ANNUAL STUDENT MSA CAPSTONE PRESENTATIONS

March 4, 2022

ANSCHUTZ MEDICAL CAMPUS

VIRTUAL

Poster Sessions

Session 1: 1:00 pm – 2:00 pm

Session 2: 2:00 pm – 3:00 pm

Session 3: 3:00 pm – 4:00 pm

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

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

Poster Session Judges

The organizing committee wishes to acknowledge their appreciation 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!

Douglas Adams	Cory Dunnick	Emily Malgor	Setareh Salehi Omran
Meredith Alston	Marisa Echaniz	Jim Maloney	Katherine Sauder
Marsha Anderson	Sarah Faubel	Leana May Moser	Irene Schauer
Yael Aschner	Lindsay "Shelley" Forbes	Julie McMurry	Deb Seymour
Natarajan Balasubramaniyan	Elizabeth Gillespie	Robert Meguid	Allison Shapiro
Eric Ballon-Landa	Daniel Goldberg	Tamra Mohs	Trevor Steinbach
Alex Barker	Patricia Heyn	Kristen Nadeau	Ellie Svoboda
Amber Berning	Paula Hoffman	Anna Neumeier	Douglas Taren
Manisha Bhide	Samantha Holden	Melissa New	Aryn Taylor
Benjamin Bitler	Peter Hountras	Lindsay Nicholson	Meredith Tennis
Meredith Bone	Nicole Kelp	Susan Niermeyer	John Tentler
Erin Bredenberg	Jessica Kendrick	Bryan Park	Caroline Tietbohl
Jim Bridges	Vijaya Knight	Jennifer Patnaik	Suhong Tong
Joseph Brzezinski	Vijaya Knight	Wei Perng	Charles Van Hook
Blaz Bush	Aurelie Ledreux	Allan Prochazka	Erin Vipler
Christine Chan	David Lehman	Michael Puente	Krista Walker
Michelle Clementi	Kelsey Lesteberg	Christopher Quinn	Jessica Walker
Caleb Doll	Steven Lewis	Christie Reimer	Eric Zacharias
Anna Dondzillo	Suzhao Li	Dan Resnick-Ault	
Lyndsey DuBose	Emily Lindley	Jennifer Romanowicz	
Julie Dunn	Jeremy Long	Sarah Rowan	

Primary Presenter: Aaron Kian

Project Title: Sagittal Craniectomy with Biparietal Morcellation: Outcome Analysis of Age at Surgery and Extended Techniques

Primary Mentor: Brooke French

Secondary Mentor(s):

Thematic Area: Clinical Science

Abstract:

Introduction: To investigate the outcomes of sagittal craniectomy with biparietal morcellation (SCBM) for the treatment of sagittal synostosis with regard to age at surgery.(2)

Materials/Patients: All 83 patients who underwent SCBM at University of Colorado School of Medicine at Children's Hospital Colorado and who had pre and post-operative 3D images are the subjects of this report.

Methods: This is a retrospective non-randomized investigation of demographic and clinical characteristics with comparison of two age groups, <6 months and ‰¥ 6 months at time of surgery. SCBM with or without forehead remodeling was undertaken for correction of sagittal craniosynostosis. 3D images morphometrically analyzed. Association between age at surgery and change in cephalic index (CI) is examined by linear model. Outcome measures are change in CI and Whitaker scores

Results: The average change in CI for patients <6 months at of age at surgery was 8% versus 4% for those ‰¥ 6 months. Younger patients tended to undergo standard operation, whereas, older patients more commonly had extended morcellation anterior to the coronal sutures and remodeling of the forehead.

Discussion: SCBM led to increased CI, although the effect was less in patients who underwent surgery at 6 months or older. Improvement in CI in the older group may be partly attributed to more extensive surgery on the anterior cranium. Overall 79% of patients received a Whitaker score of 1.

Primary Presenter: Aaron Sadowsky

Project Title: Indicators of Post-Operative Intraocular Pressure Elevation after Naïve Fluocinolone Acetonide Surgical Implantation

Primary Mentor: Alan Palestine

Secondary Mentor(s):

Thematic Area: Clinical Science

Abstract:

Purpose: To determine factors conferring an increased risk of developing ocular hypertension secondary to the fluocinolone acetonide (FA) sustained-release surgical implant (Retisert).

Design: Retrospective, observational case series.

Methods: Patients with a history of chronic noninfectious posterior uveitis undergoing naïve surgical FA implantation from 2007 to 2018 at the University of Colorado were studied. Patient demographics and multiple clinical measures were noted one year before and after FA implantation.

Results: Twenty-nine eyes of 21 patients were studied. The median age experiencing an IOP rise vs median age experiencing no IOP rise post-FA implantation was 27.0 and 54.0 years old, respectively (p = .01). A pre-FA implant risk factor of needing future glaucoma surgery after FA implantation is prior to maximum IOP (p = .02). Conclusions: A risk factor of elevated post-FA implantation IOP includes younger age. A potential risk factor for glaucoma surgery after FA implantation was higher maximum IOP before FA implantation.

Primary Presenter: Aaron Smoroda

Project Title: A One-Step Catheter Over Needle System Compared to a Single Shot Nerve Block for Shoulder Surgery

Primary Mentor: Nathan Clendenen

Secondary Mentor(s):

Thematic Area: Clinical Science

Abstract:

Background and objectives: Catheters for peripheral nerve blockade can offer advantages over a single shot technique such as prolonged analgesia, but placing catheters may require additional time which can limit routine implementation before surgery. A one-step catheter over needle system potentially reduces catheter placement procedural time and therefore could expand access to continuous peripheral nerve blockade.

Methods: We performed a study of 40 sequential patients receiving a single shot peripheral nerve block for elective shoulder surgery with either a one-step catheter over needle system (n = 20) or a traditional single shot block needle (n = 20). The primary outcome of the study was the total procedure time. Secondary outcomes included the incidence of complications and the effect of learning.

Results: We observed a statistically significant, but clinically insignificant, increase in procedure time with the catheter group compared to the single shot block needle group (2.1 minutes versus 1.4 minutes, p = <0.001). Using a linear mixed model, we noted a significant association between block type and placement time, which was increased in the catheter group by 35 seconds, 95% CI [15 €" 56]. We did not observe a significant learning effect when controlling for procedure sequence. All the blocks provided adequate analgesia and there were no complications associated with peripheral nerve blockade in either group.

Conclusions: A one-step catheter over needle system results in a statistically significant increase in nerve block procedure time, which is unlikely to be clinically consequential, compared to a nerve block using a traditional single shot block needle.

Primary Presenter: Abigail Leibowitz

Project Title: Association Between Prison Crowding and COVID-19 Incidence Rates in Massachusetts Prisons, April 2020-January 2021

Primary Mentor: Brian Dwinnell

Secondary Mentor(s):

Thematic Area: Public Health and Epidemiology

Abstract:

IMPORTANCE: COVID-19 incidence and mortality are higher among incarcerated persons thanin the general US population, but the extent to which prison crowding contributes to theirCOVID-19 risk is unknown.

OBJECTIVE: To estimate the associations between prison crowding, community COVID-19 transmission, and prison incidence rates of COVID-19.

DESIGN, SETTING, AND PARTICIPANTS: This was a longitudinal ecological study among all incarcerated persons in 14 Massachusetts state prisons between April 21, 2020, and January 11, 2021.

EXPOSURES: The primary exposure of interest was prison crowding, measured by (1) the size of the incarcerated population as a percentage of the prison's design capacity and (2) the percentage of incarcerated persons housed in single-cell units. The analysis included the weekly COVID-19 incidence in the county where each prison is located as a covariate.

MAIN OUTCOMES AND MEASURES: The primary outcome was the weekly COVID-19 incidence rate as determined by positive SARS-CoV-2 tests among incarcerated persons at each prison over discrete 1-week increments.

RESULTS: There was on average 6876 people incarcerated in 14 prisons during the study period. The median level of crowding during the observation period ranged from 25% to 155%of design capacity. COVID-19 incidence was significantly higher in prisons where the incarcerated population was a larger percentage of the prison's design capacity (incidence rate ratio [IRR] per 10-percentage-point difference, 1.14; 95%CI, 1.03-1.27). COVID-19 incidence was lower in prisons where a higher proportion of incarcerated people were housed in single-cell units (IRR for each 10-percentage-point increase in single-cell units, 0.82; 95%CI, 0.73-0.93). COVID-19 transmission in the surrounding county was consistently associated with COVID-19 incidence in prisons (IRR [for each increase of 10 cases per 100 000 person-weeks in the community], 1.06; 95%CI, 1.05-1.08).

CONCLUSIONS AND RELEVANCE: This longitudinal ecological study found that within 14 Massachusetts state prisons, increased crowding was associated with increased incidence rates of COVID-19. Researchers and policy makers should explore strategies that reduce

prison crowding, such as decarceration, as potential ways to mitigate COVID-19 morbidity and mortality among incarcerated persons.

Primary Presenter: Adam Panzer

Project Title: Improving Transitions-of-Care Training for Hospital Medicine Acting Interns

Primary Mentor: David Klimpl

Secondary Mentor(s):

Thematic Area: Clinical Science

Abstract:

Background: "Transitional care" has been defined as a set of actions designed to ensure the coordination and continuity of health care as patients transfer between different levels of care within the same location. As patients prepare to move from the hospital to other settings, failing to make adequate discharge arrangements can lead to costly and unnecessary hospital readmissions, preventable adverse events, and drug-related errors. While the TOC literature becomes ever more precise about what constitutes a good transition and how they may be achieved in different contexts, there persists a relative paucity of data informing what TOC skills should be expected of medical trainees at different levels and how best to actively teach TOC skills and concepts.

Hypothesis/Aim: I hypothesize that a TOC curriculum built into 4th year IM acting internships (Ais) or electives that incorporate self-study, observed practice, post-discharge follow-up, and personal reflection would meet these criteria. Further, I hypothesize that the practicum involved in such a curriculum could be a means of actively involving students in the improvement of patients' experience of TOC as they discharge from the hospital and their care. Our aim is to pilot a 4th year IM elective TOC curriculum within the CUSOM Hospital Medicine AI that will 1) improve students appreciation of TOCs as critical moments in patients' long term trajectories and 2) teach students evidence-based skills that increase the likelihood of safe and effective TOCs.

Anticipated Outcomes: Our primary outcome measures that will inform satisfaction of our aims will be improvement of at least 65% of student's self-rated confidence in different knowledge areas and skills related to TOCs (e.g. TOC risk factors and ability to perform medication reconciliation) and >65% of students achieving "Expected" or "Above Expected" in feedback from attendings on their final observed discharge planning encounter.

Future Directions: As the curriculum develops, we hope to Incorporate patient feedback into its design through TOC assessment using a standard measure such as the Care Transitions Measure. Assuming success of this iteration, reasonable expansions would include bridges from earlier phases of IM clinical work in student's third year and incorporation of interprofessional TOC education alongside pharmacy, social work, and APP students.

Primary Presenter: Akaysha Joiner

Project Title: DAWN Clinic Surgical/Procedural Needs Assessment

Primary Mentor: Cristos Ifantides

Secondary Mentor(s):

Thematic Area: Global Health

Abstract:

The Dedicated to Aurora's Wellness and Needs (DAWN) Clinic serves the immigrant, uninsured, and underserved population of Aurora. The majority of their services focus on providing primary care screenings, a variety of specialty appointments, and connecting patients with resources to meet various needs (including health insurance, housing, and food stamps). Currently, the DAWN clinic is unable to provide procedures or surgeries at reduced costs for this patient population who is extremely vulnerable, especially if they are unable to obtain health insurance. This is a retrospective needs assessment study to determine the number of DAWN clinic patients needing surgical/procedural treatment. Initially, we focused on ophthalmology needs. This data was used to put together a proposal to ophthalmology providers to set up methods and resources for providing these treatments. Eventually, we hope to use the established ophthalmology relationship and protocol as a template to expand to other specialties at this clinic.

