal, or absent. Current or past psychiatric comorbidities were also examined.

Setting: The otolaryngology clinic at a tertiary community hospital of Denver Health.

Participants: The medical charts of 2120 consecutive consultations of English or Spanish-speaking patients aged 18-89 who presented to the otolaryngology clinic after January 1st, 2014 were reviewed. Patients with chief complaints of either hearing loss, nasal obstruction, hoarseness (Group A), or tinnitus, globus sensation, dizziness (Group B) were included, for a total of 605 patients.

Main Outcome(s) and Measures: Number of affirmative responses on a standardized, 69-point ROS was recorded as a review of systems score or (ROSS). Objective clinical findings, chief complaint, and psychiatric comorbidities were recorded.

Results: Among patients with medically unexplained symptoms, the ROSS was significantly increased compared to those with objective clinical findings ( $p < 0.0001$ ). Group A (hoarseness, nasal obstruction, hearing loss) had significantly lower ROSS than Group B (dizziness, globus sensation, tinnitus.) Psychiatric comorbidity was associated with higher ROSS. The prevalence of psychiatric comorbidity in the patient population at the ENT clinic at Denver Health was 38.84%.

Conclusions and Relevance: The manner in which patients respond to a standardized ROS differs in those with MUS and in those with psychiatric disease. The ROS offers information beyond the actual systems review, and may be useful in the identification of somatization. Patient populations with a higher prevalence of psychiatric illness stand most to gain from physician attention to the review of systems and potential signs of somatization. Further prospective trials are needed to identify methods to diagnose somatization earlier and more accurately.

Primary Presenter: **George Olsen**

Project Title: *Mini Med School Team Based Learning Cases for 7th Grade Life Science Classrooms in the Denver Public School System*

Primary Mentor: Danielle Royer

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

The 7th Grade Science curriculum for Denver Public Schools focuses on Life Sciences. These topics mainly include the concepts of life, cells, biology, with added focus on the different systems of the human body and population and global health. Currently however, there is not application of this material to the medical world and students receive very little exposure to medical related professions. æMini-Med School Cases are a set of Team-Based Learning (TBL) exercises designed for middle schools students that align up directly with the 7th Grade Science curriculum in Denver Public Schools. These cases aim to take the background knowledge they are learning in their science class, expand on it, and apply it to medical cases that the students can understand. In addition to teaching life sciences, teachers in middle school classroom are pushing students to use æevidence-claim statements, where they are taught how to form a statement and then use evidence to back it up. In these TBL cases, students learn the parallels of evidence-claim statements and how doctors uses similar techniques to form differential diagnoses. Finally, an overall goal of these cases is to expose students in low-income communities to careers in health profession sciences. Denver Public Schools has many students from disadvantaged backgrounds and theses cases aim to expose these students to possible future jobs of physicians (both primary care and specialty fields), as well as nurses, pharmacists, EMTs, medical assistants.

Primary Presenter: **Soliman Oushy**

Project Title: *Glioblastoma Multiforme-derived Extracellular Vesicles: A Paradigm Shift in Understanding Tumorigenesis*

Primary Mentor: Michael Graner

Thematic Area: Basic Biomedical Science

Abstract:

Glioblastoma Multiforme (GBMs) are devastating tumors with abysmal prognoses. Novel approaches to understand GBM biology and therapeutic vulnerabilities are desperately needed. Extracellular vesicles (EVs) are membrane-enclosed nanospheres released locally and systemically by all cells, including tumors, that have tremendous potential for intercellular communication. Tumor EVs are capable of manipulating their local environments as well as distal targets. EVs may be a mechanism for tumorigenesis in the recurrent GBM setting. We hypothesized that GBM EVs drive molecular changes in normal human astrocytes (NHAs), resulting in phenotypically tumor-promoting, or even tumorigenic, entities. We incubated NHAs with GBM EVs and examined the astrocytes for changes in cell migration, cytokine release, and tumor cell growth promotion via the spent media. We further measured alterations in intracellular signaling and transformation capacity (astrocyte growth in soft agar). Thus, GBM EV-treated NHAs displayed increased migratory capacity, along with enhanced cytokine production (vs. controls), which promoted tumor cell growth. GBM EV-treated NHAs developed tumor-like signaling patterns and exhibited colony formation in soft agar, reminiscent of tumor cells themselves. GBM EVs are capable of modifying their local environment to benefit the tumor itself, co-opting neighboring astrocytes to promote tumor growth, and perhaps even driving astrocytes to a tumorigenic phenotype. Such biologic activities could have profound impacts in the recurrent GBM setting.

Primary Presenter: **Alida Ovrutsky**

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: Jamal Moloo

Thematic Area: Public Health and Epidemiology

Abstract:

**BACKGROUND:** Since 1997, over 5,000 refugees from Burma (Myanmar) have fled violence and persecution in their homeland to settle in Colorado. Many refugees face difficulties accessing and understanding healthcare services. Thus, the development of novel programs and partnerships to help refugees gain access to essential healthcare services must be a priority among communities, local non-profits, and providers.

**METHODS:** 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. Formative information was then gathered by speaking with community leaders, local refugee organizations, healthcare providers, and informal surveys were conducted in order to guide future research tools. The project is currently in Phase 2, Intervention Mapping, which involves seeking IRB approval to conduct a formal, publishable needs assessment. We will conduct audio recorded key informant interviews and administer surveys within the community of refugees from Burma to better understand problematic alcohol use. The results of the key informant interviews will be analyzed using standard qualitative research methods, while the results of the community surveys will be analyzed quantitatively. Phase 2 involves strengthening our community partnership and discussing potential interventions through a series of meetings funded by the Colorado Clinical and Translational Sciences Institute (CCTSI)s Community Partnership Development grant. 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 19 meetings with the YAB and over 14 meetings with local organizations. Nineteen formative community surveys were collected and three key informant interviews were held. 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: Using a CBPR approach, this project has made enormous strides in establishing a strong relationship with a local underserved community, and has identified a key health issue (alcohol abuse) on which to focus the partnership. Challenges of the project include the intense time commitment of CBPR, language and literacy barriers, and difficulties in gaining IRB approval for the unique study design fashioned for a population that communicates best through trusted, in-person conversations. Ultimately, this partnership will lead to sustainable, culturally effective treatment options for the refugee community from Burma.

Primary Presenter: **Arcadia Paine**

Project Title: *Decision making in DT-LVAD: a mechanical Turk survey*

Primary Mentor: Dan Matlock

Thematic Area: Clinical Science

Abstract:

Background: People with end-stage heart failure may have to decide about destination-therapy left ventricular

assist device (DT-LVAD). Individuals facing difficult decisions often rely on heuristics, such as anchoring, which predictably bias decision outcomes. We aimed to investigate whether showing a larger

historical Heartmate XVE creates an anchoring effect, making the smaller Heartmate II (HMII) appear more

favorable.

Methods: With the use of Amazon Mechanical Turk, participants watched videos asking them to imagine

themselves dying of end-stage heart failure, then were presented the option of LVAD as potentially lifeprolonging

therapy. Participants were randomized to a control group who were only shown the HMII device,

and the intervention group who saw the XVE device before the HMII. Participants then completed surveys.

Results: A total of 487 participants completed the survey (control = 252; intervention = 235); 79% were

<40 years of age, 84% were white, and 55% were male. The intervention group was not more likely to

accept the LVAD therapy (68% vs 61%;  $P = .37$ ). However, participants in the intervention group were more

likely (51% vs 17%;  $P < .01$ ) to agree or strongly agree with the statement that the HMII was smaller

than expected. Participants in the intervention group were also more likely to rate the size of the device

as  $\geq$ important or  $\geq$ very important in their decision (61% vs 46%;  $P < .01$ ).

Conclusions: Although the XVE anchor did not affect likelihood of accepting the LVAD, it did affect device

perception. This article highlights an important point with clinical implications: factors such as anchoring

have the potential to inappropriately influence perceptions and decisions and should be carefully considered

in research and practice.

Primary Presenter: **Austin Park**

Project Title: *ASSESSING SOCIAL DETERMINANTS OF HEALTH IN THE EMERGENCY DEPARTMENT*

Primary Mentor: Roberta Capp

Thematic Area: Public Health and Epidemiology

Abstract:

ABSTRACT

**Background:** The U.S. "Healthy People 2020" campaign highlights the importance of understanding social determinants of health (SDH).

**Objective:** We evaluated the 1) feasibility of conducting socio-health screenings in the ED, 2) prevalence of two types of SDH (economic and health care access), and 3) desire of patients to be linked with community resources.

**Methods:** Cross-sectional study of adults (aged 18-80 years) with public (Medicaid/Medicare) or no insurance, presenting to a large, urban, academic ED. From June to August of 2014, thirteen trained Student Patient Navigators (SPNs) administered socio-health screening surveys in the ED from 11 am " 5 pm, seven days a week. The surveys were designed to identify economic and health care access SDH, as defined by the "Healthy People of 2020. We used a multivariate logistic regression analysis to determine the association between patient characteristics and the presence of one or two SDHs.

**Results:** 454 of 646 patients (70%) agreed to complete the survey. The mean age was 42 years, 246 (54.2%) were females, 279 (61.5%) of patients had  $\geq 1$  chronic diseases, and 89% of patients identified at least one SDH. Approximately 6.5 out of 10 patients with 2 SDH expressed interest in being linked with community resources that could address their needs.

**Conclusions:** It is feasible to conduct socio-health screenings in the ED and a large proportion of patients who use the ED identify at least 1 SDH. A little over half of patients with 2 SDH wanted to be linked with community resources.

Primary Presenter: **Hannah Pederson**

Project Title: *Identifying Otolaryngology Systematic Review Research Gaps: Comparing Global Burden of Disease 2010 Results with Cochrane Database of Systematic Review Content*

Primary Mentor: Robert Dellavalle

Thematic Area: Public Health and Epidemiology

Abstract:

IMPORTANCE:

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Burden of disease should inform research prioritization.

OBJECTIVE:

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To determine whether systematic reviews and protocols published in the Cochrane Database of Systematic Reviews (CDSR) appropriately reflect disease burden for otolaryngologic conditions as measured by the Global Burden of Disease (GBD) 2010 project.

DESIGN:

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Two investigators independently assessed 10 otolaryngologic conditions in CDSR for systematic review and protocol representation from March to June 2014. The otolaryngologic diseases were matched to their respective GBD 2010 disability-adjusted life-years (DALYs) to assess their correlation.

MAIN OUTCOMES AND MEASURES:

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Relationship of CDSR representation (based on systematic reviews and protocols) with percentage of total 2010 DALYs, 2010 DALY rank, and DALY percentage change from 1990 to 2010 for 10 otolaryngologic conditions.

RESULTS:

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All 10 otolaryngologic conditions were represented by at least 1 systematic review in CDSR. The number of reviews and protocols in CDSR was well matched with GBD 2010 disability metrics for only 1 disease, mouth cancer. Upper respiratory infections, otitis media, thyroid cancer, and cleft lip and cleft palate were overrepresented in CDSR, and esophageal cancer, "other hearing

loss," nasopharynx cancer, larynx cancer, and "cancer of other part of pharynx and oropharynx" were underrepresented.

CONCLUSIONS AND RELEVANCE:

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The representation of otolaryngologic conditions in CDSR correlates poorly with DALY metrics. The results of this study may guide future research prioritization and allocation of funds.

Primary Presenter: **Warren Pettine**

Project Title: *Coding of Visual Stimuli and Attentional State Across Layers of Area V4*

Primary Mentor: Tirin Moore

Thematic Area: Basic Biomedical Science

Abstract:

Neurons in area V4 are organized in cortical columns and are known to convey information about sensory stimuli as well as behavioral states. The integration of these two disparate inputs within columns of V4 is poorly understood. We examined the coding of visual stimulus information and the influence of two forms of attentional deployment by single neurons and neuronal populations across superficial and deep cortical layers. Monkeys performed a task in which they covertly attended to one oriented stimulus while preparing eye movements to another. Here we show that superficial layer neurons provide greater information about stimulus orientation, whereas deep layer neurons provide greater information about attentional state. In particular, deep layer neurons provided greater information about eye movement preparation. These results reveal functional divisions between superficial and deep neurons in coding of visual stimulus and the preparation of eye movements.

Primary Presenter: **Huy Phan**

Project Title: *"A 27-Year-Old Man With Acute Severe Low Back Pain and Bilateral Leg Swelling That Prompted Renting a Wheelchair for Mobility"*

Primary Mentor: Jackie Glover

Thematic Area: Clinical Science

Abstract:

A 27-year-old man with OSA, posttraumatic stress disorder, and chronic mechanical back pain presented with a 3-day history of acute atraumatic worsening of his low back pain as well as right groin numbness that was exacerbated by walking. He also complained of bilateral leg heaviness, pain, and swelling, all becoming so severe that he rented a wheelchair for mobility.



Primary Presenter: **Ryan Pieterick**

Project Title: *Opportunities for Development of Ophthalmologic Protocols in the Emergency Department*

Primary Mentor: Alan Palestine

Thematic Area: Clinical Science

Abstract:

Abstract

Background: Eye-related complaints are one of the most common reasons for presentation to emergency departments around the world, accounting for up to 6% of visits. Similarly, ocular injury is a common cause of referral to emergency services by other health care providers. In general emergency medical care, algorithmic approaches to certain chief complaints and scoring measures to determine appropriate next steps in workup are used for various complaints; however, these have not been widely employed for ophthalmologic complaints.

Purpose: To examine the characteristics of referrals and consultations to the ophthalmology service of the University of Colorado School of Medicine and identify logical next steps for the development of protocols for ophthalmologic evaluation and workup.

Methods: Data on consultations for 227 patients was collected from residents of the University of Colorado ophthalmology residency program. An analysis of chief complaints, disposition of patients, and other referral characteristics was performed.

Results: The most common reasons for consultation of the ophthalmology service were eye pain (24.3%), ocular trauma (18.4%), and decreased/blurred vision (12.5%). Patients from the majority of consults were discharged after consultation (64.3%) or already had inpatient status and remained inpatient after ophthalmic evaluation (17.3%). Only five percent of patients had ophthalmologic issues relating to or necessitating hospital admission. A majority of consultations occurred outside of regularly scheduled clinic hours (64%). Fifty-four percent of consultations were seen in person by a resident, but only three percent required additional evaluation or intervention by a senior resident, fellow, or attending ophthalmologist.

Conclusions: Only a small minority of cases required admission to the hospital or evaluation by a senior or attending ophthalmologist, suggesting that many consultations were non-urgent or non-emergent. Eye trauma and ocular pain were the most common causes of consultation. Development of protocols for the workup of eye pain and trauma may thus provide the most utility for ophthalmologic workup for both emergency department and inpatient non-ophthalmology providers.

Primary Presenter: **Tiffany Pointon**

Project Title: *Auditory findings in Smith-Lemli-Opitz syndrome (SLOS)*

Primary Mentor: Ellen Elias

Thematic Area: Clinical Science

Abstract:

Smith-Lemli-Opitz syndrome (SLOS) is an autosomal recessive condition caused by mutations in the DHCR7 gene, resulting in abnormal cholesterol metabolism. It is characterized by a complex phenotype including cleft palate, intellectual disability, cardiac defects, and failure to thrive. Sensorineural hearing loss has been described in SLOS, however auditory function has not previously been analyzed in this syndrome. To characterize hearing and auditory brainstem neural conduction in SLOS, auditory brainstem response (ABR) was measured serially in 24 patients with SLOS being treated with cholesterol supplementation and the antioxidant preparation AquADEKS® under an IRB approved protocol. Baseline hearing loss was observed in 45% (21/47 ears), with 21% (10/47 ears) showing sensorineural hearing loss. Prolonged neural conduction through the auditory brainstem pathway was observed in 36% (17/47) at baseline. Two patients showed improvement in hearing status on cholesterol and AquADEKS treatment. These data suggest that hearing loss and changes in auditory neural conduction may be features associated with the SLOS phenotype.

Primary Presenter: **Kristina Puls**

Project Title: *Working to End Teenage Obesity*

Primary Mentor: Janet Meredith

Thematic Area: Clinical Science

Abstract:

Teen Weight Management Motivation through Engaging Conversations:

A Qualitative Community-Based Participatory Research Study

Background & Objectives:

Childhood obesity is an ever-growing health epidemic, with rates tripling over the past few decades and a disproportionate burden in neighborhoods surrounding the University of Colorado Anschutz Medical Campus in Aurora. 13,1,8 In order to address this rising health concern, this research team examined the weight management conversations taking place between teenage patients and their health care providers to learn how to best provide effective counseling that will motivate teenagers towards change.

Methods:

This study was performed through community-based participatory research (CBPR) in which research design and implementation were done in conjunction with a teenage advisory board (TAB). After collaborating with the TAB to create a focus group protocol, teenagers were recruited from local high schools to participate in focus groups during which they shared their experiences of weight management conversations with health care providers and made suggestions for improvements. They were compensated with \$25.00 gift cards. Focus groups were audio-recorded, transcribed, then qualitatively analyzed using open coding by three separate coders. The protocol was IRB exempt: 13-1670.

Results:

Two separate sets of two gender-separated focus groups have been conducted so far, the first of Latina/Latino teens and the second of mixed race. All participating teens believed it was important for health care providers to know how to conduct weight management conversations with their teenage patients and most had had such experiences in the past. Five main themes were derived from the focus groups, comprising the following: 1) make opening the conversation more comfortable by getting to know the teenager, 2) discover the teens

individual goals and motivations for health and weight in order to better tailor advice, 3) provide a written weight management plan composed of a few steps at a time that include concrete and individualized suggestions, 4) provide realistic expectations for weight loss, and 5) support them with frequent follow up and verbal encouragement.

#### Conclusions:

While teens agree that the conversations they have with their health care provider is a very important part of their weight management journey, they have many ideas for how these can be improved. Further research will be performed to uncover the perspectives of health care providers and to reach a wider pool of teens through surveys in order to make the data more generalizable.

Primary Presenter: **Saned Raouf**

Project Title: *Resurgence of malaria following discontinuation of indoor residual spraying of insecticide in a previously high transmission intensity area of Uganda*

Primary Mentor: Grant Dorsey

Thematic Area: Public Health and Epidemiology

Abstract:

ABSTRACT

Background

Indoor residual spraying (IRS) and long-lasting insecticidal nets (LLINs) are the primary tools for malaria prevention in Africa. It is not known whether reductions in malaria can be sustained after IRS is discontinued. The aim of this study was to assess changes in malaria morbidity in a historically high transmission area of Uganda where IRS was discontinued after a four year period of effective control followed by a universal LLIN distribution campaign.

Methods

Individual-level malaria surveillance data were collected from one outpatient department and one inpatient setting in Apac District, Uganda from July 2009 through November 2015. Rounds of IRS were delivered approximately every six months from February 2010 through May 2014 followed by universal LLIN distribution in June 2014. Temporal changes in the malaria test positivity rate (TPR) were estimated during and after IRS using interrupted time series analyses.

Findings

Data include 65 421 outpatient visits and 13 955 pediatric inpatient admissions for which a diagnostic test for malaria was performed. In outpatients under five years, baseline TPR was 60-80% followed by a rapid and then sustained decrease to 15-30%. Over 4-18 months following discontinuation of IRS, absolute TPR values increased by an average of 3<sup>^</sup>29% per month (95% CI 2.01-4.57%), returning to baseline levels. Similar trends were seen in outpatients over five years of age and pediatric admissions.

Interpretation

Discontinuation of IRS in a historically high transmission intensity area was associated with a rapid increase in malaria morbidity to pre-IRS levels despite high coverage with LLINs.

Primary Presenter: **Molly Ray**

Project Title: *Epidemiology and Risk Factors for Bacteremia in Children in the Emergency Setting with Clinically- Suspected Sepsis.*

Primary Mentor: Halden Scott

Thematic Area: Clinical Science

Abstract:

Sepsis is major cause of morbidity and mortality in children. Amongst the pediatric population presenting for emergency care with clinically-suspected sepsis, knowledge of the proportion with bacteremia, causative organisms, and factors associated with bacterial infection would improve design of sepsis clinical care programs. We aim to describe rates and epidemiology of bacteremia in patients treated for sepsis in a pediatric Emergency Department (ED) and urgent cares (UC) and to describe patient and ED-course factors associated with bacteremia among pediatric patients treated for sepsis. This was a secondary analysis of a sepsis registry at six affiliated pediatric ED/UCs with a sepsis treatment program. Exclusion criteria included patient age  $\geq 60$  days and  $\leq 18$  years. 913 patients were eligible for this study based on inclusion criteria. 115 patients (12.5%) had the primary outcome, bacteremia. Factors most associated with bacteremia included presence of a central venous catheter ( $p = 0.020$ ), presence of SIRS ( $p = 0.007$ ), and ED hypotension ( $p = 0.020$ ) (Table 1). The most common organisms included methicillin sensitive Staphylococcus aureus, coagulase negative Staphylococcus and Klebsiella pneumoniae. Risk factors for bacteremia included temperature, ED hypotension and acute heme dysfunction whereas presence of a peripheral venous catheter and oncologic comorbidity were protective factors. Presence of bacteremia indicated an increased hospital length of stay and increased admission to the PICU.

Primary Presenter: **Lindsey Reed**

Project Title: *The Pediatric Physical Exam as the Child Ages with a Focus on Development*

Primary Mentor: Janice Hanson

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

The pediatric physical exam and childhood developmental milestones are important parts of the third year pediatric clerkship. How to teach these two skills has been studied but still is a difficult topic to learn. Combining the two in an experiential way is an avenue that could aid in the learning process. There is no current tool that combines the two. Peer reviewed sources were reviewed and combined to create such a tool. The efficacy of this tool is yet to be determined and an experiment is being developed to evaluate this new method.

Primary Presenter: **Magdalena Reinsvold**

Project Title: *Community-Students Together Against Healthcare Racism (C-STAHR): Evaluating Effective Community-Guided Interventions to Address Implicit Bias and Perceived Discrimination in Health Care*

Primary Mentor: Janet Meredith

Thematic Area: Public Health and Epidemiology

Abstract:

C-STAHR (Community-Students Together Against Healthcare Racism) was founded in 2010 by medical students passionate about addressing racial disparities healthcare in collaboration with 2040 Partners for Health. C-STAHRs vision is for students and community to work together to better understand perceived discrimination and design a feasible intervention to better equip future healthcare providers and community members to reduce its effects. In pursuit of this vision, the group adheres to a strict Community Based Participatory Research process where decision-making is shared equally between community members and students. C-STAHR developed a problem tree to explore discrimination in healthcare as it is experienced by the Aurora/Denver community. Together, they identified breakdowns in provider-patient communication as well as institutional discrimination as major factors. C-STAHR has implemented several interventions over the past five years:

\* A communication tool to facilitate more effective communication between patients and their providers. This tool was implemented at the Salud Family Health Centers in Colorado (FQHC). Tool evaluation revealed that the most persistent difficulty experienced by patients was too little time with their healthcare provider.

\* HEROES, a youth health education and empowerment experience, began in 2014. The program was designed to increase the representation of individuals from diverse backgrounds in healthcare careers. After completing the curriculum, students expressed a statistically significant increase in their interest to pursue a healthcare career.