The ultimate goal is to create a working surgical/procedural unit that will be a reliable resource for the DAWN clinic. Data was collected via chart review in the electronic medical record system, Practice Fusion, then later, EPIC. We were looking at the assessment and plan of charts for patients seen on specialty nights (by Ophthalmology team specifically) from April 2016-April 2018 for two years of data collection. Data points include diagnoses (eye-related and risk factors/comorbidities, such as diabetes), treatment needed, treatment received, and demographic information. During this time period, we identified roughly 120 patients seen for ophthalmological services, about 20% of which needed procedures. Our goal was to identify the number of patients with surgical/procedural needs, the specific surgeries/procedures needed, and the frequency of these needs. By determining that a need did in fact exist, we were able to build a protocol for working with community providers to meet the need for cataract surgery and laser photocoagulation for diabetic retinopathy. There are no conflicts of interest to report, and COMIRB was not needed due to the nature of this project.

Primary Presenter: Alexander Linse

Project Title: Docs on TikTok: The risks and benefits physicians experience on social media.

Primary Mentor: Mark Reid

Secondary Mentor(s):

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

Background: The social media application TikTok has quickly gained popularity, with over 1.1 billion users worldwide after only two years. There is a growing community of physicians and other healthcare workers posting videos on the application, serving as an additional avenue to enhance medical education, improve patient care, and expand career opportunities. Given the limited literature on the physician experience creating content on social media, there is little guidance for physicians interested in developing medical social media accounts. Our objective is to gain insight into the experiences of physician 'TikTok-ers,' while delineating potential risks and benefits to healthcare recognized during their own social media engagement.

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

Results: Overall there were 55 physicians who completed the questionnaire across 20 unique specialties. Approximately 24% of the respondents report creating medical content on social media for less than one year, with over 75% for fewer than five years. 76% of physicians viewed TikTok having positive impacts on the medical field with benefits including opportunities in education, community engagement, creative outlet discovery, and patient empowerment. An overall net-negative impact of TikTok on healthcare was reported by 2%. The risks identified by the surveyed physicians included potential HIPAA violations, professionalism concerns, controversial medical data, and blurred patient boundaries. The remaining 22% saw no overall impact on medicine. There was a statistically significant difference in which the benefit of being on TikTok was on average greater than the risks associated with participation ($p=<0.001$).

Conclusion: Physicians are making their presence known on social media, and TikTok provides no exception. This has created additional opportunities to beneficially engage with an online, patient-based audience. According to surveyed physicians, the benefits provided a stronger positive impact on their careers when compared with risks, thus paving ways in which near unanimous social media use in the community can help foster physician-patient relationships. This suggests social media platforms may provide physicians innovative ways to educate, learn, and improve the quality of medical care delivered.

Primary Presenter: Alexander Shu

Project Title: Clinical Outcome Differences Between Single and Multi-Staged Transtibial Amputations

Primary Mentor: Kenneth Hunt

Secondary Mentor(s): Daniel Moon

Thematic Area: Clinical Science

Abstract:

Introduction: Transtibial amputations are often necessary when patients experience irreversible lower extremity tissue damage. Current amputation methods incorporate either a single-stage amputation with primary wound closure or a multi-stage amputation. A multi-stage amputation consists of an initial amputation, typically performed at a more distal site, followed by a second more proximal amputation with stump formalization. The reported advantages of multi-staged amputations include decreased muscle retraction and reduced spread of infection/necrosis, which allows for reduced failure rates and lower rates of stump revision. However, multi-stage amputations are associated with increased monetary costs, time spent in the hospital, and clinical resources used over single-stage amputations. This study assesses if multi-staged amputations provide improved clinical outcomes over single-stage transtibial amputations and what patient groups it may benefit.

Methods: We conducted a retrospective study of individuals who received transtibial amputations at our institution from January 1, 2015 through December 31, 2020. Exclusion criteria included patients with less than six months of follow-up, history of malignancy, presence of congenital limb deformity, revision amputation without a record of primary amputation, and traumatic amputations. We reviewed the charts of patients meeting our inclusion criteria (n=118), and collected data on demographics, comorbidities, labs, indications for amputation, complications, and functional outcomes. Our sample size of 118 patients provided more than 80% power to reject the null hypothesis using parameters from a previous study. Chi-square or student's t-tests were used to test for group differences in demographics and clinical characteristics. Multivariable Cox proportional hazards regression analyses were used to identify surgical and patient characteristics related to the hazard of a complication, revision to a higher level, and timing of prosthetic fitting within the first post-operative year.

Results: Our query returned 118 total patients, of which 40 underwent a multi-staged amputation based on the surgeon's typical amputation preferences. Age, pre-operative WBC (white blood cell) count, history of prior amputation, presence of diabetes, insurance type, and presence of osteomyelitis were unequally distributed across groups. These variables were considered potential confounding variables in our analyses. In the multivariable model, an increase in pre-operative WBC count and a multi-staged procedure were associated with a significantly higher hazard of complications (p=0.04 and p= 0.004, respectively). There were no significant

associations for multi-staged amputations to increase the hazard of revision amputation or increase the likelihood of prosthetic fitting within one post-operative year.

Conclusion: Based on these results, multi-staged transtibial amputations do not demonstrate a significant improvement in functional outcome and may suggest a higher level of complication risk compared to single-staged amputations. As these outcomes do not control for disease severity, more analyses will be required to determine the extent to which these results may be applicable for electively staged amputations compared to elective single-stage amputations.

Primary Presenter: Alexis Hunter

Project Title: Law enforcement and criminal justice professionals' knowledge and attitudes towards medication assisted treatment for opioid use disorder in rural communities

 Primary Mentor: Linda Zittleman

Secondary Mentor(s):

Thematic Area: Public Health and Epidemiology

Abstract:

Context: There is a lack of medication assisted treatment (MAT) in prisons and jails for opioid use disorder (OUD), despite leading health organizations' recommendations. Drug overdose death rate in individuals released from jail is three- to eightfold that the general population. Objective: As part of the Implementing Technology and Medication Assisted Treatment Team Training in Rural Colorado project (IT MATTTRs), explore rural law enforcement and criminal justice system professionals' knowledge and beliefs related to OUD and MAT and perceived barriers to MAT in jail and prison settings. Study Design: Descriptive study using cross-sectional quantitative survey data and qualitative data using key informant interviews. Setting: 16 rural counties in the High Plains Research Network in (eastern Colorado). Population: Sheriffs, county and district court judges, police chiefs, probation officers, and staff. Outcome Measures: Perception of problem of OUD in community, knowledge of OUD and MAT with buprenorphine, awareness of MAT-related policy and procedures, and provision of and barriers to MAT in local jail. Results: Surveys were completed by 45 respondents (71% response rate). Of these, 66% reported that opioid pain medication abuse is a serious problem within their community. However, 52% reported not knowing if MAT with buprenorphine helps reduce crime and re-incarceration, 49% did not know if screening for OUD occurs in the judicial system, and 32% did not know if MAT with buprenorphine is available in the local jail. While 77% have referred or would consider referring people with OUD for MAT, only 35% know where to refer people for MAT with buprenorphine. Common perceived barriers to MAT in jails and prisons included lack of local providers and insufficient funding. KI interviews were conducted with 13 criminal justice system professionals. Regional variation in frequency of contact with people with opioid use disorder was found. There were positive opinions regarding MAT with some worries around funding and substituting one medication for another. Conclusions: This study helps identify challenges and opportunities for partnerships between the law enforcement, criminal justice system, and health professionals in rural, underserved communities. A thorough understanding of the neurobiology of opioid dependence and addiction and MAT coupled with improved communication with health care providers may strengthen criminal justice system professionals' role in combating OUD in rural communities.

Primary Presenter: Alison Abele

Project Title: Antenatal Mesenchymal Stromal Cell Extracellular Vesicle Treatment Preserves Lung Development in A Model of Bronchopulmonary Dysplasia due to Chorioamnionitis

Primary Mentor: Steven Abman

Secondary Mentor(s):

Thematic Area: Basic Biomedical Science

Abstract:

Background: Antenatal stressors such as chorioamnionitis (CA) increase the risk for bronchopulmonary dysplasia (BPD). Studies have shown that experimental BPD can be ameliorated by postnatal treatment with mesenchymal stromal cell-derived extracellular vesicles (MEx). However, the antenatal efficacy of MEx to prevent BPD is unknown.

Objective: To determine whether antenatal MEx therapy attenuates intrauterine inflammation and preserves lung growth in a rat model of CA-induced BPD. Methods: At embryonic day (E)20, rat litters were treated with intra-amniotic injections of saline, endotoxin (ETX) to model chorioamnionitis, MEx, or ETX plus MEx followed by cesarean section delivery with placental harvest at E22. Placental and lung evaluations were conducted at day 0 and day 14, respectively. To assess the effects of ETX and MEx on lung growth in vitro, E15 lung explants were imaged for distal branching. Results: Placental tissues from ETX-exposed pregnancies showed increased expression of inflammatory markers NLRP-3 and IL-1ÃŸ and altered spiral artery morphology. Additionally, infant rats exposed to intrauterine ETX had reduced alveolarization and pulmonary vessel density (PVD), increased right ventricular hypertrophy (RVH), and decreased lung mechanics. Intrauterine MEx therapy of ETX-exposed pups reduced inflammatory cytokines, normalized spiral artery architecture, and preserved distal lung growth and mechanics. In vitro studies showed that MEx treatment enhanced distal lung branching and increased VEGF and SPC gene expression.

Conclusions: Antenatal MEx treatment preserved distal lung growth and reduced intrauterine inflammation in a model of CA-induced BPD. We speculate that MEx may provide a novel therapeutic strategy to prevent BPD due to antenatal inflammation.

Primary Presenter: Allison Moore

Project Title: Medical Response and Factors Leading to Violent Death in the US Incarcerated Population

Primary Mentor: Catherine Velopulos

Secondary Mentor(s):

Thematic Area: Public Health and Epidemiology

Abstract:

Background: This study aims to characterize trauma-associated deaths in the United States prison system. We hypothesize that incarcerated victims are less likely to receive appropriate medical care compared to the non-incarcerated.

Methods: We utilized 2015-2017 National Violent Death Reporting System data. Victims were classified by whether they were seen by emergency medical services, in the emergency room, or hospitalized prior to death, with the latter considered higher levels of care. Propensity score matching was used to compare highest level of care received by incarcerated versus non-incarcerated victims with similar age, sex, race/ethnicity, weapon type, and state where the incident occurred.

Results: Of 101,054 victims, 1229 (1.2%) were incarcerated at the time of fatal injury; 64.4% died by suicide. For suicide, the proportion of minority victims was higher in the incarcerated compared to the non-incarcerated population, but the opposite was true of homicide. Firearms were more commonly used in the non-incarcerated population. After Propensity score matching, we found that incarcerated victims received higher levels of medical care following suicide ($P < 0.001$) while there was no difference for homicide ($P = 0.28$). However, when only victims injured in public settings were included, we found that incarcerated homicide victims were less likely to receive hospital-based medical care.

Conclusions: Contrary to our hypothesis, overall, incarcerated victims received similar levels of medical care as compared to non-incarcerated victims following lethal injury. However, this fails to account for the highly supervised setting of prisons. Our findings reinforce that violence prevention methods should be tailored to specific populations.