\* Focus groups exploring key issues around discrimination and cultural respect that need to be addressed in medical education. We plan to develop a community advisory board to evaluate bias and stereotypes in school of medicine cases and to create an interdisciplinary curriculum that can be implemented for health professional students.

By facilitating community dialogue and developing multi-pronged interventions, C-STAHR is a unique example of how sustainable partnerships can be created between academia and community, hence community.



Primary Presenter: **James Reszczenski**

Project Title: *Medication-Assisted Treatment of Substance Use Disorders Among Adolescents.*

Primary Mentor: Charles Johnson

Thematic Area: Clinical Science

Abstract:

The FDA has approved many medications for the treatment of various substance use disorders given the large pool of available clinical data. However, due to the restricted populations of larger trials, none of these medications are approved for adolescent substance use management. As the data surrounding use of these medications grow, physicians must remain attentive to the applicability of treatment options to their patient population. All the medications herein described have lacked data with sufficient external validity to generalize reported efficacy to adolescent populations. For more definitive, applicable adolescent recommendations, further higher-powered studies will be required. Double-blind, placebo controlled, randomized control trials directed at US adolescents stratified for varying support systems, severity of disease, motivation, concurrent mental health co-morbidities, and general demographics will be required before definitive recommendations can be made and comparative studies can be initiated. Additionally, given the increased rate of concurrent opiate and alcohol abuse, specific studies oriented towards treatment of these concurrent abuse disorders would be beneficial for practical application. While this article summarizes much of the research regarding medication-assisted treatment of alcohol and opiate use disorders, further investigations of treatment options for tobacco abuse, marijuana abuse, and cocaine abuse are also needed for generalization to the adolescent population.

Primary Presenter: **Devin Rigg**

Project Title: *Neoadjuvant FOLFIRINOX in Borderline Resectable and Locally Advanced Pancreatic Adenocarcinoma Improves PFS and OS in Surgically Resected Patients*

Primary Mentor: Ana Gleisner

Thematic Area: Clinical Science

Abstract:

**Introduction:** Pancreatic adenocarcinoma carries a dismal prognosis and surgical resection remains the only potential curative option; however, only 15-20% of patients present with resectable disease. Neoadjuvant FOLFIRINOX is increasingly used to allow surgical resection in these patients. The purpose of this study is to compare perioperative outcomes, progression free survival (PFS), and overall survival (OS) in patients receiving neoadjuvant FOLFIRINOX with those undergoing surgery alone.

**Methods:** We analyzed data from an institutional database identifying patients that underwent pancreatic resection for pancreatic adenocarcinoma from June 2012 to June 2016. A Wilcoxon rank-sum (Mann-Whitney) test, Student's t-test, and chi-square analysis were used for comparison where appropriate. The Kaplan-Meier method for PFS and OS were compared between the FOLFIRINOX group and surgery alone and differences were tested with a log-rank test.

**Results:** Among 165 patients undergoing pancreatic resection, 72 (43.6%) received neoadjuvant FOLFIRINOX and 93 (56.4%) received no neoadjuvant chemotherapy. The median number of completed FOLFIRINOX cycles was 4 (range 1-12) and 19 (26.4%) patients required a dose reduction. Patients in the FOLFIRINOX group were younger, had a lower BMI and creatinine, and had more advanced cancers based on Ca 19-9, tumor size, and clinical T- and N-stage (all  $p < 0.05$ ). Operative time was longer and more patients required a vein resection in the FOLFIRINOX group (both  $p < 0.05$ ), but there was no difference in blood loss ( $p = 0.630$ ). The incidence of pancreatic fistula, hemorrhage, and need for transfusions was lower in the FOLFIRINOX group (all  $p < 0.05$ ). Patients in the FOLFIRINOX group were more likely to have smaller tumors and a lower lymph node ratio, be node-negative, and less likely to have lymphovascular or perineural invasion (all  $P < 0.05$ ). There was no difference in PFS or OS in all patients between the groups ( $p < 0.05$ ); however, patients that made it to resection had significant longer median PFS (26.6 vs. 18.3 months) and OS (42.6 vs. 29.9 months) compared to patients undergoing surgical resection alone ( $p < 0.05$ ).

**Conclusions:** In conclusion, administration of neoadjuvant FOLFIRINOX to patients with BR and LAPC may identify patients with a favorable disease biology and help select patients that may benefit from surgical resection. Neoadjuvant FOLFIRINOX in surgically resected patients was associated with improved short-term oncologic outcomes and translated into a significantly

longer PFS and OS compared to surgically resected patients that did not receive neoadjuvant FOLFIRINOX.

Primary Presenter: **Kenny Rodriguez**

Project Title: *Otolaryngology Education: Recent Trends in Publication*

Primary Mentor: Scott Mann

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

**Objectives.** (1) Evaluate peer-reviewed publications regarding education in otolaryngology since 2000. (2) Analyze publication trends as compared with overall otolaryngology publications.

**Study Design.** Bibliometric analysis.

**Setting.** Academic medical center.

**Subjects and Methods.** A search for articles regarding education in otolaryngology from 2000 to 2015 was performed with MEDLINE and EMBASE databases, yielding 1220 articles; 362 relevant publications were categorized by topic, subspecialty, subject, article type, and funding source. Impact factors for each journal by year were obtained, and trends of each category over time were analyzed. These were then compared with publication numbers and impact factors for all otolaryngology journals.

**Results.** From 2000 to 2015, publications in otolaryngology education increased more rapidly than the field of otolaryngology overall. The most published topics included operative skills training, surgical simulation, and professionalism/career development. Recently there has been a decline in publications related to residency administration and duty hours relative to other topics. Only 12.2% of publications reported a funding source, and only 12.2% of studies were controlled.

**Conclusion.** Recent trends in otolaryngology literature reflect an increasing focus on education; however, this work is underfunded and often lacks high-quality evidence.

Primary Presenter: **Douglas Rooke**

Project Title: *Dosimetric Analysis With and Without Abdominal Compression For Patients Who Underwent SBRT for Locally Advanced Pancreatic Cancer*

Primary Mentor: Karyn Goodman

Thematic Area: Clinical Science

Abstract:

Every year over 40,000 people will die from pancreatic cancer, making it the fourth leading cancer-related cause of death for both men and women in the US. Currently, complete surgical resection is the only potential cure. Unfortunately, due to the location of the pancreas and somewhat indolent onset, many tumors are locally advanced at initial presentation and deemed unresectable. Many patients undergo neoadjuvant chemotherapy or chemoradiation followed by maximal safe tumor resection with the goal of attaining better disease outcomes[[](#\_edn1)[[](#\_edn2)]. Notwithstanding, median overall survival for locally advanced pancreatic cancer remains dismal at around 20 months[[](#\_edn3)]. Consequently, there is need for new treatment modalities to improve survival as well as the quality of life of those afflicted with pancreatic cancer. SBRT for locally advanced pancreatic cancer (LAPC) offers a modality where very high doses of radiation are targeted to a very conformal volume[[](#\_edn4)]. This allows for shorter number of treatments for patients.

Currently abdominal compression is not commonly used for the treatment of LAPC. It has been previously established that the use of a pneumatic compression belt can significantly decrease the movement of abdominal tumors caused by respiration. Our results will hopefully help answer the question as to whether such abdominal compression is beneficial to reducing radiation to OARs. This will, in turn, hopefully help guide practitioners toward techniques that will improve radiation treatment outcome. As SBRT is a relatively new method for the treatment of LAPC and only practiced at a select number of radiation oncology centers. Preliminary research has shown improved local control of the cancer[[](#\_edn1)] over conventionally fractionated RT. Yet, gastrointestinal tumors, especially those in the upper abdomen still pose a challenge for radiation oncologists to provide adequate treatment while minimizing margins to spare organs at risk[[](#\_edn2)[[](#\_edn3)[[](#\_edn4)]. Furthermore, there is a significant benefit to the patient who would only need 5 or fewer treatments with a hypofractionated approach. Additional research is necessary to identify and outline ideal practices for safety and quality before the technique becomes mainstream practice.

Primary Presenter: **Shoshana Rosenthal**

Project Title: *Longitudinal relationship of systemic lupus erythematosus disease activity with complement receptor 1 and 2 expression on peripheral B-cells*

Primary Mentor: Susan Boackle

Thematic Area: Clinical Science

Abstract:

**Purpose:** To further elucidate the role of the complement system in lupus, specifically complement receptors 1 and 2, to determine if these levels on peripheral B-cells can be used as biomarkers for disease activity specific to SLE as opposed to other patients with and without autoimmune conditions. Additionally, the further analysis of peripheral B-cell populations to confirm previous reports of aberrations in specific B-cell subsets in SLE and to further investigate the specificity of these changes to SLE as opposed to other autoimmune conditions and analyze the changes in B-cell populations over time.

**Aims:** Determine whether levels of CR1 and CR2 on peripheral B-cells correlate with SLE disease activity longitudinally. Determine if known alterations in B-cell populations of SLE patients correlate to disease activity longitudinally. Determine if these relationships are specific to SLE, or are also found in other autoimmune conditions.

**Study Design:** Longitudinal study consisting of 5 visits with 3 month intervals of 4 groups of subjects including those with active and inactive SLE, rheumatoid arthritis, and a control group. At each visit disease activity was assessed using history, physical and laboratory disease markers including collection of peripheral blood for quantitative determination of CR1 and CR2 expression on populations of B-cells by flow cytometry.

**Results:** CR1 and CR2 are significantly decreased at the initial study time point as compared to RA and control populations. CR1 and CR2 significantly fluctuated in the control group over time irrespective to CRP and infection questionnaire. Despite this, a significant inverse relationship was demonstrated in SLE subjects using a mixed model of SLE disease activity as measured by SLEDAI with CR1 and CR2 levels. In the RA cohort in a similar mixed model approach there was no relationship between disease activity as measured by DAS28 and CR1 and CR2 levels.

**Conclusion:** CR1 and CR2 levels on peripheral B-cells are inversely related to disease activity as measured by SLEDAI over time, and this is unique to SLE in our study as levels of CR1 and CR2 in RA patients did not have any significant relationship with disease activity. This finding is limited due to the significant fluctuation in CR1 and CR2 levels in the control population, however despite the fluctuation in the control population, their levels of CR1 and CR2 were significantly higher than the SLE cohort regardless of disease activity.

Primary Presenter: **Allen Ruan**

Project Title: *Effect of medical student anxiety on USMLE Step 1 scores and contributing factors: a systematic review*

Primary Mentor: Tai Lockspeiser

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

**Objective:** Assess the existing literature for the effect of medical student anxiety on USMLE Step 1 performance, and assess common factors that impact student anxiety.

**Methods:** Research articles were identified through the PubMed and ERIC Education databases. All study types discussing the U.S. medical undergraduate students taking USMLE Step 1 were included. Articles were limited to those published in English between 2006 and 2016. Further eligibility based on relevance to the objective was assessed through review of the abstracts by the two authors.

**Results:** Sixteen articles were selected for full-text review, and eight studies met inclusion criteria. Two of these studies showed a correlation between lower medical student anxiety and higher USMLE Step 1 score. Four of the studies did not find a significant correlation between differences in anxiety and Step 1 score. The remaining two studies showed qualitative effects of various stress mitigation strategies that improved the subjective experience of stress and test anxiety.

**Conclusions:** Despite, or perhaps due to, the high stakes of the USMLE Step 1 exam, there is no clear consensus in the literature about how test anxiety affects Step 1 scores. Indeed, even the effect of such common interventions as test preparation seminars and switching to pass/fail grading have produced mixed results for medical student anxiety and Step 1 scores. What is clear is that this important area of medical education needs further research to guide evidence-based interventions for optimizing student performance.

Primary Presenter: **Ramses Saavedra**

Project Title: *CTIDES: A Novel Classification System for Traumatic Brain Injuries*

Primary Mentor: Marlin Richardson

Thematic Area: Clinical Science

Abstract:

Reasons for Study: Current traumatic brain injury (TBI) classification systems fail to consider the different types of trauma-induced intracranial pathology. CTIDES accounts for the 6 types of injury commonly seen on imaging: Cerebral contusions/intraparenchymal hemorrhage, Traumatic subarachnoid hemorrhage, Intraventricular hemorrhage, Diffuse axonal injury, Epidural hematoma, and Subdural hematoma. Simple stratification of TBI patients via available radiologic data will allow for improved short- and long-term outcome prediction.

Main Findings: A total of 379 patients were included in the analysis. Mean age was 40.7. Most common injury type was a CTS and mean CTIDES count was 2.6 (SD=1.19). 53.44% of all patients were GCS 6 or less. There was a positive Kendall correlation between the accumulation of CTIDES count and decreasing GCS within 24-hours post-injury ( $p=0.03$ ). For every increase in CTIDES variables, the predicted presenting GCS declined by 0.37 points on average ( $p$  value = 0.0102), according to least squares regression, and the odds of having a GCS of  $\leq 7$  at 1 week increased by 64% ( $p$  value < 0.0001). Additionally, as the number of CTIDES variables increases, the average GCS at one week decreases ( $p$  value < 0.0001). The presence of I increased the odds of dying within 1 week significantly ( $p=0.0075$ ). No other CTIDES variable were statistically significantly associated with death at one week.

Principal Conclusions: CTIDES demonstrated preliminary value as an alternative to the more complex Marshall, Rotterdam, and Helsinki scoring systems. Because it offers a simple and practical method for subclassifying TBI, we advocate for external validation of CTIDES using independent data sets



Primary Presenter: **Jason Santiago**

Project Title: *Financial and Societal Impact of a Neurodevelopmental and Behavioral Dual Diagnosis*

Primary Mentor: Cordelia Robinson-Rosenberg

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

Approximately 30-50% of individuals with an intellectual or developmental disability also have a psychiatric disorder. However, mental health treatment options for these individuals are often severely limited. This is especially true in Colorado where care for these individuals is fragmented and ineffectual due to complexities in the delivery system, incomplete understanding of special health care needs, lack of adequate support for caregivers, and insufficient cross-system coordination. As a result, when an individual with a dual diagnosis experiences a mental health crisis, caregivers often use first-responders and/or Emergency Department services to secure the safety of the individual and those around them. However, use of these entities is costly and ultimately of minimal value since the staff is often ill equipped to effectively manage crisis situations and address follow-up needs for these complex circumstances. This study will interview primary caregivers of individuals with a dual diagnosis to ascertain areas where care coordination is inadequate, instances where lack of appropriate and/or timely interventions directly led to costly escalation of care, and to systematically document the financial and societal impact of caregiving requirements on families. Approximately 80 caregivers will be recruited for this study via advertisements placed in Community Centered Boards and Community Mental Health Centers, or participation in a previous study indicating consent to be re-contacted. In-depth interviews of the caregivers will be conducted to gather detailed information related to demographics, mental health crises, and family circumstances, which will be audio recorded and entered into a secure REDCap database. Discrete answer items will be analyzed by descriptive statistics, while open-ended questions will be summarized thematically. Preliminary results from 16 caregiver interviews indicate the need for immediate action items including provision of Crisis Intervention Training for families, support for the acceptance of in-home family behavior therapy, and effecting change in family respite provisions. Ultimately, we hope the findings from this study can be used to help create and implement a cross-system model of crisis prevention in Colorado.

Primary Presenter: **Maithri Sarangam**

Project Title:

*Human Breast Milk Insulin Concentration Increases with Maternal Pre-Pregnancy BMI*

Primary Mentor: Bridget Young

Thematic Area: Public Health and Epidemiology

Abstract:

**Background:** The impact of maternal phenotype on bioactive components of human milk (HM) remains unclear. This is particularly relevant given the increasing worldwide prevalence of maternal obesity and insulin resistance. In particular, the relationships between maternal BMI, macronutrients and HM insulin concentration requires further study.

**Methods:** We analyzed 126 HM samples collected at 14 days postpartum from participants in the æWomen First study in Guatemala, which administered small quantity lipid-based nutrient supplements from either the preconception or prenatal period until delivery. The RCT is ongoing and treatment arms are unknown. All maternal supplementation concluded at birth. HM samples were collected via hand expression, after the infant initiated let-down. Skim milk was generated via centrifugation and HM insulin was analyzed via chemiluminescence immunoassay. Macronutrients and total calories were analyzed via human milk analyzer (Miris) in 102 milk samples.

**Results:** In the cohort as a whole HM lactose =  $6.9 \pm 0.6$  g/100mL; protein =  $1.2 \pm 0.4$  g/100mL; fat =  $3.9 \pm 1.3$  g/100mL; calories =  $70.4 \pm 12.0$  kcal/100mL; insulin  $14.3 \pm 9.0$  µIU/mL. Neither maternal BMI nor time-of-day (between 09:00 and 16:30) were related to any of the macronutrients or HM caloric density. Mean HM insulin concentration was significantly different across maternal pre-pregnancy BMI categories ( $p < 0.002$ ). Mean HM insulin concentrations were  $12.4 \pm 6.6$  µIU/mL,  $15.3 \pm 10.0$  µIU/mL, and  $21.5 \pm 13.0$  µIU/mL, for the normal ( $n=71$ ), overweight ( $n=40$ ), and obese ( $n=14$ ) BMI categories respectively. Neither HM macronutrient concentrations nor caloric density were related to HM insulin concentrations. In multivariable regression, both maternal pre-pregnancy BMI and the time-of-day of HM collection were significantly and positively related to HM insulin values ( $p < 0.001$ ). Together these variables explained 16% of the variation in HM insulin.

**Conclusions:** Our findings suggest that maternal pre-pregnancy BMI likely impacts the concentration of insulin in HM. This finding is particularly relevant given that prandial state was

not controlled in our collection methods. The impact of higher concentrations of HM insulin on the recipient infant requires further investigation.

Primary Presenter: **Ann Scheels**

Project Title: *Point of Care Ultrasound in Rural Primary Care*

Primary Mentor: Mark Deutchman

Thematic Area: Clinical Science

Abstract:

Point- of-care ultrasound (POCUS), once a diagnostic tool utilized by radiologists and ultrasound technicians for comprehensive evaluation of anatomical regions, has increasingly been utilized for focused, protocol-directed assessments at the bedside by many other specialties. This study examined 1.) the potential utility of focused point of care ultrasound in primary care settings, particularly rural settings and 2.) what, if any, of the educational methods employed to develop proficiency with POCUS, resulted in physician confidence and implementation of POCUS in their practice. In this study, donated hand-held ultrasound devices were utilized by rural primary care providers in their practice after receiving training in the modalities they wished to utilize the ultrasound. Currently, data collection and recruitment is ongoing for the study.

Primary Presenter: **Kristin Schmid**

Project Title: *Barriers and Facilitators for Community CPR Education in San Jose, Costa Rica (published) CPR in Schools: San Jose, Costa Rica (in progress)*

Primary Mentor: Nee-Kofi Mould-Millman

Thematic Area: Global Health

Abstract:

Abstract

**Background:** Bystander cardiopulmonary resuscitation (CPR) improves survival after prehospital cardiac arrest. While community CPR training programs have been implemented across the US, little is known about their acceptability in non-US Latino populations.

**Objectives:** The purpose of this study was to identify barriers to enrolling in CPR training classes and performing CPR in San Jos<sup>©</sup>, Costa Rica.

**Methods:** After consulting 10 San Jos<sup>©</sup> residents, a survey was created, pilot-tested, and distributed to a convenience sample of community members in public gathering places in San Jos<sup>©</sup>. Questions included demographics, CPR knowledge and beliefs, prior CPR training, having a family member with heart disease, and prior witnessing of a cardiac arrest. Questions also addressed barriers to enrolling in CPR classes (cost/competing priorities). The analysis focused on two main outcomes: likelihood of registering for a CPR class and willingness to perform CPR on an adult stranger. Odds ratios and 95% CIs were calculated to test for associations between patient characteristics and these outcomes.

**Results:** Among 371 participants, most were male (60%) and <40 years old (77%); 31% had a college degree. Many had family members with heart disease (36%), had witnessed a cardiac arrest (18%), were trained in CPR (36%), and knew the correct CPR steps (70%). Overall, 55% (95% CI, 50-60%) indicated they would likely enroll in a CPR class; 74% (95% CI, 70-78%) would perform CPR on an adult stranger. Cardiopulmonary resuscitation class enrollment was associated with prior CPR training (OR: 2.6; 95% CI, 1.6-4.3) and a prior witnessed cardiac arrest (OR: 2.0; 95% CI, 1.1-3.5). Willingness to perform CPR on a stranger was associated with a prior witnessed cardiac arrest (OR: 2.5; 95% CI, 1.2-5.4) and higher education (OR: 1.9; 95% CI, 1.1-3.2). Believing that CPR does not work was associated with a higher likelihood of not attending a CPR class (OR: 2.4; 95% CI, 1.7-7.9). Fear of performing mouth-mouth, believing CPR is against Gods will, and fear of legal risk were associated with a likelihood of not attending a CPR class and not performing CPR on a stranger (range of ORs: 2.4-3.9).

**Conclusion:** Most San Jos<sup>©</sup> residents are willing to take CPR classes and perform CPR on a stranger. To implement a community CPR program, barriers must be considered, including misgivings about CPR efficacy and legal risk. Hands-only CPR programs may alleviate hesitancy to perform mouth-to-mouth respirations.

Primary Presenter: **Alyssa Self**

Project Title: *Defibrillation time intervals and outcomes of in-hospital cardiac arrest*

Primary Mentor: Steven Bradley

Thematic Area: Clinical Science

Abstract:

**Objective:** To describe temporal trends in the time interval between first and second attempts at defibrillation and the association between this time interval and outcomes in patients with persistent ventricular tachycardia or ventricular fibrillation (VT/VF) arrest in hospital.

**Design:** Retrospective cohort study.

**Setting:** 172 hospitals in the United States participating in the Get With The Guidelines-Resuscitation registry, 2004-12.

**Participants:** Adults who received a second defibrillation attempt for persistent VT/VF arrest within three minutes of a first attempt.

**Interventions:** Second defibrillation attempts categorized as early (time interval of up to and including one minute between first and second defibrillation attempts) or deferred (time interval of more than one minute between first and second defibrillation attempts).

**Main outcome measure:** Survival to hospital discharge.

**Results:** Among 2733 patients with persistent VT/VF after the first defibrillation attempt, 1121 (41%) received a deferred second attempt. Deferred second defibrillation for persistent VT/VF increased from 26% in 2004 to 57% in 2012 ( $P < 0.001$  for trend). Compared with early second defibrillation, unadjusted patient outcomes were significantly worse with deferred second defibrillation (57.4% v 62.5% for return of spontaneous circulation, 38.4% v 43.6% for survival to 24 hours, and 24.7% v 30.8% for survival to hospital discharge;  $P < 0.01$  for all comparisons). After risk adjustment, deferred second defibrillation was not associated with survival to hospital discharge (propensity weighting adjusted risk ratio 0.89, 95% confidence interval 0.78 to 1.01;  $P = 0.08$ ; hierarchical regression adjusted 0.92, 0.83 to 1.02;  $P = 0.1$ ).

**Conclusions:** Since 2004, the use of deferred second defibrillation for persistent VT/VF in hospital has doubled. Deferred second defibrillation was not associated with improved survival.