Primary Presenter: Alysa Edwards

Project Title: Gender Disparities in Emergency Medicine Publications: 1991-2018

Primary Mentor: Sarah Rowan

Secondary Mentor(s): Jody Vogel

Thematic Area: Clinical Science

Abstract:

Background: Scholarly productivity in academic medicine, determined by measures including publication count, is often a factor in hiring, promotion, and retention decisions. Existing research has demonstrated a €œgender gap€⬚ in the academic medical literature across specialties that may influence how female academic physicians advance in their career. Limited research exists specific to the field of emergency medicine and the interaction between author degree, affiliation, region and author gender.

Objective: This study examined the gender of first and last authors published in four emergency medicine journals (Annals of Emergency Medicine, American Journal of Emergency Medicine, Journal of Emergency Medicine, and Academic Emergency Medicine) between 1991 and 2018. Secondary analysis assessed degree type, the association between author team composition and institutional affiliation, and author region.

Methods: All articles from selected emergency medical journals between 1991 and 2018 at three-year intervals were extracted from PubMed. Article title, type, year of publication, first and last author name, author degree(s), and first and last author affiliation information were documented for each article. Author gender was determined by name comparison to US Social Security Administration name-gender lists. When the author's gender could not be determined by comparison, gender was manually determined by searching the author's institutional website. Only articles containing original research from authors with US institutional affiliations were included.

Results There were 3417 articles included in the study with a total of 6764 authors. Female authors accounted for 19.3% of all physician authors, 23.2% of first authors, and 15% of last authors. Female authors were significantly more likely to be first authors than last authors (OR 1.72, CI: 1.49-1.98) and first authors were more likely to be female if publishing with a female last author (OR 1.5, 95%CI 1.25-1.8). The proportion of female authorship for first and last authors increased over the study period although there was not a significant trend for last authors in three of the four journals. There was a significant relationship between degree type and author gender for all authors ($\ddot{I}\ddagger 2$ - 366.57, p < 0.0001); female authors made up 19.3% of MDs, 20% of DOs, 37.2% of PhDs, and 47.8% of authors with other degrees. There were no significant relationships found between author gender and geographic region or shared institutional affiliation.

Conclusion: Between 1991 and 2018, female authorship of original research in four emergency medicine journals increased although the proportion of female last authors remained lower than the proportion of female physicians in the emergency medicine workforce. Female physicians were more likely to be first authors than last authors and female first authors were more likely to publish with a female last author. The gender gap in authorship was especially prominent for physicians compared to non-physician authors.

Primary Presenter: Alyssa Hill

Project Title: Loneliness in Substance Use Disorder Patients

Primary Mentor: Rebecca Mullen

Secondary Mentor(s):

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

Despite the serious implications of loneliness on health and wellbeing, little is understood about this experience across people with substance use problems. We know there is a connection between loneliness and ability for patients with substance use disorder to seek and stay in treatment that was apparent well before the COVID-19 pandemic.[2] However, this subject has not been studied in depth, and the COVID-19 pandemic laid bare the deep connection when community and support is not available to these patients.[1] It is important to understand the current connection between the degree of loneliness people experience and the connection to and impact on their ability to seek out and stay in treatment in order to provide these patients with better resources going forward. This qualitative study will be using a validated survey to assess the levels of loneliness that patients with substance use disorder in inpatient treatment are experiencing and how that impacts their treatment. I am currently nearly complete with interviewing patients, and still need to do data analysis.

Primary Presenter: Alyssa Shepherd

Project Title: Reducing Auto-inflammation: The Impact of T Cell Deficiency on Atherosclerosis

Primary Mentor: David Wagner

Secondary Mentor(s): Martin Yussman

Thematic Area: Basic Biomedical Science

Abstract:

Type 1 diabetes (T1D), a prototypic autoimmune disease, creates several serious complications of which atherosclerosis is the major co-morbid condition. Atherosclerosis is defined by arterial plaque deposition due to coagulation blood products, lipid deposition, and inflammation. The latter has been known for more than a decade but only recently have inflammatory mediators proven to be a beneficial target once traditional treatment has been exhausted. T-cell mediators associated with the CD40-CD154 inflammatory dyad are found in autoimmune diseases such as T1D and rheumatoid arthritis and may be a cause of the added atherosclerotic risk which these disease states maintain. This study seeks to explore the role of T cells in atherogenesis through the use of pro-atherogenic ApoE-/- mice bred to create T cell deficiency (ApoE-/- TCRa-/-) for analysis of the overall effect of T cells in atherogenesis. Mice are sacrificed at 8 months of age and dissected to obtain the aortas and hearts. The aorta is used for en-face Sudan IV staining analysis while serial aortic valve cross sections are used to characterize the lesion in terms of area and content. Analyses of aortic valve cross sections (A-D) and whole aortas (E-F) of this novel model not only demonstrated a significant reduction in overall plaque, but also revealed a change in plaque composition due to T cell deficiency. Future aims are to define the specific subset of pathogenic T cells.

Primary Presenter: Amelia Davis

Project Title: A Case-Based Approach Developed in COVID-19 for Training in Implementation of Crisis Standards of Care for Hospital Resource Allocation

Primary Mentor: Daniel Goldberg

Secondary Mentor(s): Phil Fung

Barbara Statland

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

Healthcare professionals receive training in ethical decision making, but the ability to morally implement and apply hospital policies around issues such as scarce resource allocation is a critical yet absent component of training. These cases were designed to train individuals on COVID-19 Crisis Standards of Care, especially ventilator allocation algorithms, in Colorado. The training was completed by 43 individuals who identified as members of Colorado hospital triage teams in the event of resource scarcity during the COVID-19 pandemic. A total of twelve unique participants completed the follow-up survey, eight within two months of training and four at a one-year follow-up for a total response rate of 28%. 42% of survey responders had previous experience with resource allocation. Average score for training usefulness was 4.5 (out of 5), and average confidence in implementation ability was 3.5 (out of 5). Overall themes for impact of the case-based training included: 1) facing reality, 2) solidification of knowledge, 3) logistical hurdles, 4) team building, and 5) moral distress. Areas for growth elucidated a desire for additional training and application to a real-life setting. There is a paucity of experience in addressing the ethics and issues of resource allocation in the healthcare field. Participants reflected that they found this training modality useful and felt it illuminated logistical and moral challenges in resource allocation. These materials, which can be utilized in future trainings with healthcare professional communities, provide hands-on logistical and ethical training regarding resource allocation.

Primary Presenter: Amir Ali Jaberizadeh

Project Title: Values and qualitative themes among patients in two clinical trials using a self-affirmation intervention

Primary Mentor: Stacie Daugherty

Secondary Mentor(s): Julie Maertens

Thematic Area: Public Health and Epidemiology

Abstract:

Background: Values affirmation interventions target stereotype threat and can improve patient-clinician communication among African American/Black (AAB) patients. Understanding values chosen, reasons these values are important, and value differences by race may uncover how values could be discussed during visits.

Objective: To understand patient values and how they differ among AAB, American Indians/Alaskan Natives (AI/AN) and White patients.

Design: Secondary data analysis using a multiple methods approach, including quantitative Poisson regression models and qualitative content analysis.

Participants: A convenience sample of 387 writing exercises were analyzed from two trials comparing a values affirmation or control writing exercise deployed before clinic visits. The sample included 153 non-Hispanic AAB, 181 White, and 53 AI/AN participants balanced by study site and intervention arm.

Interventions: Participants selected their most (intervention) or least (control) important values and explained the importance of these values to themselves (intervention) or others (control).

Approach: Multivariable Poisson models examined race as a factor in patients' probability of selecting each value, adjusting for age, gender, employment and marital status. Common themes were derived from transcribed writing exercises through qualitative content analysis.

Key Results: Relationships with friends and family, independence, and religion were important among all groups. Social relationships and religion were more important among AAB and AI/AN. Guiding behavior, managing stress, providing a source of inner strength or a sense of life meaning, and facilitating better life quality are themes derived for reasons values are important to patients.

Conclusions: Understanding patient values may help clinicians appreciate patient perspectives and improve patient-clinician communication.

Primary Presenter: Amy Rao

Project Title: Cerebral cryptococcomas: a systematic scoping review of available evidence to facilitate diagnosis and treatment

Primary Mentor: Carlos Franco-Paredes

Secondary Mentor(s):

Thematic Area: Clinical Science

Abstract:

Background: Recommendations for managing patients with cerebral cryptococcomas are scarce across multiple clinical guidelines. Due to the deficiency of high-quality data coupled with increasing number of at-risk patients, the purpose of this review is to describe the demographic characteristics, causative pathogen, intracranial imaging, surgical and/or pharmacological interventions, as well as outcomes of patients with cerebral cryptococcomas to improve recognition and management.

Methods: We conducted a scoping review in accordance with the PRISMA guidelines using PubMed and Web of Science. Reports were included if the following details were presented: 1) site of infection, 2) treatment details to at least include the specific antifungal therapy administered, if applicable, and 3) patient outcome.

Results: A total of 40 records representing 47 individual patients were included of which the median age was 48.5 years, 75% were male, and 60% reported a significant past medical, surgical, or social history. C. neoformans was isolated more often than C. gattii (74% vs 26%, respectively). Patients most often presented with headache, altered mental status and/or confusion, and vomiting occurring over a median of 30 days, though few were noted to have significant findings on physical examination. More than 50% of patients had a single cerebral cryptococcoma lesion, while perilesional edema was present in 73% of cases. Surgical intervention occurred in 49% of patients. An amphotericin B-based formulation was administered as €˜induction' therapy to 91% of patients but combined with flucytosine or fluconazole in only 58%, for an overall median of 42 days. Fifty two percent of patients received €˜maintenance' therapy for a median of 126 days, in which fluconazole was most often used. Corticosteroids were administered to approximately 30% of patients for a median of 31.5 days. Overall, mortality was 34%.

Conclusion: Based on our findings, management should include antifungal therapy for a minimum of 6 months with considerations for concomitant corticosteroids in the setting of perilesional edema as well as surgical intervention. Emphasis should be placed on providing well-documented treatment details in future case reports and series to allow for development of more concise evidence-based recommendations.

Primary Presenter: Anastasiya Trizno

Project Title: Optimal Nail Diameter to Medullary Canal (ND/MCD) Ratio in Diaphyseal Tibia Fractures Treated With Intramedullary Nailing

Primary Mentor: Jason Stoneback

Secondary Mentor(s):

Thematic Area: Clinical Science

Abstract:

Purpose: Up to 17% of diaphyseal tibia fractures result in delayed union. Most patients achieve excellent outcomes with intramedullary nailing and it is unknown why some experience delayed healing. The goal of our study was to assess potential risk factors that may influence fracture healing in these patients with an emphasis on the nail diameter to medullary canal (ND/MCD) ratio.

Methods: 1050 adult patients who underwent operative treatment of tibia fractures between 2006 and 2018 were retrospectively reviewed. Exclusion criteria were inadequate follow-up (<12 months), additional lower extremity fractures, additional hardware, and nondiaphyseal and pathologic fractures. All fractures were classified using AO/OTA and Gustilo-Anderson schemas. Postoperative AP and lateral radiographs were used to calculate the ND/MCD ratio. Regression analyses were used to identify demographic and clinical variables associated with complications. A receiver operating characteristic curve analysis was used to identify the ND/MCD ratio that best differentiated between subjects who developed a nonunion and those who did not.