Primary Presenter: **Brittany Shilling**

Project Title: *Rural Emergency Department Visits to Critical Access Hospitals in Colorado: Is Family Medicine Training Adequate Preparation?*

Primary Mentor: Mark Deutchman

Thematic Area: Public Health and Epidemiology

Abstract:

**Importance** Family physicians (FPs) provide the majority of care in emergency departments (EDs) in rural hospitals. However, a minority of these physicians have board certification in both emergency medicine and family medicine. This study compares reasons for ED visits to family medicine residency training in order to determine if this training adequately prepares FPs to practice emergency medicine in rural, critical access hospitals.

**Objectives** To identify potentially necessary additional training needed for FPs who plan to work in rural EDs by documenting the reasons for visits to rural EDs and comparing this information to residency curriculum guidelines for family physicians.

**Design, Setting, and Participants** The frequency of principal discharge diagnosis clusters, principal discharge diagnoses of deceased patients, and principal procedures were determined. The top diagnoses and procedures were compared to family medicine residency curriculum guidelines, as defined by the Accreditation Council for Graduate Medical Education (ACGME) and American Academy of Family Physicians (AAFP). The data set included discharge data from 20 of the 29 critical access hospitals (CAHs) in Colorado in 2012.

**Results** The most common principal discharge diagnosis clusters included (1) superficial injury; contusion, (2) sprains and strains, (3) abdominal pain, (4) other upper respiratory infections, and (5) other injuries and conditions due to external causes. The most common principal diagnosis clusters for deceased patients included (1) cardiac arrest and ventricular fibrillation, (2) residual codes; unclassified, (3) acute myocardial infarction, (4) other injuries and conditions due to external causes, and (5) intracranial injury. The most common principal procedures included (1) injection or infusion of other therapeutic or prophylactic substance, (2) application of splint, (3) administration of diphtheria-tetanus-pertussis, combined, (4) electrocardiogram, and (5) insertion of endotracheal tube. With the exception of two principal diagnosis clusters, which were very ambiguous, family medicine residency training curricula included all of the top 103 principal diagnoses, which account for 95% of such diagnoses made in Colorado critical access hospital EDs in 2012. Family medicine residency training curricula also included all of the principal diagnoses for deceased patients and the top 40 principal procedures, which account for over 95% of procedures carried out in Colorado critical access hospital EDs in 2012.

**Conclusion** The most common problems and procedures in rural critical access hospital EDs are a part of current family medicine residency training curricula. While the volume training

conducted within the confines of an ED is less in FM residencies, as compared to EM residencies, FPs receive training in the same diagnoses and procedures in other ambulatory and inpatient settings and are therefore prepared to care for patients with the same problems in the rural ED setting. If additional training for infrequent and acute problems is required by such FPs “ focused courses such as ACLS, ATLS, PALS, and even rural ED fellowships are available.



Primary Presenter: **Shilo Smith**

Project Title: *MicroRNA-26a is strongly downregulated in melanoma and induces cell death through repression of silencer of death domains (SODD)*

Primary Mentor: Yiquin Shellman

Thematic Area: Basic Biomedical Science

Abstract:

Melanoma is an aggressive cancer that metastasizes rapidly and is refractory to conventional chemotherapies. Identifying microRNAs (miRNAs) that are responsible for this pathogenesis is therefore a promising means of developing new therapies. We identified miR-26a through microarray and quantitative reverse-transcription-PCR (qRT-PCR) experiments as an miRNA that is strongly downregulated in melanoma cell lines as compared with primary melanocytes. Treatment of cell lines with miR-26a mimic caused significant and rapid cell death compared with a negative control in most melanoma cell lines tested. In surveying targets of miR-26a, we found that protein levels of SMAD1 (mothers against decapentaplegic homolog 1) and BAG-4/SODD were strongly decreased in sensitive cells treated with miR-26a mimic as compared with the control. The luciferase reporter assays further demonstrated that miR-26a can repress gene expression through the binding site in the 3' untranslated region (3'UTR) of SODD (silencer of death domains). Knockdown of these proteins with small interfering RNA (siRNA) showed that SODD has an important role in protecting melanoma cells from apoptosis in most cell lines sensitive to miR-26a, whereas SMAD1 may have a minor role. Furthermore, transfecting cells with a miR-26a inhibitor increased SODD expression. Our findings indicate that miR-26a replacement is a potential therapeutic strategy for metastatic melanoma, and that SODD, in particular, is a potentially useful therapeutic target.

Primary Presenter: **Bree Smouse**

Project Title: *Resection of renal cell carcinoma tumor thrombus extending to the right atrium - a case report*

Primary Mentor: Allan Prochazka

Thematic Area: Clinical Science

Abstract:

Renal cell carcinoma (RCC) is a solid tumor that can invade the venous system via the renal vein to the IVC with extension to the right heart in 1% of cases (1). Surgical management is required to control the tumor thrombus burden of cavoatrial RCC with patients placed on cardiac bypass during intracardiac tumor resection. The patient in this case study presented with RCC tumor thrombus extending to the right atrium requiring extensive cardiac and caval thrombectomy who developed vasoplegic syndrome requiring ICU pressor support.

Primary Presenter: **Vera Staley**

Project Title: *Enhancing Access to Primary Care Through Innovative Scheduling and Health Information Technologies*

Primary Mentor: Catherine Battaglia

Thematic Area: Public Health and Epidemiology

Abstract:

Abstract:

Background: With increasing demand for primary care, clinics across the United States are searching for effective means to enhance patient access without increasing number of providers or hours worked.

Purpose: To report the effect of innovative scheduling, clinic flow management, and health information technologies on patient access in primary care.

Methods: A critical systematic review of the existing literature through PubMed.

Results: Though research driven by outcomes data remains sparse, some transformations have emerged as best practices. Scheduling must be informed by the patient panel and robust inquiry of supply and demand variations. Clinic flow transformation requires increased staff but clearly increases productivity and efficiency. Health Information Technologies (HIT) provide billable alternatives to the traditional office visit but the platform must be carefully reviewed before selection to ensure efficiency and accessibility.

Discussion: A multitude of approaches exist for each of these areas of interest and there are still limited outcomes data regarding cost-effectiveness and clinic efficiency. With the many options available for practice transformation, each clinic must consider its resources and patient population before attempting any intervention. A unifying theme, however, is that any clinical change requires buy-in from practice leadership at all levels.

Primary Presenter: **Alex Steinberg**

Project Title: *Voice of the Patient*

Primary Mentor: Tyler Miller

Thematic Area: Clinical Science

Abstract:

Background: Patient satisfaction is a pillar of quality healthcare defined by the Institute of Medicine, and is commonly a key domain used to define and measure quality. The æHospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) survey is a widespread and validated tool to assess patient satisfaction, but is limited, failing to give provider-specific or qualitative details regarding patient experience. Voice-of-Customer (VoC) is a widely used method in commercial product design to collect formative information about customer experience. We aim to investigate physician behaviors affecting patient satisfaction scores by integrating VoC methods with HCAHPS style data.

Methods: Face-to-face interviews were conducted with patients admitted to the Hospital Medicine Service at DVAMC, with a focus on the patient-physicians interactions. Both HCAHPS style rating and VoC style Open-ended questions were used to elucidate patient needs and complaints.

Results: Of the veterans interviewed, seventy-five percent reported a generally positive experience. Patients were particularly positive about their physicians skill and empathy. They expressed more concern about problems with physician communication, and the patients own readiness to manage their own care upon discharge. Patients mentioned specific examples of ways they felt ignored or unheard in communication with their team. A number of patients voiced concerns about future readmission for the same medical problem.

Conclusion: Our results suggest that poor physician-patient communication and patient preparation for discharge may contribute to low patient satisfaction. Using the VoC approach identified a number of specific factors that contribute to patient dissatisfaction, which could not have been elucidated with HCAHPS. This approach provides actionable formative feedback from a small number of interviews and could be used to improve patient experience and satisfaction.

Primary Presenter: **Jennifer Sternberg**

Project Title: *Deficits of Gynecologic Research in the Cochrane Database Relative to Global Burden of Disease*

Primary Mentor: Joseph DeNagy

Thematic Area: Public Health and Epidemiology

Abstract:

Objective: To evaluate the quantity of systematic reviews and protocols from the Cochrane Database of Systematic Reviews for gynecological diseases, and identify deficits in research relative to disability and mortality as measured by the Global Burden of Disease Study 2010.

Materials and Methods: A cross-sectional analysis was performed. The Cochrane Database of Systematic Reviews was interrogated for reviews and protocols related to the seven causes of disability and mortality under the œGynecological Disease subcategory in the Global Burden of Disease Study. A chi-squared goodness-of-fit test was performed across each cause, which compared the Disability-Associated Life Year metric per 100,000 to the number of reviews and protocols identified.

Results: 216 reviews and protocols were identified that fell under diagnoses related to the œGynecological Disease subcategory: three related to genital prolapse, eight related to premenstrual syndrome, eight related to uterine fibroids, 22 related to polycystic ovarian syndrome, 26 related to endometriosis, 53 related to female infertility, and 96 related to diagnoses assigned to the œother gynecological cause. Relative to disability and mortality, genital prolapse, uterine fibroids, premenstrual syndrome and polycystic ovarian syndrome had fewer reviews and protocols than expected. Endometriosis, female infertility and œother gynecological had more reviews and protocols than expected.

Conclusion: Reviews and protocols in the Cochrane Database of Systematic Reviews for causes assigned to gynecological disease are disproportionately represented relative to their morbidity and mortality. These disparities should guide future research efforts and funding.

Primary Presenter: **Ericson Stoen**

Project Title: *Housing instability at the University of Colorado Hospital: Gauging the problem*

Primary Mentor: Greg Misky

Thematic Area: Public Health and Epidemiology

Abstract:

Housing instability, whether manifest as literal homelessness, couch surfing, or living in tumultuous social situations or extended-stay hotels is a pervasive theme in the population of many cities. It is one that appears to be rapidly expanding within the patient population served by the University of Colorado Hospital. We believe healthcare outcomes may be negatively impacted by housing instability and that providers and support staff may lack necessary tools in order to provide effective transitional care for such individuals. To assess provider, community, and support medical staff outlook on the degree and impact of housing instability on health outcomes, we informally interviewed members of each group to identify perceived barriers and potential areas of improvement in providing care to this unique patient population. We also performed a background literature search to further inform us on the characteristics and scope of this problem. Through these investigations, 3 broad threads were identified to further characterize the issue of housing instability within this area: patient characteristics, systems issues, and patient care. This, combined with the literature search performed, will help to inform and guide further research into this population at the University of Colorado Hospital, as well as the creation of future interventions.

Primary Presenter: **Whitney Sumner**

Project Title: *Neutrophil Nadir is Associated with Improved Distant Control and Overall Survival in Oropharyngeal and Laryngeal Cancer Patients Undergoing Definitive Radiotherapy*

Primary Mentor: Sana Karam

Thematic Area: Clinical Science

Abstract:

**Purpose/Objective(s):** Squamous cell carcinoma (SCC) of the head and neck represents an array of diseases processes with generally unfavorable prognosis. To date, studies relating the neutrophil count to treatment outcomes for these patients are scarce. We therefore used patient data from the University of Colorado and University of New Mexico to explore the relationship of the neutrophil nadir at various time points during treatment with overall survival (OS), cancer-specific survival (CSS), local control (LC) and distant control (DC) among patients with HNSCC.

**Materials/Methods:** Patients who received definitive treatment for SCC of the oropharynx or larynx between 2006-2015 were included in this study. Neutrophils counts were collected in pre-treatment, treatment, and post-treatment periods. OS, CSS, LC and DC were assessed using the Kaplan-Meier (KM) method. Univariate (UVA) and multivariate (MVA) analyses were performed using Cox proportional hazards regression models.

**Results:** 196 patients met our inclusion criteria; 171 patients were AJCC Stage III or IV. Median follow-up was 2.7 years. Unadjusted 2-year OS was significantly better with lower overall neutrophil nadir (<2 x1000 mm<sup>3</sup>, 91.5%; 2-4 x1000 mm<sup>3</sup>, 83.5% and >4 x1000 mm<sup>3</sup>, 72%)(Hazard ratio [HR], 1.85; 95%CI, 1.81-2.90; p=0.007). Unadjusted 2-year DC similarly improved with lower neutrophil nadir (<2 x1000 mm<sup>3</sup>, 92.5%; 2-4 x1000 mm<sup>3</sup>, 88% and >4 x1000 mm<sup>3</sup>, 77.5%)(HR, 2.71; 95%CI, 1.08-6.80; p=0.03).

Accounting for age, primary site, gender, race, tobacco use, Karnofsky performance status (KPS), stage, post-operative status, HPV status and receipt of chemotherapy, patients with higher neutrophil nadir experienced worse OS (HR, 1.37; 95%CI, 1.13-1.67; p=0.002), CSS (HR, 1.31; 95%CI, 1.09-1.57; p=0.004) and DC (HR, 1.40; 95%CI, 1.04-1.90; p=0.03), though no associated was identified in LC (HR, 1.19; 95%CI, 0.96-1.48; p=0.12)

**Conclusion:** Higher overall neutrophil nadir across the treatment period predicted worse OS, CSS and DC among patients receiving curative-intent treatment for oropharyngeal or laryngeal SCC.

Primary Presenter: **Alec Sundet**

Project Title: *Management of the pediatric patient*

*following upper extremity replantation or revascularization: a suggested protocol.*

Primary Mentor: Rodrigo Banegas

Thematic Area: Clinical Science

Abstract:

Background:

Traumatic pediatric amputations of the hand and upper extremity can have long-term financial, psychological, developmental, and functional consequences that readily extend beyond the realm of that which is normally encountered in comparatively injured adults. These factors, along with a paucity of medical comorbidities, have guided a more liberal and aggressive approach to treating pediatric amputations in hopes of optimizing psychosocial, aesthetic, and developmental outcomes. Furthermore, advances in pharmacology and microsurgical replantation techniques have allowed what were otherwise exceedingly rare surgeries to become commonplace in hospitals all over the world.

Despite these gains, vascular thrombosis remains the leading cause of failure in

microvascular surgeries. A recent survey showed that 96% of reconstructive surgeons use some form of anticoagulation therapy in their treatment, but no consensus regarding pharmacologic agents, dosing, or efficacy exists. The risk of thrombosis is further complicated by the dynamic nature of vasculature in response to stressors such as sympathetic tone, decreased intravascular volume, and response to external temperature. Given the lack of a higher-level evidence to guide the replantation surgeon in postoperative orders, we created an inclusive protocol, outlining complete and proper management of the pediatric patient following revascularization or replantation surgery.

Methods:

We reviewed the methods employed by our microvascular surgeons and consulted with board-certified pediatricians to produce a final document that was adopted ubiquitously among our providers.

Results:

We do not have head-to-head data demonstrating improved outcomes with use of the protocol. Nonetheless, the original document has been modified and reproduced here for your consideration and use.

Conclusions:



Since initiating the protocol, we feel it has helped standardize our practice, avoid instances of incomplete or missed order sets, and facilitate interdisciplinary management through decreased gaps in communication, especially in those surgeries terminating in the middle of the night.

Primary Presenter: **Kenji Tanabe**

Project Title: *A survey of CUSOM preclinical medical students: an assessment of study habits, resources, attitudes and motivations*

Primary Mentor: John Cohen

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

Background: The United States Licensing Exam (USMLE) Step 1 was created with the purpose to serve as a common evaluation system for applicants for initial medical licensure. Today, the numerical score of this exam is commonly utilized in the selection of candidates for residency positions, with 67% of residency program directors stating that they have a set minimum Step 1 score for selecting which applicants to interview.<sup>1</sup> The medical education community has recently taken interest in how Step 1 has evolved from a licensing exam to an essential component for residency selection. Some have called the Step 1 exam an insufficient tool for the job, and highlighted how its inadvertent role in residency selection has unintended consequences in medical education.<sup>2</sup>

Methods: A cross-sectional, descriptive study designed by two second year medical students in the form of a survey was administered to all first and second year medical students at the University of Colorado in March 2015. The survey inquired about the students study habits, specifically study time allocation and resource utilization. The survey also evaluated students trust in study materials and in the preclinical curriculum in relation to Step 1 preparation.

Lastly, the Academic Motivation Scale (AMS) was included to categorize students as intrinsically or extrinsically motivated. The results from the anonymous and voluntary surveys were statistically analyzed between first and second year students for significant patterns.

Results: Of a total of 340 students, 127 surveys were completed. Students prioritize the Step 1 exam during their preclinical years of medical school, with second year medical students spending significantly more time studying for Step 1 (mean 23.8 hours vs 1.39 hours,  $p < 0.0001$ ) and less time on the schools Core Curriculum (mean 25.14 hrs vs. 45.2 hrs,  $p < 0.0001$ ) when compared to first year students. Additionally, 79.1% of MS2s and 41.6% of MS1s indicated that Step 1 was their highest motivational priority. Second year students trusted the Core Curriculum less when it came to preparing them for Step 1 ( $p=0.0133$ ) and trusted external resources more to prepare them for Step 1 ( $p=0.0426$ ). There was no significant difference when it came to study time, study resources, or motivational factor when comparing intrinsically and extrinsically motivated students as categorized by the AMS.

Conclusion: The majority of second year students and a sizable number of first year medical students prioritize Step 1 in their preclinical years. Students clearly value external resources in

their Step 1 preparation, citing the qualities of cohesiveness, conceptual frameworks, and simplified organization as reasons these external resources are valued over the schools primary curriculum. As Step 1 retains its importance in the residency selection process and external resources continue to refine their role in test preparation, it will be important to consider solutions for reconciling this pattern of multiple, conflicting curricula: Step 1 preparation pursued largely through external resources and the schools primary preclinical curricula.

Primary Presenter: **Samuel Tesfalidet**

Project Title: *The ethical concerns regarding compensated organ donation*

Primary Mentor: jackie glover

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

A quick glance of the data for the incomplete year of 2016 provided by the Organ and Procurement Transplantation Network reveals that there are 119,860 patients who need a lifesaving organ transplant, 77,252 are actively waiting and medically eligible for transplantation, 27,605 organ transplants have been performed and there are 13,066 donors.<sup>1</sup> Every ten minutes, another patient is added to the national transplant waiting list and roughly twenty-two patients die each day while waiting for a transplant.<sup>1</sup> In 2005, there were 90,526 patients waiting at year end, 28,118 transplants performed, and 14,497 donors recovered.<sup>2</sup> It is clear there is a mismatch between the need for organs and the supply. So how can we narrow this gap? Either decrease the number of those who need this procedure (prevention) or increase the number of organs available to meet this need (treatment). When it comes to answering the question by proposing the second possibility, it seems, individuals have strong ethical concerns when it involves compensation. But why? This paper is intended to briefly describe the state of organ transplantation in the United States; the response and state of the black market of organ donation; the various proposals to increase the donor pool; a brief review of the attitudes regarding compensated organ donation in the U.S.; a brief review of the Iranian and Philippine compensated organ donation models; the ethical concerns regarding compensated organ donation. I conclude that both uncompensated and compensated organ donation can co-exist.

Primary Presenter: **Eryn Thiele**

Project Title: *Vascular Dysfunction as a Mechanism for the Effects of Estrogen on Cognition in Women*

Primary Mentor: Kerry Hildreth

Thematic Area: Clinical Science

Abstract:

Background: Traditional cardiovascular risk factors increase the risk of Alzheimers disease (AD). The loss of estrogen (E2) with menopause appears to augment the age-associated increase in these risk factors, which may help explain the additional increased risk of AD in aging women. E2 helps maintain neuronal integrity, particularly in the prefrontal cortex (PFC) which supports executive function and working memory, and is vulnerable in AD. E2 is also vasoprotective. E2-deficient postmenopausal women show arterial stiffening and impaired endothelial function compared to age-matched premenopausal women; these impairments are attenuated with E2-based hormonal therapy. Arterial stiffening and endothelial dysfunction have been linked to small-vessel cerebrovascular disease and cognitive impairment. Mechanisms for the effects of E2 on cognition are not known, but acute changes in both vascular function and brain activation occur with surgical or pharmacologic ovarian suppression. This study is investigating whether vascular dysfunction mediates the negative effects of E2 on brain activation.

Methods: 34 healthy, premenopausal women (40-60y) randomized to 6-months of gonadotropin releasing hormone agonist (GnRHag) or placebo as part of an ongoing study will be enrolled. Measures of 1) vascular function ([carotid artery compliance-ultrasound] and endothelial function [brachial-artery flow mediated dilation]); and 2) PFC activation (fMRI during a working memory task) are obtained at baseline and 6-months. To isolate the effects of E2, participants randomized to GnRHag (n=17) receive 3 additional months of GnRHag with E2 add-back, with outcomes assessed at 9-months.

Expected Results: GnRHag treatment will be associated with reduced arterial compliance and endothelial function, and these changes will be correlated with decreased PFC activation. Changes observed with GnRHag will be reversed with E2 add-back.

Conclusion: This study is a novel investigation of vascular dysfunction as a possible mechanism underlying the negative effects of E2-deficiency on cognition. Use of a controlled experimental model of ovarian suppression and incorporation of an E2 add-back condition will examine the effects of E2, independent of age or other ovarian hormones. Results will inform future studies

investigating new sex-specific therapeutic or lifestyle interventions to prevent cognitive decline in aging women.

Primary Presenter: **Theodore Timothy**

Project Title: *Integration of Behavioral and Physical Health with Electronic Health Records*

Primary Mentor: Rita Lee

Thematic Area: Public Health and Epidemiology

Abstract:

Purpose

The integration of behavioral and physical health care for children and adolescents is essential in school-based health clinics (SBHCs) to provide coordinated treatment for both the body and the mind. Current models allow for coordinated care, but the medical records used in SBHCs are often dis-coordinated and inefficient. The purpose of this paper is to explore the opportunities and barriers to achieving fully integrated electronic medical records. The current systems used by these clinics are summarized, and possible solutions to overcome the barriers are suggested.

Methods

Our methods consisted of meeting with managers, administrators, physical health care providers, and mental health care providers at several SBHCs in Colorado. We also interviewed individuals from the Mental Health Center of Denver, the Office of Behavioral Health, and Colorado Regional Health Information Organization (CORHIO) to identify common barriers in achieving integrated electronic health records (EHRs). Additionally, literature searches on the development of EHRs, information on the reasoning and structure of the current systems used by SBHCs, and the challenges and benefits of providing fully integrated care in schools were conducted. The information gathered was then synthesized, and solutions to the discovered barriers were investigated.

Results

Several common barriers to achieving fully integrated records were identified. These included: EHR variability among SBHCs, funding, record compatibility between physical and behavioral health providers, EHR design in documenting confidential information, access and release of information, special criteria for psychotherapy notes, insurance billing and after visit summaries, and laws and regulations. The most obstructive laws include Federal Rule 42 CFR Part 2 and Family Education Rights and Privacy Act (FERPA). We propose several recommendations to overcome these barriers.

Conclusions

The integration of behavioral and physical health with EHRs is an attainable goal for SBHCs in Colorado. EHR integration is beneficial for both patients and providers. The barriers discussed in

this report can be overcome through the recommendations proposed, or through alternate means.