Results: The majority of patients included in the study presented with 42B fracture type (50 of 95, 53%). 27 patients had open fractures and grade III was the most prevalent injury pattern (11 of 27, 41%). The cumulative incidence of complications was 29.5%. Complications included nonunion, delayed union, infection, valgus deformity, symptomatic hardware, and compartment syndrome. Nonunion was noted in 18 patients (19.0%). In the univariate analysis, prescription medication use (P = 0.0137), open fractures (P<0.0001), and a decrease in the ND/MCD ratio (P = 0.0425) were significantly associated with the development of a complication. The odds of a complication among open fractures were 10.1 times (95% confidence interval [CI]: 3.2 to 32.1, P<0.0001) the odds of a complication among closed fractures. ND/MCD ratio cutoff of 85% was associated with the highest area under the curve value (sensitivity = 44%, specificity = 79%) in an exploratory analysis differentiating between the subjects that developed nonunion and the ones that did not.

Conclusion: A large proportion of patients with tibia fractures smoke (38%) and have comorbidities (54%). Patients who sustain open fractures and those with lower ND/MCD ratios are at higher risk for complications. ND/MCD ratio of <85% should be avoided as it may lead to nonunion development.

Primary Presenter: Andrew Goodman

Project Title: Health Disparties in PrEP

Primary Mentor: Katherine Frasca

Secondary Mentor(s):

Thematic Area: Basic Biomedical Science

Abstract:

Background: Retention in HIV pre-exposure prophylaxis (PrEP) care and adherence to PrEP has been suboptimal, despite evidence that high adherence dramatically enhances PrEP's efficacy. A comprehensive PrEP Clinic with a retention specialist and clinical may impact patient's adherence and retention in in PrEP care.

Methods: A retrospective chart review was conducted of electronic medical records of patients in an academic PrEP Clinic between 6/2018 to 6/2019 for at least one visit for PrEP. Retention was defined as a medical or lab visit every three months +/- 30 days, as recommended by CDC guidelines. Adherence was calculated using a Medication Possession Ratio (MPR). Patient characteristics were compared for both retention and adherence using chi-squared tests, Fisher's exact tests, or regression analyses.

Results: 122 patients were identified by chart review, 91 had sufficient data for follow-up and were included in at least one analysis. The population was primarily cis gender MSM, 50% selfidentified as non-white race/ethnicity. Just under half (43%) of patients were classified as retained in care, consistent with larger studies. The retention analysis demonstrated that individuals who self-identified as gay were more likely to be retained than those who identified as heterosexual (53% vs. 18%, p=0.044). Though not statistically significant, African Americans were less likely to be retained (25%) vs. other racial/ethnic groups (50%). The adherence analysis found higher MPRs among individuals over age 35 vs. ages 18-24 (87% vs. 60%, p=0.02), and among those not reporting previous incarceration (83% vs. 53%, p = 0.008).

Conclusions: Despite comprehensive PrEP clinical care, heterosexual individuals and previously incarcerated individuals were less likely to be retained in PrEP care. The study found younger individuals are less likely to be adherent to PrEP, similar to other studies. Additional research should be conducted to determine what barriers may impede retention and adherence among these populations.

Primary Presenter: Andrew Ormsby

Project Title: The Effect of the COVID-19 Pandemic on Opioid Prescribing for Patients with Pleuritic Pain

Primary Mentor: Caitlin Dietsche

Secondary Mentor(s):

Thematic Area: Public Health and Epidemiology

Abstract:

Objective: We sought to understand opioid prescribing for COVID-19 positive and negative patients with pleuritic pain during the first wave of the pandemic. We hypothesized that patients without COVID-19 would be prescribed opioids more frequently intra-pandemic compared to pre-pandemic and postulated that COVID-19 patients would be prescribed opioids more frequently and at greater quantity than their peers.

Design: A retrospective observational analysis of electronic health record data.

Setting: A quaternary academic hospital from February through April 2020.

Participants: 1,400 of 3,169 adult inpatient hospitalizations involving pleuritic pain were included.

Main Measures: Frequency and average daily dose of opioid prescriptions were analyzed using logistic and linear regression. Opioid prescribing habits were compared pre- and intra-pandemic. Hypotheses and primary outcome measures were formulated pre-data collection.

Key Results: During the pandemic, COVID-19 patients were 15.77% less likely to be prescribed opioids compared to patients without COVID-19 (CI -8.98% to -22.56%, $P < 0.001$). Patients without COVID-19 were equally likely to be prescribed opioids pre- and intra-pandemic (95% CI -9.37% to 2.42%, $P = 0.248$). Odds of opioid prescription for COVID-19 patients was 0.44 (95% CI 0.08 to 0.80; $P < 0.001$). Within those given opioids, COVID-19 patients were prescribed 3.0% greater morphine milligram equivalents (MMEs) (95% CI 1.07 to 5.85%; $P < 0.001$).

Conclusion: During the first wave of the pandemic, COVID-19 patients with pleuritic pain were prescribed opioids less frequently than patients without COVID-19, while patients without COVID-19 were equally likely to be prescribed opioid pre- and intra-pandemic. On the other hand, COVID-19 patients treated with opioids were given greater daily MMEs due to the greater utilization of opioid infusions.

Primary Presenter: Andy Truong

Project Title: 24-hour Oral Morphine Equivalent Based Opioid Prescribing After Surgery - A Pilot Randomized Clinical Trial

Primary Mentor: Karsten Bartels

Secondary Mentor(s):

Thematic Area: Public Health and Epidemiology

Abstract:

Background: Opioids are commonly prescribed to women for pain control following Cesarean section. Given that Cesarean section is the most common surgical procedure in the United States, reducing opioid use to meet individualized requirements in this patient population can have a significant impact on decreasing unnecessary opioid prescriptions and encouraging non-opioid and non-pharmacologic forms of analgesia. Here, we hypothesized that basing post-discharge analgesic prescriptions on pre-discharge use recorded in the electronic medical record would reduce the amount of opioid medications prescribed while maintaining adequate post-operative pain control.

Methods: This randomized controlled trial was conducted in 55 female inpatients who underwent Cesarean section. Following IRB approval and after obtaining patient written informed consent, eligible patients with a 24-hour before-discharge opioid intake of 22.5 milligram morphine equivalents (MME) - the equivalent of 3 oxycodone 5 milligram tablets - or less were randomized into two groups. In the control group, at the time of writing the discharge prescription for a patient the provider received a control best practice alert (BPA) to consider prescribing the usual medications for pain management after discharge. In the intervention group, the provider was informed by the BPA prescription tool that a patient may be considered for a lower post-discharge opioid dose (no opioids for patients who did not take any opioids in the last 24 hours, and 10 oxycodone 5mg tablets [75 MME], for patients having taken less than 22.5 MME). Final medication choices and dosing decisions remained at the discretion of the treating provider. Surveys were administered to patients for each of the four weeks following discharge. Independent-Samples Mann-Whitney U Test was used to analyze total discharge MME after confirming a non-normal distribution of the primary outcome within groups (visual assessment and testing via Kolmogorov-Smirnov $p < 0.001$).

Results: There was no difference in the amount of opioids prescribed on discharge between the intervention group compared to the control group (62.8 vs 55.3 MMEs, $p = 0.65$). The majority of patients took non-steroidal anti-inflammatory drugs (NSAIDs) (92.5% vs 100%) and 100% of patients took acetaminophen predischarge. In the four weeks following discharge, patients continued to take NSAIDs (77.8% to 21.4%), acetaminophen (82.2% to 21.4%), and a lower amount of opioids (11.9 vs 15.0 MMEs, $p = 0.807$) than what they were prescribed on discharge. By week 4, 50% of patients reported having left over opioid pills.

Conclusions: Shortly after design and approval of this study, our labor and delivery ward instituted a protocol based on current recommendations for appropriate opioid prescribing on discharge and the use of multimodal analgesia including NSAIDs and acetaminophen. The impact of this quality improvement project is reflected by our findings. Yet, even at the current, more conservative level of opioid prescribing, a large proportion of leftover opioids were reported. Further studies are needed to determine the optimal approach for interventions that can decrease unnecessary opioid prescriptions while maintaining effective pain control.

Primary Presenter: Anessa Sax-Bolder

Project Title: Long-term Follow Up of Ileal Ureteral Replacement for Complex Ureteral Strictures: Single Institution Study

Primary Mentor: Dr. Ty Higuchi Higuchi

Secondary Mentor(s):

Thematic Area: Clinical Science

Abstract:

PURPOSE: Ureteral reconstruction continues to evolve to include less invasive techniques to successfully manage ureteral stricture. However, long, complex, obliterative and especially radiated ureteral strictures are not amneable to less invasive techniques and may require Ileal ureter interposition. We report our 16 year experience with ileal ureter interposition for complex ureteral stricture.

MATERIALS AND METHODS: Retrospective review of a single institution's ureteral reconstruction database was performed. Demographics, operative details, type of reconstruction, success rate, complication rate and length of follow-up were noted. Unilateral replacements utilized ileal ureteral interposition. Success rate was defined as no need for further open intervention.

RESULTS: Between 2003 and 2019, 188 ureteral reconstructions were performed, of which 46 required ileal ureter interposition. Of these 46 patients, 10 required bilateral reconstruction. Average age was 53 years, 26 (57%) were female. The average stricture length was 9.1 cm (2-20 cm). Stricture etiology included iatrogenic causes (n=24, 52%), radiation (n=12; 26%), vascular disease (n=3; 7%), and idiopathic retroperitoneal fibrosis (n=3; 7%). Forty-three surgeries were performed by open abdominal approach; 3 were performed robotically. The average length of operation was 412 minutes, blood loss 417 mLs and LOS was 10 days. At mean follow up of 4.4 years, overall success rate was 83%, with 17% (n=8) patients requiring subsequent major surgery (5 successful ureteral revision, 3 nephrectomy) and 11 (24%) patients experiencing a major complication.

CONCLUSIONS: In our long-term follow up of over 4 years, ileal ureteral interposition remains a successful option for complex ureteral strictures in properly selected patients.

Primary Presenter: Anika Suddath

Project Title: pH Extremes: An Ineffective Method of Opioid Destruction

Primary Mentor: Cristina Sempio

Secondary Mentor(s): Myron Yaster

Thematic Area: Basic Biomedical Science

Abstract:

Non-medical use of prescription opioids (e.g., abuse, misuse, addiction) is one of the most serious public health problems in the United States, resulting in unprecedented rates of accidental deaths and opioid-related treatment admissions. Multiple studies have documented strong relationships among the increase in pain assessment, opioid sales volume, opioid consumption, and opioid associated morbidity and mortality. Unfortunately, a significant number of prescribed opioids are neither consumed nor discarded, and the left-over opioids have become a primary source (€œgateway drug€) for teenage and young adult drug misuse and addiction. Our aim is to study the stability of two of the most commonly prescribed opioids, hydrocodone and oxycodone, under different conditions in order to provide an effective, easy-to-enact and environmentally safe disposal method to be performed at home by patients. Pure reference standard solutions of hydrocodone and oxycodone were spiked in aqueous solutions at pH 0, 4, 7, 10 and 14. pH solutions were adjusted using hydrochloric acid (0.01 €" 1 N) and sodium hydroxide (0.01 €" 1 N). Five independent replicates were collected at 5 minutes, 1, 2, 24 hours, 4 and 7 days. Samples were diluted using 0.1% formic acid in pure water: methanol (50:50 v/v) containing 600 µg/mL of ascorbic acid. This resulted in a final drug concentration of 100 ng/mL and achieved pH levels compatible with liquid chromatography tandem mass spectrometry analysis. Calibration standards were prepared at varying concentrations within the working range of the respective compound (1.95-500 ng/mL). Analysis was performed on Agilent 1100 Series HPLC system coupled to an AB SCIEX API 5000 tandem mass spectrometer with an electrospray ionization source. The analytical column was an Agilent InfinityLab Poroshell 120 EC-C18 column (2.7 mm, 4.6 x 50 mm), held at 60 ° C. The flow rate was 1 mL/min with a 5 mL injection volume, and the mass spectrometer was run in the positive multiple reaction monitoring mode. The disappearance of oxycodone and hydrocodone compared to baseline was monitored. As tandem mass spectrometry is highly selective, signal reduction is an indicator for the destruction of the opioid structure. No significant variation in the calculated concentrations was observed up to 4 days neither for hydrocodone nor for oxycodone. After 7 days, hydrocodone and oxycodone were stable at pH 0, 4, 7 and 10 while concentrations dropped close to 10% at pH 14. Very little literature is available on the stability of hydrocodone and oxycodone under different conditions. This is the first data to prove that even extreme pH solutions do not alter the chemical structure of these compounds over a short period of time demonstrating that pH alone is not a suitable method to dispose of €œleft-over€ opioids. The experiments were

performed using pure standards making the compounds readily available in the solution, unlike the commercial pharmaceuticals, which may be more difficult to destroy.