Primary Presenter: **Jacqueline To**

Project Title: *The Value of Practical Projects in Interprofessional Education: A Qualitative Attitude Analysis of Interprofessional Student Leaders Creating a Student-Run Free Clinic Using PARS Methodology*

Primary Mentor: Lynn Vanderwielen

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

Providing interprofessional education opportunities to health program trainees has demonstrated clear value to promoting more effective team-based clinical care. Programs limited to classroom-based, didactic education sessions could be enhanced by the addition of real world projects. In this paper we discuss the benefits experienced by interprofessional students from the University of Colorado Denver Anschutz Medical Campus who created and led a student-run free clinic (SRFC) in the local community of Aurora, Colorado. Post-implementation of the SRFC, student leaders were surveyed regarding their perspectives and understanding of interprofessional teams. Qualitative analysis revealed common themes of a deepened respect and understanding of interprofessional collaboration, enhanced knowledge of other professionals roles, and increased confidence in their ability to work within an interprofessional healthcare team in the future. Interprofessional education can be improved by incorporating practical, faculty-guided service-learning projects.

Primary Presenter: **Tuong-Vi Tran**

Project Title: *Re-emergence of Schistosomiasis infection in large scale mass drug administration programs: Is Drug Resistance a Concern?*

Primary Mentor: Elizabeth Carlton

Thematic Area: Global Health

Abstract:

Schistosomiasis is caused by the trematode flukes of the genus *Schistosoma*. Of the three main disease-causing schistosome species, *Schistosoma japonicum*, is the only true zoonosis infecting humans and a wide range of mammalian hosts, thus complicating transmission control and elimination programs. *S. japonicum* is primarily localized to Asia, and has been given public health priority in China since early 1950s. Alongside control strategy aimed at environmental and epidemiological factors, praziquantel has been the cornerstone of morbidity control, and transmission interruption. In schistosomiasis-endemic Sichuan Province, these integrated efforts have achieved great strides in transmission control and interruption. However, within the last couple decades, some areas that previously achieved transmission interruption, or transmission control have now seen re-emergence of the disease.

This paper discusses the possible causes, and determinants of the reemergence of schistosomiasis by reviewing original research, case reports, retrospective case studies, and epidemiological surveys. Although reliance on one sole medication, and repeated nonselective use i.e. mass chemotherapy can induce tolerance of the pathogen to the drug, there is no evidence of drug resistance of *Schistosomiasis japonicum* to date. Rather, host factors, epidemiological, environmental, and sociopolitical factors all likely contribute to the current rising public health concern in Sichuan Province, and China at large.

Primary Presenter: **Garrett Urban**

Project Title: *Risk Behaviors and Health Management in the Overweight and Obese Population in Colorado*

Primary Mentor: Kathy James

Thematic Area: Public Health and Epidemiology

Abstract:

Background: Obesity rates in rural areas has been shown to be higher than urban areas, which may be due to a variety of factors. However, these rates have not been examined in the leanest state in the nation: Colorado. The current study looks to investigate behavior, environment, and healthcare factors that influence obesity rates in rural vs urban Colorado.

Methods: A Colorado cohort from the TABS and IFHL cross-sectional survey weighted data sets were used to look at a variety of factors including, BMI, age group, ethnicity, SES status, insurance status, education level, work status, sexual orientation, chronic disease status, exercise, food access, and other. Analysis was performed with design-adjusted chi-square and T-tests.

Results: Colorado rural residents were more overweight/obese than their urban counterparts especially males, whites, and high school graduates. When looking at obesity alone, other ethnicity, age 65+, and GLB rural populations were significant. Rural residents were less likely to see their HCP in the last year. Rural obese/overweight residents were less likely to be insured, have access to safe places to exercise, access to healthy foods, or advised by their HCP to lose weight. Those given advice to lose weight were able to lose significantly more weight with even more weight lost in those given both advice and instruction.

Conclusion: The Colorado rural overweight/obese population is vulnerable and has many unique factors that can be addressed to improve overall health and may prove important in other US rural populations.

Primary Presenter: **Chris Varani**

Project Title: *What is Care Coordination and How Does it Impact My Practice?*

Primary Mentor: Christine Gilroy

Thematic Area: Clinical Science

Abstract:

Coordinating care for patients has the potential to improve their health while reducing costs for a practice. This paper provides an overview of care coordination starting with definitions and a scope of potential impacts. It provides insight into how care coordination relates with newer healthcare models and with quality programs. Planning considerations and a flowchart are presented for the practice executive interested in implementing or improving their coordination efforts. This considers unique patient populations and communities as well as the practices goals, strategy, resources, and culture. Finally, methods of valuing a coordination program are suggested. Care coordination will look different across systems as each practice tailors their program to their distinct situations.

Primary Presenter: **Thad Vickery**

Project Title: *Human Chronic Rhinosinusitis: Identification and Profiling of Eicosanoids and Pro-Resolving Lipid Mediators*

Primary Mentor: Vijay Ramakrishnan

Thematic Area: Basic Biomedical Science

Abstract:

**Introduction:** Current literature implicates arachidonic acid-derived leukotriene and prostaglandin pathways in the pathogenesis of CRS subtypes. Recently novel proresolving lipid mediators have been identified that activate resolution of inflammation that may be relevant in CRS. These new lipid mediator pathways and their relationship to eicosanoids have not been examined in CRS. Here, we aim to characterize the arachidonic acid (AA) mediators and docosahexanoic acid (DHA) derived pro-resolving metabolome in CRS and control tissues to better characterize how these inflammatory and pro-resolving pathways present in CRS subtypes.

**Methods:** IRB-approved cross-sectional study. Sinonasal epithelial tissue was collected from 47 patients undergoing endoscopic sinus surgery, including control subjects and CRS with and without polyps. Eight CRS subjects manifest aspirin sensitive polyps. Lipid mediator containing fractions were isolated from frozen tissue using C18 solid phase extraction. Samples were subject to liquid chromatography/tandem mass spectrometry and a multiple reaction monitoring strategy was employed to target 32 analytes from the omega-3 and omega-6 proinflammatory and pro-resolving metabolomes. Metabolite concentrations were inferred using standard calibration curves, and data analyzed using non-parametric tests.

**Results:** Nasal polyps from aspirin tolerant CRS patients demonstrated significantly elevated concentrations of several AA-derived compounds [prostaglandin D2, thromboxane A2, lipoxin A4, leukotriene B4, cysteinyl leukotrienes (C4 and E4)], and the DHA-derived novel pro-resolving mediators resolvin D1 and resolvin D2 when compared with non-polyp patients ( $p < 0.05$ ). Aspirin sensitive polyps demonstrated increased levels of resolvin D1, resolvin D2, lipoxin A4, thromboxanes (A2 and B2), and prostaglandin D2 when compared with aspirin tolerant polyps ( $p < 0.05$ ).

**Conclusions:** Dysfunctional lipid mediator pathways in CRS, especially CRS with polyps, extend beyond the traditional descriptions of leukotrienes and prostaglandins. These pathways provide a novel approach to the study of chronic inflammation and its resolution in particular CRS subtypes.

Primary Presenter: **Albert Vu**

Project Title: *Defining and Managing Neonatal Hypoglycemia*

Primary Mentor: Allan Prochaska

Thematic Area: Public Health and Epidemiology

Abstract:

Neonatal hypoglycemia can lead to adverse neurodevelopmental outcomes, but remains largely undefined due to transient postnatal adaptations witnessed in healthy newborns and a distinct lack of consensus outcome data regarding the determination of when intervention should occur. The imperfect diagnostic standards of obtaining glucose levels and reliance on antiquated single cut-off values have been limiting factors in improving care of the at risk population and there still remains confusion as to which clinical guidelines should be followed. The goal of this literature review is to discuss the advancements of knowledge in neonatal physiologic adaptation, explain the reasoning behind historical cut-off values and operational thresholds, and assess outcome data in order to provide a reasonable approach to the definition and management of neonatal hypoglycemia.

Primary Presenter: **Gregory Wiener**

Project Title: *Shock releases bile acid inducing platelet inhibition and fibrinolysis*

Primary Mentor: Ernest Moore

Thematic Area: Basic Biomedical Science

Abstract:

**Introduction:** Recently it has been appreciated that bile acids can block the anti-fibrinolytic protein plasminogen activator inhibitor 1 (PAI-1) and promote degradation of fibrin sealant. The concept of metabolites changing coagulation properties is not well documented in the surgical literature, and may be causality for persistent localized bleeding from the liver despite normalization of systemic coagulation. We hypothesize that bile acid impairs whole blood clot formation and promotes fibrinolysis.

**Methods:** Healthy volunteers (n=6) had blood collected in citrated tubes. Taurcholic acid (TUCA) was titrated in vitro into whole blood with a range from 250  $\mu$ M to 1000  $\mu$ M. This range was selected as previous literature indicated that systemic TUCA can exceed 600  $\mu$ M. Whole blood mixtures were assayed using thrombelastography (TEG) to quantify clot strength (MA) and degree of fibrinolysis (LY30). Tranexamic acid (TXA) was used to block plasmin mediated fibrinolysis. Statistical analysis used SPSS software. Correlations between TEG parameters and concentration of TUCA were analyzed using Spearman's Rho Test, and the Wilcoxon test was used for pair-wise comparisons.

**Results:** Clot strength had a negative correlation to dose of TUCA (Spearman's Rho = -0.677,  $p < 0.001$ ). Median whole blood MA was 56.25 (IQR 53.25-58.50), which decreased to a median MA of 42.00 (IQR 38.00-48.50) at the highest dose of TUCA. Ly30 had a positive correlation to dose of TUCA (Spearman's Rho = 0.702,  $p < 0.001$ ). Median whole blood Ly30 was 1.35 (IQR 0.8-1.73), which increased to a median Ly30 of 4.0 (IQR 2.85-10.3) at the highest dose of TUCA. At a dose of 750  $\mu$ M TUCA, TXA reduced Ly30 from 7.7 (IQR 5.7-14.8) to 2.9 (IQR 1.9-3.3),  $p = 0.028$ , but did not have a significant effect on MA ( $p = 0.249$ ). At the highest dose of 1000  $\mu$ M TUCA, TXA did not significantly reduce Ly30 ( $p = 0.658$ ) and MA was unchanged by TXA at this dose ( $p = 0.144$ ).

**Conclusion:** Bile acid has a dose response in reducing clot strength and promoting fibrinolysis. This is consistent with previous literature that bile can promote fibrin clot degradation. The reduction in clot strength also suggests platelet inhibition, which is not correctable by TXA. This metabolic effect on coagulation warrants further investigation, as localized areas of the body, particularly the liver, with high levels of bile acid may be at risk for post-operative bleeding.

Primary Presenter: **MariaElena Williams**

Project Title: *Access to Care Under the Affordable Care Act: The Challenges Insured Patients Face When Attempting to Utilize Their Behavioral Health Benefits*

Primary Mentor: Deborah Seymour

Thematic Area: Public Health and Epidemiology

Abstract:

**Purpose** The Affordable Care Act mandates that non-grandfathered health insurance plans include sufficient access to behavioral health providers for their policyholders, but lacks specific guidelines to define sufficient access. In this study we evaluated access to behavioral health services for privately insured patients in the Denver metro area after implementation of the Affordable Care Act.

**Methods** We called behavioral health providers in the Denver metro area networked with three large insurance providers that participate in Colorado's Health Insurance Marketplace while portraying a potential patient. Using this secret shopper methodology, we collected data regarding the accuracies of the insurance directories and the availability of those providers listed.

**Results** We found 13.0% of the entries in the insurance directories were incorrect. Only 43.6% of all calls to providers and 11.5% of calls to psychiatrists yielded an appointment.

**Conclusions** Our data suggest that a patient would, on average, need to call between seven and ten psychiatrists before finding an available appointment. Our findings are consistent with similar studies conducted in other regions, indicating access to outpatient behavioral health care is limited despite existing ACA regulations. This suggests a need for

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Primary Presenter: **Lauren Winsauer**

Project Title: *Assessing Social Determinants of Health in the Emergency Department*

Primary Mentor: Roberta Capp

Thematic Area: Public Health and Epidemiology

Abstract:

**Background:** The U.S. "Healthy People 2020" campaign highlights the importance of understanding social determinants of health (SDH).