Primary Presenter: Ann Rowland

Project Title: Dysglycemia, diabetes, and clinical outcomes in renal transplantation patients

Primary Mentor: Cecilia Low-Wang

Secondary Mentor(s):

Thematic Area: Clinical Science

Abstract:

It is well known that patients with diabetes mellitus (DM) have an increased risk of postoperative complications. The postoperative period itself can lead to challenges with glycemic management. In renal transplant patients, glycemic control is highly labile due to changes in the physiology of glucose and insulin regulation, with the additional challenge of high-dose steroids for the prevention of organ rejection. This study aims to characterize the renal transplant population as well as glycemic management of the renal transplant population at the University of Colorado Hospital. This will provide a foundation with which to compare future studies using continuous glucose monitoring with the goal of providing better glycemic control and preventing postoperative complications including the development of post-transplant diabetes mellitus (PTDM). We hypothesized that good glycemic control in the immediate peri-transplant period is associated with a lower risk of organ rejection, readmission, and infection. Results of the study show that patients with a past medical history of diabetes mellitus have a trend toward increased incidence of hospital-acquired infection, Intensive Care Unit (ICU) admission, need for dialysis during hospitalization, 30-day readmission, and death within 30 days. Length of hospital stay was also slightly increased with an average stay of 4.5 days compared to 4.0 days in patients without a history of DM. Patients experiencing hyperglycemia during hospitalization had a higher percentage of patients with hospital-acquired infection and readmission within 30 days. Future research should evaluate insulin management strategies in the postoperative period to reduce rates of hyperglycemia in both patients with and without a diagnosis of diabetes.

Primary Presenter: Ariel Kiyomi Daoud

Project Title: What Happened and Why? A Peer-Led Case-Based Curriculum for Pre-Clinical Medical Students to Address Bias and Discrimination

Primary Mentor: Rita Lee

Secondary Mentor(s):

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

Introduction: The literature clearly documents the impacts of bias and discrimination among health care providers on patient outcomes. Health professional training programs should prioritize curriculum on bias and discrimination. €œWhat Happened and Why?€⬜ is a peer-led case-based curriculum for pre-clinical medical students to address bias and discrimination along multiple axes of identity.

Methods: The curriculum was developed by medical students with faculty mentorship. The objectives were for learners to recognize, consider the implications of, develop strategies and list resources to address acts of bias and/or discrimination. Learners started with a large group didactic session discussing the importance of bias in health and healthcare. They then moved into small groups with senior medical students serving as facilitators supported by a faculty member. Small group discussions addressed cases of students who experienced bias on campus. After this session, students re-convened in a large group to discuss strategies to address acts of bias and/or discrimination and campus resources. Qualitative open-ended evaluations were completed by learners.

Results: The evaluation received 184 responses. Many learners expressed a sentiment of increased insight/awareness of bias and/or discrimination (n=81), and/or feeling empowered to confront bias and/or discrimination (n=61), including knowledge of school resources. Very few (n=4) students expressed negative reactions toward the program. A few students were disappointed with the school's responses (n=2) within the cases or felt more unsafe (n=3) knowing these cases occurred in the past year.

Discussion: This curriculum is effective in increasing student recognition of and willingness to engage with acts of bias and discrimination.

Primary Presenter: Armaan Yaseyyedi

Project Title: Cerebral cryptococcomas: a systematic scoping review of available evidence to facilitate diagnosis and treatment

Primary Mentor: Bill Cornwell

Secondary Mentor(s): Carlos Franco

Thematic Area: Clinical Science

Abstract:

Background: Recommendations for managing patients with cerebral cryptococcomas are scarce across multiple clinical guidelines. Due to the deficiency of high-quality data coupled with increasing number of at-risk patients, the purpose of this review is to describe the demographic characteristics, causative pathogen, intracranial imaging, surgical and/or pharmacological interventions, as well as outcomes of patients with cerebral cryptococcomas to improve recognition and management.

Methods: We conducted a scoping review in accordance with the PRISMA guidelines using PubMed and Web of Science. Reports were included if the following details were presented: 1) site of infection, 2) treatment details to at least include the specific antifungal therapy administered, if applicable, and 3) patient outcome.

Results: A total of 40 records representing 47 individual patients were included of which the median age was 48.5 years, 75% were male, and 60% reported a significant past medical, surgical, or social history. C. neoformans was isolated more often than C. gattii (74% vs 26%, respectively). Patients most often presented with headache, altered mental status and/or confusion, and vomiting occurring over a median of 30 days, though few were noted to have significant findings on physical examination. More than 50% of patients had a single cerebral cryptococcoma lesion, while perilesional edema was present in 73% of cases. Surgical intervention occurred in 49% of patients. An amphotericin B-based formulation was administered as €˜induction' therapy to 91% of patients but combined with flucytosine or fluconazole in only 58%, for an overall median of 42 days. Fifty two percent of patients received €˜maintenance' therapy for a median of 126 days, in which fluconazole was most often used. Corticosteroids were administered to approximately 30% of patients for a median of 31.5 days. Overall, mortality was 34%.

Conclusion: Based on our findings, management should include antifungal therapy for a minimum of 6 months with considerations for concomitant corticosteroids in the setting of perilesional edema as well as surgical intervention. Emphasis should be placed on providing well-documented treatment details in future case reports and series to allow for development of more concise evidence-based recommendations.

Primary Presenter: Benjamin Massey

Project Title: Procalcitonin levels and antibiotic use associations with COVID-19 disease severity in the absence of bacterial co-infection of Hospitalized Adults: An observational cohort investigation

Primary Mentor: Julie Dunn

Secondary Mentor(s):

Thematic Area: Clinical Science

Abstract:

What utility does procalcitonin have in the setting of COVID infection? Presently elevated procalcitonin levels have guided clinicians in antibiotic use for suspected bacterial co-infection in COVID-19 patients. Our hypothesis was that elevated procalcitonin can be a marker of disease severity and not bacterial co-infection in patients with COVID-19. Electronic medical records were interrogated in a cohort of hospitalized adults with COVID-19 (n=78) who experienced moderate and severe disease (NCT05603677.). Antibiotics were administered to 47.4% of all patients enrolled while the rate of bacterial co-infection in this patient population was 18.7%. Hospitalized patients with severe COVID-19 had significantly higher procalcitonin levels than those with moderate disease. Of the 55 participants with procalcitonin levels, 30 (55%) were given antibiotics while 25 (45%) were not, and only 8 patients had documentation of bacterial co-infection, as evidenced by blood, respiratory, or urine culture positivity. The results from this study show that in the setting of COVID-19 infection, procalcitonin is more closely linked to viral disease severity and less associated with bacterial co-infection. Procalcitonin as a prognostic tool for bacterial infection and COVID-19 disease severity warrants further investigation to ensure therapeutic measures and antibiotic stewardship are appropriately applied. More data are needed to set standardized clinical guidelines regarding procalcitonin use to ensure appropriate treatment is maintained.

Primary Presenter: Beshoy Tawfik

Project Title: Anatomy In Action: Incorporating 3D Printing in Pre- Collegiate Anatomy Education

Primary Mentor: Sam Dancis

Secondary Mentor(s):

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

Increasing and maintaining student engagement within anatomy education at a pre-collegiate level is a challenge that educators continue to encounter. Finding an appropriate level of difficulty that prepares students for the rigor of undergraduate anatomy education while balancing the need to inspire student interest in STEM-related fields of study can inadvertently discourage students, particularly when content is relayed in a 'traditional' lecture-based curriculum.

The University of Colorado's Pre-Health Scholars Program (CUPS) is an academic enrichment program for high school students from under-represented minority groups who are interested in healthcare and STEM- related professions. To address the challenges in pre-collegiate anatomy education, the CUPS anatomy curriculum has shifted away from instruction that is purely lecture-based, to a project-oriented curriculum utilizing 3D printing. Here, students are encouraged to connect hands- on experiences and collaborate on individualized projects that require mastery of anatomical principles to create. Students are also introduced to anatomic structures in a multi-dimensional fashion that allows them to examine the complementary relationship between structure and function. This model of curriculum has the potential to improve engagement and create better foundations of anatomical knowledge through thoughtful instructional design.

Primary Presenter: Brandi Krieg

Project Title: Does Prehabilitation Improve Outcomes in Complex Spine Surgery Patients? Development of Exercise-Focused Pilot Prehabilitation Program

Primary Mentor: Vikas Patel

Secondary Mentor(s): David Ou-Yang

Thematic Area: Clinical Science

Abstract:

Background: Evidence has shown that patients with multiple comorbidities, who are frail, and/or obese have higher rates of complications and poorer post-operative outcomes after spinal surgical treatment. Many comorbidities that contribute to frailty and obesity are modifiable to various extents with physical activity which can contribute to an overall improved health state. Multiple studies have shown that patients can benefit from a prehabilitation intervention prior to various surgeries; however, the impact and necessary components of a prehabilitation protocol for patients with adult spinal deformity has not yet been established.

Purpose: The purpose of this project is to use current evidence to develop a pilot prehabilitation protocol for spine surgery patients.

Methods: We retrospectively reviewed a control group of patients with symptomatic degenerative disc disease requiring spinal surgery receiving standard of care with focus on comorbidities, peri- and postoperative outcomes, adverse events, and patient-centered outcomes. Using this data, we will compare the same outcome measures as well as implementing updated outcome measures in patients who will be participating in a pilot prehabilitation program developed with current evidence and delivered through a software platform for data tracking.

Results: An overwhelming majority of patients in the control group were either overweight or obese, 42.9% and 34.3% respectively while 57.1% of patients had hypertension, 42.9% had sleep apnea, 25.7% had diabetes mellitus. Results of this pilot study will guide future efforts to establish an appropriate and feasible prehabilitation program for patients who undergo spine surgery.

Conclusion: This pilot program will help to establish a multi-disciplinary approach to optimization of health prior to spine surgery and provide guidance on the most important factors to emphasize in a prehabilitation program.

Primary Presenter: Brian Vu

Project Title: Cannabis use is associated with depression severity and suicidality in the National Comorbidity Survey-Adolescent Supplement

Primary Mentor: Jesse Hinckley

Secondary Mentor(s):

Thematic Area: Clinical Science

Abstract:

Objective: The aims of this study are to 1) investigate the prevalence of MDD in adolescents with lifetime cannabis use and 2) explore the association of lifetime cannabis use with MDD severity and symptomatology.

Method: Data are from the National Comorbidity Survey Replication Adolescent Supplement (n=10,123), a nationally representative survey of adolescents aged 13 to 18 years old. Weighted logistic regression analyses were conducted, utilizing study weighting procedures and incorporating sociodemographic variables associated with lifetime cannabis use or DSM-IV MDD (age, gender, race/ethnicity, and region).

Results: Of the 2,281 adolescents reporting lifetime cannabis use, 432 (18.9%) met criteria for a lifetime diagnosis of MDD, compared to 8.9% of adolescents who never used cannabis (p<0.0001). Severe depression is also more prevalent in adolescents with lifetime cannabis use (6.8% vs 1.8%, p<0.0001). Adolescents with lifetime cannabis use have 2.1 times higher odds of having mild/moderate depression (aOR 95% CI 1.69, 2.53) and 3.1 times higher odds of having severe depression (aOR 95% CI 2.31, 4.75) than no depression, compared to adolescents who never used cannabis. Similarly, adolescents who used cannabis in the past 12 months had higher odds of a mild/moderate or severe depressive episode within that time, compared to adolescents who did not use cannabis (aOR 2.06 and 2.83, respectively). Among adolescents with a lifetime diagnosis of MDD, appetite (p=0.021), suicidal ideation (p=0.0027), and suicide attempt (p=0.030) were associated with lifetime cannabis use. There were no significant differences in the prevalence of depressed mood, anhedonia, sleep, psychomotor agitation or retardation, fatigue, worthlessness, concentration, guilt, or suicide plan.

Conclusion: MDD is more prevalent among adolescents with lifetime cannabis use, with higher odds for severe MDD. Of concern, lifetime cannabis use is also associated with a higher prevalence of suicidal ideation and suicide attempt.

Primary Presenter: Briana Tolbert

Project Title: Patient Insurance and Access to Obstetrics and Gynecology Subspecialists: Findings from a National Mystery-Caller Study in the United States

Primary Mentor: Tyler Muffly

Secondary Mentor(s):

Thematic Area: Public Health and Epidemiology

Abstract:

OBJECTIVE: To evaluate the mean appointment wait time for a new patient visit to female pelvic medicine and reconstructive surgery, gynecologic oncology, maternal-fetal medicine, and reproductive endocrinology and infertility when presenting with public versus private insurance.

HYPOTHESIS: We hypothesize that the mean wait time for a new appointment for those presenting with public insurance exceeds the mean wait time for a new appointment for those presenting with private insurance.

METHODS: Each subspecialty medical society has a patient-facing physician directory tool to generate a list of physicians across the United States. Eight hundred unique physician offices were randomly selected from the directories -- 200 per subspecialty. Each of the 800 individual physician offices was called twice. The caller presented with Medicaid or, in a separate call, with Blue Cross/Blue Shield. The order in which the calls were placed was randomized. The caller asked for the soonest appointment available for respective medical conditions based on subspecialty: stress urinary incontinence, new-onset pelvic mass, preconceptual counseling for twin-twin transfusion syndrome, and primary infertility. Data for each office were collected, including the date of the soonest appointment and physician demographics.

RESULTS: From eight hundred physicians initially contacted, 477 responded to at least one call in 48 states plus the District of Columbia. The mean appointment wait time was 20.3 (SD=18.6) business days for an appointment. A significant difference was found in waiting times by type of insurance with 44% longer waiting time for Medicaid (ratio = 1.44, 95%CI = 1.34 to 1.54, z = 10.51, p <0.001). When the interaction between insurance type and subspecialty was added to the model, it was found to be highly significant (p<0.01), with Medicaid patients in Female Pelvic Medicine and Reconstructive Surgery having the most waiting time increase relative to private insurance and Maternal-Fetal Medicine having the least, with Medicaid times always longer than private insurance times.

CONCLUSION: Typically, a woman can expect to wait almost three weeks for a new patient appointment with a board-certified obstetrics and gynecology subspecialist. There was a significant difference in wait time for patients with Medicaid public insurance versus private insurance.

Primary Presenter: Brittany Denzer

Project Title: Considerations for physicians:

Mitigating the adverse health effects of heat in older Colorado adults

Primary Mentor: Janet Meredith

Secondary Mentor(s):

Thematic Area: Clinical Science

Abstract:

Increasing temperature due to climate change is one of the greatest emerging threats to human health. Older adults are particularly vulnerable to adverse effects of heat due to age-related physiologic changes that impair homeostasis when temperatures are high. This risk is increased when combined with other social and environmental factors, which vary immensely between individuals. This study aims to explore vulnerabilities of older adults (65 years and older) in Colorado, based on population demographics and local climate considerations, with the goal of identifying information important to physician-led mitigation of adverse effects of heat in this population. Other related risks among older adults in Colorado include living alone (26% of adults 65 and older), overall disability (31%), high levels of physical activity, a large agricultural workforce, and a dry climate which may increase the risk of dehydration. Medications that may increase the risk of adverse effects of heat were also reviewed and compiled into a chart designed to facilitate physician education. The goal is to provide clinicians with information on how climate change can pose risks to the health of individual patients seen in everyday practice, the vulnerable elders in particular, and the importance of a medication review, with appropriate dose adjustments, modifications, and patient counseling to decrease the risk of heat-related injury or illness.

Primary Presenter: Casey Weinstein

Project Title: Selective Measurement of Ionized Calcium (iCal) Levels in Trauma: Early iCal is Associated with Worse Outcomes

Primary Mentor: Shane Urban

Secondary Mentor(s):

Thematic Area: Clinical Science

Abstract:

Recent data suggests that hypocalcemia plays a key role in the outcomes of trauma patients. Ionized calcium (iCal) is believed to be the most physiologically relevant blood calcium measure. However, in current practice, providers select on which patients to draw iCal levels, and, to date, there have been no published prospective studies on iCal in trauma. We hypothesized that the occurrence of early (<4hr) iCal measurement will reflect injury severity and predict outcomes. We interrogated a prospectively maintained trauma data repository from a single urban Level 1 Trauma Center. Trauma patients >15 years old were included. Of the 1431 patients included in the data base, only 76 had iCals measured within the first four hours of their presentation. It was found that these patients were on average hypocalcemic. There was a higher proportion of penetrating injury in those who had iCals drawn within four hours (36% vs 7%). Further, mean Injury Severity Score (ISS) and shock index were higher for those with early iCal measurement (23 vs 9 and 0.98 vs 0.66, respectively; P<0.0001). Finally, patients with iCal measured in the first four hours spent more time in the ICU and hospital (mean ICU- and hospital-free days 13 vs 23 and 18 vs 26, respectively; P<0.0001) and had higher overall mortality (16% vs 2%). This study demonstrates that a select group of trauma patients get iCals drawn early in their course, and the mere event of this lab measure predicts a longer time in the ICU and hospital as well as higher mortality. This study reveals that injury severity and shock appear to contribute to the decision-making of ordering an iCal on a trauma patient. A single early laboratory measurement, such as ionized calcium, can serve as valuable clinical and prognostic information in trauma cases, though a follow-up prospective study of hypocalcemia in trauma would be more conclusive.

Primary Presenter: Cecile Harmange

Project Title: Histologic and Radiographic Characteristics of Pulmonary Metastases from Sarcoma

Primary Mentor: John Mitchell

Secondary Mentor(s): Ashok Muniappan

Thematic Area: Clinical Science

Abstract:

Background: The histologic and radiologic characteristics of lung metastases of sarcoma subtypes have not yet been well described, including their prognostic implications and their role in pulmonary metastasectomies.

Objective: To define radiologic and histologic features of pulmonary metastases from sarcoma and to understand implications of these features as related to intra-pulmonary recurrence, survival, and overall disease prognosis.

Methods: We conducted a retrospective chart review of patients diagnosed with sarcoma with pulmonary metastases at Massachusetts General Hospital (MGH) from January 1992 to May 2019. 471 thoracic resections involving sarcoma of the lung were identified, 85 of these cases were analyzed at the time this manuscript was written. 14 cases were excluded: 9 chest wall metastases, 1 pleural metastasis, 2 primary lung sarcomas and 2 needle biopsies. A total of 71 cases were ultimately included at the time of this study, representing 57 patients. Analysis was performed using Kaplan-Meier estimates of survival.

Results: At the time this manuscript is written, results are only preliminary and limited by small sample size. Overall 5-year survival was 44%. Median survival in those patients with visceral pleural involvement (VPI) was 22 months, Median survival in those without VPI was 36 months ($p = 0.1299$). In the smaller subset of 21 patients, tumor size, number of metastases, and certain radiologic and histologic characteristics were examined. Although there were no significant results at this time given the small sample size, it was noted that 75% of leiomyosarcoma nodules had pleural abutment, while this was only present in 14.5% of the synovial cell sarcoma nodules. 100% of synovial cell sarcoma and liposarcoma nodules had a smooth surface, while this was only present 50% of leimyosarcoma and 52% osteosarcoma pulmonary metastases. Calcification was present in 50% of osteosarcoma metastases and 11% of fibrosarcma metastases. 6 of the 21 patients had a local recurrence, 3 were osteosarcoma, 2 fibrosarcoma, 1 synovial cell. Median survival in those with local recurrence was 32.5 mo, and 60.0 months in those without local recurrence ($p = 0.5243$).

Conclusion: Although no results were significant due to the small sample size, our data does begin to show certain trends in local recurrence rate and sarcoma subtypes, as well as the implications of certain histologic and radiologic features such as pleural abutment, visceral

pleural involvement, size of metastases in patient prognosis. Next steps will be to analyze the full subset of 471 resections for a more complete set of results.

Primary Presenter: Chad Cole

Project Title: Current practice for adolescent substance use screening in family medicine clinics

Primary Mentor: Mark Deutchman

Secondary Mentor(s):

Thematic Area: Public Health and Epidemiology

Abstract:

Background: Substance use during adolescence is a highly prevalent and undertreated issue. Screening for substance use has been shown to be an effective method of identification of adolescents with substance use disorder for treatment. The American Academy of Pediatrics (AAP) recommends screening of adolescent patients for substance use by primary care physicians at all well child visits and acute care visits using the screen to brief intervention approach. The USPSTF, however, has concluded that there is insufficient evidence to recommend universal screening in the adolescent population. We hypothesize that the current rate of adolescent substance use screening at UCHealth clinics is below the rate recommended by the AAP.

Methods: This study is a retrospective chart review of records from well child visits and acute care visits of patients between 12-17 years old at UCHealth clinics in 2019. Clinical notes will be reviewed for the presence of adolescent substance use screening, our primary outcome of interest. Secondary data will be collected to elucidate associations between screening and patient demographics. Data will be analyzed to determine the rate of screening and describe the methods by which screening occurs. This will be compared to the current recommendations on adolescent substance use screening practices.

 Results: This study is still in the data acquisition phase, and does not have any data to report. Results of literature review show that current rates of screening for adolescent substance use are far below the rate recommended by the AAP, even though most studies are performed in pediatric clinics. Our study population involves visits to family practice clinics, thus we anticipate a rate of screening that is lower than what has been observed in pediatric clinics.

Implications: This study will inform on the current adolescent substance use screening rates and practices within a university-based healthcare system. The results of these data will contribute to the growing body of literature on adolescent substance use screening. It will also provide insight into any associations between screening and patient demographics. Ultimately, this study will provide a base of knowledge with which we intend to carry out a prospective trial of standardized adolescent substance use screen implementation.

Primary Presenter: Chayce Weaver

Project Title: Congestive Heart Failure Patient Education

Primary Mentor: Kelsey Flint

Secondary Mentor(s):

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

The purpose of this MSA project was to provide patient education on congestive heart failure (CHF). I have no conflicts of interest to disclose. The patient population selected to receive this education were the participants in cardiac rehabilitation at Platte Valley Medical Center. While not all participants had CHF themselves, they all had risk factors for developing the disease including previous myocardial infarction, chronic hypertension, persistent atrial fibrillation, coronary artery disease, and diabetes.