**Objective:** We evaluated the 1) feasibility of conducting socio-health screenings in the ED, 2) prevalence of two types of SDH (economic and health care access), and 3) desire of patients to be linked with community resources.

**Methods:** Cross-sectional study of adults (aged 18-80 years) with public (Medicaid/Medicare) or no insurance, presenting to a large, urban, academic ED. From June to August of 2014, thirteen trained Student Patient Navigators (SPNs) administered socio-health screening surveys in the ED from 11 am – 5 pm, seven days a week. The surveys were designed to identify economic and health care access SDH, as defined by the "Healthy People of 2020. We used a multivariate logistic regression analysis to determine the association between patient characteristics and the presence of one or two SDHs.

**Results:** 454 of 646 patients (70%) agreed to complete the survey. The mean age was 42 years, 246 (54.2%) were females, 279 (61.5%) of patients had ≥1 chronic diseases, and 89% of patients identified at least one SDH. Approximately 6.5 out of 10 patients with 2 SDH expressed interest in being linked with community resources that could address their needs.

**Conclusions:** It is feasible to conduct socio-health screenings in the ED and a large proportion of patients who use the ED identify at least 1 SDH. A little over half of patients with 2 SDH wanted to be linked with community resources.

Primary Presenter: **Rachel Wojcik**

Project Title: *Knowledge, Attitudes, and Practices Surrounding Exclusive-Breastfeeding at Dhulikhel Hospital, Nepal*

Primary Mentor: Jennifer Bellows

Thematic Area: Global Health

Abstract:

Background Nepalese children under five years of age have some of the highest stunting and malnutrition rates amongst developing countries. While there are many factors that contribute, . The World Health Organization recommends EBF for the first six months of life and the introduction of breast-milk within one hour of delivery. While women in resource-limited settings typically agree that breastfeeding a child is important, many are unaware of the WHO's breastfeeding guidelines and breastfeeding benefits. This study was conducted to determine the Knowledge, Attitudes, and EBF Practices of pregnant Nepalese women attending the antenatal clinic of Dhulikhel Hospital

Methods The quantitative questionnaire was created based on a survey used to evaluate barriers to exclusive breastfeeding in Zimbabwe. Demographic information was added as well as questions based on the Behavioral Theory Model. The survey was reviewed for cultural sensitivity, clarity of questions, and was then piloted with pregnant women at the antenatal clinic. After translation into Nepali, the survey was administered by Nepali research assistants to pregnant women on a voluntary basis. The collected data was stored into REDCaps for analysis.

Results Knowledge of EBF was minimal with only 17% of survey respondents (N=53) acknowledging that they had heard of EBF. Many thought they would not be able to produce enough breastmilk (N=108, 36%). How women fed their babies could be influenced by healthcare workers advice (N=267, 89%), but women reported not feeling pressure from family or community member to feed their babies a certain way. The majority of women work as housewives (N=216, 72%) and feel that would have enough time during the day to breastfeed (N=246, 82%).

Conclusions The majority of survey participants were not aware of exclusive-breastfeeding or its importance and utilized various feeding methods “ breastfeeding, animal milk, Lito, etc. “ during their infants first six months of life. It is essential to train healthcare professionals to educate women about the benefits of EBF during their antenatal visits and at following pediatric visits.

Primary Presenter: **Matthew Wood**

Project Title: *Decision Making in Children with Complex Medical Problems: A Qualitative Survey*

Primary Mentor: David Fox

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

**Objectives:** To understand parents decision process around feeding and nutrition decisions for medically complex children to support the development of a decision support tool for gastrostomy tube insertion.

**Methods:** A trained qualitative researcher conducted 20 semi-structured interviews with parents who had made feeding-related decisions and had been offered a gastrostomy tube for their child. Parents were recruited from a hospital-based complex care clinic at a major tertiary care center and were included if their child had significant nutritional concerns that had been treated with a gastrostomy tube, a nasogastric tube, or nutritional supplements or feeding thickeners for aspiration prevention. We included families of children who had a G-tube and those who did not to reduce bias toward one treatment strategy. The interview guide included thematic exploration of (1) the support that families used or needed during the decision process; (2) parent experience with medical decision making; and (3) the effect of the parent “child relationship on the decision process. All interviews were audiorecorded then coded using ATLAS.ti software for analysis using a hermeneutic editing style.

**Results:** Many parents discussed the importance of a spouse or partner in helping to make decisions about feeding. They also described the value of peer support from other parents who had similarly medically complex children or who had undergone a gastrostomy tube. Speaking to others, neighbors or extended family, without the shared experience of caring for a medically complex child was not helpful. Families described decisions about nutrition and feeding, in particular the G-tube decision, in three distinct ways based upon locus of control: (1) MD control (œtake the doctors advice), (2) Parent Control (œlearning how to make decisions on your own), and (3) a shared locus (œlisten to the doctor, but do your own research). More experienced families were more likely to prefer a parent or shared control style. With regard to serving as a proxy decision maker for a child, our parents struck a strong altruistic tone of putting the childs interests first above their own. Parents used words like œunique, œdelicate, œcomplex and fragile to describe their medically complex children, and saw themselves in the role of a protector or advocate for their children.

**Conclusions:** Parents of children who are medically complex recognize that with time they have become more experienced and better decision makers. Encouraging families to identify and use available peer supports, secure a trusted medical team, and establish a decision making strategy or philosophy reflecting the familys goals for the child may be useful to families in these settings.

Primary Presenter: **Allison Wood**

Project Title: *The long-term effect of complementary feeding with different macronutrient quantities on body composition in young children*

Primary Mentor: Nancy Krebs

Thematic Area: Clinical Science

Abstract:

Abstract

Objective

This study sought to assess whether high-protein complementary foods consumed during infancy may influence obesity trajectory in early childhood.

Methods

Participants from a primary study were contacted and asked to participate in this follow-up study (n=12 of original 42 were able to participate). Anthropometric measurements and Dual-energy X-ray Absorptiometry (DXA) were used to assess growth and body composition. Both qualitative and quantitative food questionnaires were used to assess dietary habits.

Results

There was no statistically significant difference in growth or body composition in early childhood between the two primary complementary feeding groups as assessed by anthropometric measurements and DXA scan.

Conclusions

This study was limited by sample size but suggests that high-protein complementary foods in infancy are not deterministic for longer-term health outcomes in early childhood with regards to growth and adiposity. Further study is needed.

Primary Presenter: **Andrew Xu**

Project Title: *ERCP with Balloon Dilation Alone or Balloon Dilation with Stenting for*

*Dominant Strictures in Patients with Primary Sclerosing Cholangitis*

Primary Mentor: Samuel Han

Thematic Area: Clinical Science

Abstract:

Primary sclerosing cholangitis (PSC) is a chronic disease of the liver resulting in inflammation and fibrosis of the intrahepatic and extrahepatic bile ducts, which can lead to development of a dominant stricture (DS) manifested by jaundice, pruritus, right upper quadrant pain, increasing LFTs and cholangitis. Endoscopic therapy is often pursued to relieve these symptoms, primarily via balloon dilation or stenting. As few studies have compared the two techniques, this study aims to evaluate the clinical success and safety of both techniques.

Primary Presenter: **James Yarovoy**

Project Title: *Bacteremia risk factors differ between MSSA and MRSA bacteremia: a retrospective cohort study.*

Primary Mentor: Andrew Monte

Thematic Area: Clinical Science

Abstract:

**Background.** *S. aureus* bacteremia has a mortality of 20-30%. The literature suggests that patients with methicillin-sensitive *S. aureus* (MSSA) bacteremia have improved outcome with early beta-lactam therapy. While traditionally methicillin-resistant *S. aureus* (MRSA) was hospital-acquired, it has recently become a community-acquired organism. It can be difficult for ED physicians to determine which patients with suspected bacteremia are more likely to have MSSA and should thus be treated with a beta-lactam. We sought to identify factors that predict MRSA versus MSSA bacteremia.

**Methods.** This was a retrospective cohort study of community-onset *S. aureus* bacteremia cases seen in the ED at Denver Health Medical Center during 2013-2015. Cases were identified from the microbiology lab blood culture log. Community-onset bacteremia was defined as blood cultures positive within 2 days of hospital admission. We extracted clinical factors via chart review. Univariate analysis was performed and a logistic regression model was constructed. Factors with a univariate p-value <0.3 were considered for the multivariate model. Odds ratios and 95% CIs were calculated for factors in the multivariate model. We controlled for co-morbid disease using Elixhauser comorbidity scoring.

**Results.** 135 patients (MRSA, n=43; MSSA, n=92) with community-onset *S. aureus* bacteremia were identified. Patients with MRSA bacteremia were younger (OR 0.5, 95%CI 0.4-0.7, p<0.0001). They were more likely to have a history of MRSA infection or colonization (OR 8.9, 95%CI 2.7-29.7, p<0.0001), a history of IV drug use (OR 2.383, 95%CI 1.004-5.659, p=0.05), higher Elixhauser comorbidity score (OR 1.4, 95%CI 1.1-1.7, p=0.01). The two groups were not significantly different in terms of prior *S. aureus* bacteremia, history of diabetes, renal, cardiac or rheumatic disease, malignancy, HIV infection, history of orthopedic medical device, and suspected sources of infection. We found no significant difference in A1C values, baseline creatinine, or bacteremia duration between the two groups.

**Conclusions.** Prior MRSA infection, history of IV drug use, and more co-morbid disease are associated with a higher likelihood of developing MRSA bacteremia. Early treatment with optimal antibiotics was not associated with a shorter duration of bacteremia, although this analysis is limited by a small sample size.

Primary Presenter: **Michael Ziemke**

Project Title: *Reduced Smad4 expression and DNA topoisomerase inhibitor chemosensitivity in non-small cell lung cancer*

Primary Mentor: Stephen Malkoski

Thematic Area: Clinical Science

Abstract:

Objective: Smad4 is a tumor suppressor that transduces transforming growth factor beta signaling and regulates genomic stability. We previously found that Smad4 knockdown in vitro inhibited DNA repair and increased sensitivity to DNA topoisomerase inhibitors. In this study, we assessed association between reduced Smad4 expression and DNA topoisomerase inhibitor sensitivity in human non-small cell lung cancer (NSCLC) patients and evaluated the relationship between genomic alterations of Smad4 and molecular alterations in DNA repair molecules.

Materials and Methods: We retrospectively identified NSCLC patients who received etoposide or gemcitabine. Chemotherapeutic response was quantified by RECIST 1.1 criteria and Smad4 expression was assessed by immunohistochemistry. Relationships between Smad4 mutation and DNA repair molecule mutations were evaluated using publically available data.

Results: We identified 28 individuals who received 30 treatments with gemcitabine or etoposide containing regimens for NSCLC. Reduced Smad4 expression was seen in 13/28 patients and was not associated with significant differences in clinical or pathologic parameters. Patients with reduced Smad4 expression had a larger response to DNA topoisomerase inhibitor containing regimens than patients with high Smad4 expression (-25.7% vs. -6.8% in lesion size,  $p=0.03$ ); this relationship was more pronounced with gemcitabine containing regimens. The overall treatment response was higher in patients with reduced Smad4 expression (8/14 vs 2/16  $p=0.02$ ). Analysis of data from The Cancer Genome Atlas revealed that Smad4 mutation or homozygous loss was mutually exclusive with genomic alterations in DNA repair molecules.

Conclusions: Reduced Smad4 expression may predict responsiveness to regimens that contain DNA topoisomerase inhibitors. That Smad4 signaling alterations are mutually exclusive with alterations in DNA repair machinery is consistent with an important role of Smad4 in regulating DNA repair.