The prevalence of CHF continues to rise in the United States especially in rural areas. Heart failure rates are 40% higher in rural communities when compared to the prevalence in urban cities. [1] Often, patients in these areas have limited access to healthcare and fewer opportunities to discuss their chronic conditions such as CHF. These patients also often lack a strong foundation of health literacy which leads to a certain level of disconnect between them and their provider. As the field of medicine continues to advance toward shared decision making, it is critical that patients are able to understand their conditions to the best of their ability.

Having to abide by Covid 19 social distancing regulations, an informational brochure was handed out to all patients during their orientation for cardiac rehabilitation from March, 2020 to January, 2022. These patients were then asked to complete a 6-question survey to quantify how their knowledge base changed. Out of the 68 surveys returned most individuals felt informational brochures were a helpful medium to give them additional information. More than half of the patients stated that they had a better understanding of the medications that they had been prescribed. About one third of patients reported that their definition of CHF changed after reading their brochure. 60% of patients felt that they knew what heart failure was prior to reading their brochure.

Overall, this data suggests that important clinical knowledge is failing to reach the patients. It remains unclear as to whether or not this lack of transmission is secondary to time restraints, varying levels of health literacy, or simply being overlooked and that is something that can be further investigated as a future endeavor. In the meantime, quick informational material such as brochures can aid in bridging the gap in knowledge sharing between physicians and their patients.

Primary Presenter: Christian Curran

Project Title:

Clinical and Anatomic Outcomes of 3-piece Poly(methyl methacrylate) Intraocular Lens Rescue and Scleral Refixation

Primary Mentor: David Wagner

Secondary Mentor(s): Murtaza Adam

Thematic Area: Basic Biomedical Science

Abstract:

Abstract: We have shown that peripheral expansions of a CD3+CD4+ T cell subtype, which co-expresses CD40 (termed TH40), demarcates systemic inflammation in numerous auto-inflammatory disorders including type I diabetes, rheumatoid arthritis, and multiple sclerosis (MS). The purpose of the present study is to clarify the behavior of these cells in MS patients. We found that TH40 cells are significantly elevated in a cohort of clinically isolated syndrome (CIS) patients€"the earliest clinical manifestation of MS€"at levels that are consistently elevated in the relapsing-remitting (RRMS) form. Surprisingly, TH40 cells were uniformly elevated in number in primary progressive (PPMS) and secondary progressive (SPMS) disease types. We found TH40 cells present in peripheral blood and cerebrospinal fluid (CSF) of untreated RRMS patients and demonstrated prominent co-expression of CD20 on these cells. Treatment of RRMS, SPMS and PPMS patients with Ocrelizumab (ocrelizumab) caused significant ($p < 0.001$) reductions in peripheral blood TH40 cell numbers receding from autoimmune levels to healthy control levels. At 12-months post treatment, TH40 cell numbers returned to pre-treatment levels. T cells isolated from Ocrelizumab-treated patients had significantly ($p < 0.001$) lower production of inflammatory cytokines but increased production of regulatory cytokines when compared to RRMS patients not receiving Ocrelizumab. These data support that TH40 cells play a prominent role through progressive MS. While B cell depletion is the currently accepted mechanism of action for Ocrelizumab these data show that T cell reductions, specifically Th40 cells, is an additional effect of Ocrelizumab in the MS patient.

Primary Presenter: Christina Nguyen

Project Title: Mechanisms of Acquired Osimertinib Resistance and Clinical Outcomes in EGFR-Positive Non-Small Cell Lung Cancer

Primary Mentor: Tejas Patil

Secondary Mentor(s):

Thematic Area: Clinical Science

Abstract:

BACKGROUND: Lung cancer is the leading cause of cancer-related deaths with 2.21 million cases and 1.80 million deaths worldwide in 2020. Within the United States alone, an estimated 235,760 new cases and 131,880 deaths are projected to occur in 2021. Osimertinib is an oral, third-generation tyrosine kinase inhibitor (TKI) that irreversibly binds EGFR-sensitizing and T790M mutations in non-small cell lung cancer (NSCLC) with encouraging results as first-line therapy in treatment-naïve patients and as a later-line agent in previously treated patients. Unfortunately, acquired resistance to osimertinib is inevitable. A previous retrospective study investigated the molecular alterations and outcomes of 92 patients with EGFR-positive NSCLC treated with osimertinib at the University of Colorado health system from 2008-2018. This project seeks to expand upon the original dataset of patients to a) provide a larger sample size, b) identify molecular alterations prior to and upon progression of osimertinib, and c) describe the survival benefit derived from treatment with targeted therapies following radiographic progression on osimertinib.

METHODS: This is a single-center, retrospective study of adult patients with EGFR-positive NSCLC treated with osimertinib who were evaluated at the University of Colorado health system from 2008-2021. Eligible patients were identified from an IRB-approved database of thoracic cancer patients treated at the University of Colorado. Eligibility criteria include histologically confirmed Stage IV NSCLC; radiographic demonstration of disease progression after initiation of osimertinib; pretreatment and posttreatment molecular testing using validated tissue biopsy or ctDNA assays; and at least one instance of physician follow-up after disease progression. Patient demographics, clinicopathological features, molecular alterations, and treatment outcomes were collected. Survival curves were generated through the Kaplan-Meier method using a log-rank test to assess for differences in progression-free survival (PFS) and overall survival (OS).

RESULTS: The results of the expanded study are anticipated to remain similar to previous findings. Specifically, TP53 co-mutation identified at the time of osimertinib initiation in 43 patients (57%) was associated with worse PFS (13 vs 9 months; $p = 0.013$, HR 0.32, 95% CI 0.01 €" 0.67) and OS (44 vs. 33 months; $p = 0.03$, HR 0.43, 95% CI 0.21 €" 0.92). Molecular testing via ctDNA assay or tissue biopsy was performed on 41 patients (44%), with 8 (19%) found to have acquired resistance mutations responsive to currently available targeted therapies. Osimertinib resistance in treatment naïve patients is likely to encompass more bypass

signaling mechanisms (ex. MET amplification) while T790M-positive patients are likely to demonstrate EGFR-dependent resistance mechanisms (ex. C797S). Resistance testing at the onset of osimertinib resistance will identify targetable mutations in a subset of patients €" particularly MET amplification and HER2 amplification. Finally, patients who received second-line, targeted treatment in conjunction with continued osimertinib achieved an additional median PFS of approximately 13.5 months.

CONCLUSION: Preliminary data suggest the following: detection of mutant TP53 prior to osimertinib initiation is associated with significantly worse progress free survival and overall survival; identification of T790M mutation at the time of osimertinib progression may drive the acquisition of EGFR-dependent resistance mechanisms; resistance testing at the time of progression may identify targetable resistance mutations; and targeted therapies in combination with osimertinib may achieve longer progress free survival. By and large, the expansion of the participant population is anticipated to demonstrate the same overall findings; additional mechanisms of resistance and their prognostic value may be identified as the project expands. Nevertheless, a study of this kind of would benefit from expansion of the participant population and inclusion of multiple institutions.

Primary Presenter: Christine Krentz

Project Title: Medical Dental Integration for Vaccinations: A Targeted Intervention to Increase Rates of Tdap, MCV4, and HPV9 vaccinations in children ages 9-17.

Primary Mentor: Jessica Jack

Secondary Mentor(s):

Thematic Area: Public Health and Epidemiology

Abstract:

BACKGROUND: Children older than 9 years of age typically see the dentist more often than they do their primary care provider.1 This highlights an opportunity to collaborate with dentistry to promote timely vaccinations and well-child checks (WCC). This study aimed to increase vaccination rates of the Tdap, MCV4, and HPV9 vaccines by 5% in patients aged 9-17 through vaccination at pediatric dental visits or via assisted follow-up scheduling.

METHODS: The project was conducted at a large Federally Qualified Healthcare Center with three pilot dental clinics that were co-located within medical clinics. Data was collected from 5/24/21-10/29/21. Reports were run daily to identify patients ages 9-17 who were overdue for vaccinations, vaccine reminders were added to the electronic medical record, and large colorful flags were placed in patient charts as a visual cue for providers. Patients were offered same-day vaccines or the opportunity to schedule a follow-up visit with their medical clinic. Chart review was conducted to determine if vaccines were administered the same day or within 30-days of the dental visit.

RESULTS: Across all clinics during the 5-month period, 3.4% (N=119) of all patients vaccinated were due to medical-dental integration (MDI) intervention. Montbello Clinic was particularly successful, with 7.3% of patients vaccinated in the 5-month period being due to MDI. Factors for success were buy-in from clinic staff, visual cues in charts and in the office, and an in-clinic MDI champion.

CONCLUSION: It is evident that there is a significant benefit to integrating the medical and dental disciplines at the routine dental visit. Patients were receptive to discussing and receiving vaccinations during dental visits. The dental office appears to be an effective and appropriate place to offer reminders regarding vaccines and preventative health measures to patients and their parents. This highlights that dentists, dental assistants, and auxiliary team members play a powerful role in promoting and improving vaccination rates.

Primary Presenter: Chris Greenlee

Project Title: Mandibular Distraction Osteogenesis for Severe Neonatal Airway Obstruction: A Follow-up Study

Primary Mentor: Christian Francom

Secondary Mentor(s):

Thematic Area: Clinical Science

Abstract:

Objective: Micrognathia in neonates can lead to adverse outcomes affecting breathing, feeding, growth, and development. When conservative therapy is unsuccessful, selected patients have been managed with mandibular distraction osteogenesis (MDO). We previously reported airway, feeding and growth outcomes and this study evaluates MDO over a longer time and with a larger cohort.

Study Design: Retrospective chart review

Setting: Tertiary care referral center

Methods: We performed a retrospective review over a 15-year period of patients with micrognathia who underwent MDO within the first 90 days of life. Demographic data, hospital course, associated syndromes, duration of distraction, need for additional procedures, and growth data were included. The Cormack-Lehane classification was used to evaluate the grade of laryngeal view pre and post MDO. Descriptive statistics along with Mixed-Effects growth curve analyses were utilized.

Results: Sixty-three patients were included. The age at MDO was 36.0 days (SD±24.3), the duration of distraction was 7.62 days (SD±2.11), and discharge was on postoperative day 19.4 days (SD±11.9). Ninety-six percent of patients showed objective improvement in airway grade following MDO with 95% obtaining a grade II view or better. Fifty-six percent of patients were able to feed exclusively with oral intake at discharge and no patients required tracheostomy placement following MDO.

Conclusion: Our results support early intervention with MDO as a successful option for neonates with symptomatic micrognathia refractory to conservative measures. Airway improvement is significant as tracheostomy is avoided, and ease of future intubation is enhanced. Feeding outcomes are encouraging as many patients avoid gastrostomy tube placement.

Primary Presenter: Clara Kerwin

Project Title: Nasal-type NK/T-cell lymphoma in a patient with hidradenitis suppurativa: A case report

Primary Mentor: Anne Getz

Secondary Mentor(s):

Thematic Area: Clinical Science

Abstract:

Background: Nasal-type NK/T-cell lymphoma is a rare but deadly form of non-Hodgkin's lymphoma that initially presents with local symptoms including erythema, swelling, and [epistaxis] (https://www.sciencedirect.com/topics/medicine-and-dentistry/epistaxis). Due to misdiagnosis and improper treatment with antibiotics, this tumor will frequently expand to involve nearby [facial bones] (https://www.sciencedirect.com/topics/medicine-and-dentistry/facial-bone) and the [oropharynx] (https://www.sciencedirect.com/topics/medicine-and-dentistry/oropharynx), with characteristic erosion of the [hard palate] (https://www.sciencedirect.com/topics/medicine-and-dentistry/hard-palate). Even with treatment, mortality rates are high. We present a case of Nasal-type NK/T-cell lymphoma in a patient whose disease was initially attributed to his pre-diagnosed [hidradenitis suppurativa] (https://www.sciencedirect.com/topics/medicine-and-dentistry/hidradenitis-suppurativa) (HS).

Case description: A 38-year old male presented with several weeks of progressive nasal swelling and redness, which he initially attributed to his pre-existing HS and self-treated with antibiotics. The patient was subsequently prescribed several courses of increasingly broad-spectrum antibiotics without improvement in his symptoms. Alternative non-infectious diagnoses were only given strong consideration once the tumor had grown to involve nearby structures including the [maxilla] (https://www.sciencedirect.com/topics/medicine-and-dentistry/maxilla), [nasal sinuses] (https://www.sciencedirect.com/topics/medicine-and-dentistry/paranasal-sinuses), and oropharynx with characteristic erosion of the hard palate.

Conclusions: Nasal-type NK/T-cell lymphoma is a rare and frequently misdiagnosed disease that can cause progressive morbidity and death if not properly treated. A broad differential should be maintained when evaluating prolonged nasal inflammation without systemic signs of infection, particularly when symptoms do not improve with antibiotic therapy.

Primary Presenter: Clayton Foster

Project Title: Functional Outcomes Following Anterior versus Posterior Total Hip Arthroplasty

Primary Mentor: Michael Dayton

Secondary Mentor(s):

Thematic Area: Clinical Science

Abstract:

Introduction: Recent studies have investigated patient outcomes after total hip arthroplasty (THA) based on surgical approach. Though self-reported outcomes are commonly utilized, functional measures represent a novel technique to measure outcomes after THA.

Methods: A cohort of patients undergoing primary THA surgery were included and grouped by surgical approach (n=400 direct anterior; n=379 traditional posterior). Patients were evaluated pre-operatively and at both three and twelve months post-operatively using the Hip Dysfunction and Osteoarthritis Outcome Score (HOOS JR), timed up and go (TUG) test, 30 second sit to stand test (30STS), and four-meter walk test (4MWT). Mean differences between the direct anterior and posterior groups were tested using independent t-tests (normality assumption satisfied).

Results: Patient demographics showed the two groups were similar. Compared to pre-operative values, functional outcome scores improved among patients in both groups at both three and twelve months post-operatively. At three months, the posterior group had a 2.33 second improvement with TUG test, repetition improvement of 2.71 in 30 sec STS, and 1.23 second improvement in 4MWT; the anterior group had 2.66 second, 2.49 repetition, and 1.18 second improvements respectively. At twelve months, the posterior group had a 2.86 second improvement with TUG test, repetition improvement of 3.99 in 30 sec STS, and 1.19 second improvement in 4MWT; the anterior group had 3.15 second, 3.83 repetition, and 1.23 second improvements respectively. No significant differences were noted between the two approach groups in these outcomes. However, the anterior group did show significant improvement in HOOS JR score compared to the posterior group at three months postoperatively (p=0.045).

Discussion: This study is the first to use TUG, 30STS, and 4MWT as objective comparative measures of function based on surgical approach. These data suggest anterior and posterior approaches are equally effective in restoring function among THA patients, while the anterior approach may have improved patient satisfaction in the early postoperative period.

Primary Presenter: Colt Burtard

Project Title: Prevalence of Cerebral Sinovenous Thrombosis in Abusive Head Trauma

Primary Mentor: David Mirsky

Secondary Mentor(s):

Thematic Area: Clinical Science

Abstract:

Background: Cerebral sinovenous thrombosis (CSVT) has been proposed in legal settings to be an atraumatic mimic of abusive head trauma (AHT).

Objective: The objective of this study was to determine the prevalence of CSVT and subdural hemorrhage (SDH) in a large AHT population.

Materials and methods: This retrospective cohort study measured the prevalence of CSVT and SDH on MR venograms of 243 patients diagnosed with AHT at a single center. We also reported the presence of additional intra and extracranial injuries, head injury severity, and hospital length of stay.

Results: Among 243 patients diagnosed with AHT, 7% (16/243) had CSVT. SDH was present in 94% (15/16) of CSVT cases. Cytotoxic edema and SAH were present in 88% (14/16) and 69% (11/16) of CSVT cases respectively. Extra-cranial signs of abuse were also present in 100% (16/16) of patients with CSVT. Critical to maximal head injury severity (AIS >=5) was present in 75% (12/16) of the CSVT population versus 33% (82/243) in the total AHT population. Length of hospital and PICU stay was greater in those with CSVT (10 vs 21.9 and 3.5 vs 7.3 days).

Conclusion: These findings suggest that CSVT is uncommon in AHT and is associated with additional traumatic injuries and greater injury severity.

Primary Presenter: Colton Lynn

Project Title: Differences in Hip Alpha Angles on Different Imaging Modalities

Primary Mentor: Stephanie Mayer

Secondary Mentor(s):

Thematic Area: Clinical Science

Abstract:

Purpose: The primary aim of this study was to identify differences in alpha angle on plain radiographs, MRIs, and CTs of patients diagnosed with abnormal hip pathologies.

Methods: This was a retrospective review of 60 (n=93 hips) patients diagnosed with slipped capital femoral epiphysis (SCFE), Legg-Calvé-Perthes disease, hip dysplasia, pelvic apophyseal injuries, or femoroacetabular impingement (FAI) who had a plain radiograph, MRI, and CT of their hips performed prior to treatment. We compared the alpha angle of the affected hip measured on an AP view of the pelvis on plain radiograph, the coronal view on CT, and the coronal view on MRI using a one-way ANOVA. This study was approved by the COMIRB, and we defined statistical significance as $p < 0.05$.

Results: We found no statistically significant differences between the alpha angle on plain radiograph, MRI, or CT ($p < 0.48$), nor were there statistically significant differences in alpha angle between genders on plain radiograph ($p < 0.53$), MRI ($p < 0.93$), or CT ($p < 0.17$) for those diagnosed with FAI.

Conclusion: This study revealed no significant differences between alpha angles on plain radiograph, MRI, or CT for patients diagnosed with FAI. Further data needs to be collected to complete this study.

Primary Presenter: Conan Chen

Project Title: Viability of preloaded Descemet membrane endothelial keratoplasty grafts with 96-hour shipment

Primary Mentor: John Lohmeier

Secondary Mentor(s):

Thematic Area: Basic Biomedical Science

Abstract:

Objective: To assess feasibility and compare the effects of 96-hour shipment of Descemet membrane endothelial keratoplasty (DMEK) grafts as a scroll or a tri-fold on cell viability.

Methods and analysis: DMEK grafts were prepared at the Rocky Mountain Lions Eye Bank. Twenty pre-stripped DMEK grafts, paired from 10 donors, were either tri-folded in an endothelium-in configuration using microforceps and loaded into a plastic Treyetech cartridge, or suctioned in a scrolled endothelium-out configuration into a modified Jones Tube. Grafts were shipped via FedEx to a secondary location and back for 48 hours each way, resulting in a total shipping time of 96 hours. After shipping, grafts were removed from inserters onto glass slides and unfolded using viscoelastic with endothelium facing upwards. Calcein-AM stained grafts were imaged with a fluorescent microscope and endothelial cell loss (ECL) was measured using trainable segmentation in Fiji by a masked grader.

Results: A total of 20 grafts were shipped for 96 hours, split between preloaded tri-folded (n=10) and preloaded scrolled (n=10) tissues. No significant difference in ECL was observed across groups after prolonged shipping (14.8% vs 13.7% ECL respectively, p=0.68).

Conclusion: For preloaded DMEK after 96 hours, both scrolled and tri-folded tissue demonstrated clinically acceptable levels of ECL. The data suggest a wider window of time for endothelial cell viability and is promising for the prospect of international shipment of preloaded grafts.

Keywords: DMEK; cornea; descemet membrane endothelial keratoplasty; eye (tissue) banking; preloaded; trifolded.

Primary Presenter: Daniel Thieu

Project Title: WHAT CAUSES PRIMARY CUTANEOUS MELANOMA TO METASTASIZE TO THE SENTINEL LYMPH NODES? WHEN SHOULD WE BIOPSY?

Primary Mentor: Ana Gleisner

Secondary Mentor(s):

Thematic Area: Clinical Science

Abstract:

Background and Objectives: Guidelines for sentinel lymph node biopsy (SLNB) in primary cutaneous melanoma are still under debate. We wanted to see which factors other than Breslow Depth (BD) contribute the most to sentinel lymph node (SLN) metastasis in the hopes of giving clearer recommendations for SLNB. Ultimately, we want to prevent patients from undergoing any unnecessary procedures and limit any undue risk and harm.

Methods: We used EPIC and REDCAP to identify patients at University of Colorado Hospital (UCH) who underwent wide local excision (WLE) and SLNB and had evidence of SLN metastasis on pathology. We looked at multiple different factors such as demographics, ulceration, mitosis, margin involvement, and analyzed them using univariate analysis.

Results: 318 patients were identified. 67/318 were patients with metastasis to the SLN. SLN metastasis positive (SLNP) and SLN metastasis negative (SLNN) patients differed significantly in age, ulceration, mitosis, deep margin, and lymphovascular involvement.

Conclusions: Younger age, presence of ulceration, presence of mitosis, involvement of the deep margins, and lymphovascular involvement are all strongly correlated with SLN metastasis and should be factors when recommending SLNB.

Primary Presenter: Danielle Davis

Project Title: Pre-incision vs. Post-incision Frequent Door Openings During Total Joint Arthroplasty

Primary Mentor: Heather Young

Secondary Mentor(s):

Thematic Area: Clinical Science

Abstract:

Objective: Frequent door openings in the OR are believed to disrupt laminar airflow and increase airborne contamination, leading to increased rates of surgical site infections. The objective of this study was to understand the reasons for door openings in the pre-incision and post-incision period of total hip and knee arthroplasty procedures and to determine if these periods are significantly different from one another.

Design: This is a cross-sectional, observational study.

Setting: Three large academic hospitals.

Participants: Total hip and total knee arthroplasty procedures were included in this study. 25 pre-incision sessions and 26 post-incision sessions were included in analysis.

Methods: The pre-incision period was defined as the time between the opening of the sterile instrument tray to the first incision. The post-incision period was defined as the time between the first incision and the application of the bandage.

Results: There were 0.56 (IQR 0.40-0.70) door openings/minute in the pre-incision period and 0.34 (IQR 0.26-0.45) door openings/minute in the post-incision period. This study found a significant difference between these two periods, with $p=0.0036$. The most common reasons for pre-incision door openings were (25%) due to nurses obtaining supplies and (20%) due to the surgical team. The most common reasons for post-incision door openings were (18%) due to nurses obtaining supplies, (18%) due to the vendor.

Conclusions: This study found a significant difference in door openings between the pre- and post-incision periods, which signifies that their roles are distinct, and they should be investigated separately. Given the previously reported significant increase in airborne contamination during the pre-incision period and the high rate of pre-incision door openings, it is reasonable to hypothesize that door openings may affect the sterility of the instrument tray. Further research is needed to understand the effect of door openings during these two periods as well as to discover an effective and sustainable intervention.

Primary Presenter: Derek Mason

Project Title: Early EBV Infection In Kenyan Infants by 6-Months and Response to Measles Vaccination

Primary Mentor: Rosemary Rochford

Secondary Mentor(s):

Thematic Area: Public Health and Epidemiology

Abstract:

Objective: To assess if infection with EBV by 6 months of age is associated with decreased response to measles vaccination while infants infected with CMV have preserved immune response to vaccination.

Methods: This study utilized samples from the Chulaimbo Antenatal Postnatal study based in Chulaimbo County, Kenya, which followed infants from delivery through 2 years of age. Infants were vaccinated at 9-months against measles with a single dose of measles-containing vaccine at the time. EBV positivity was defined by any infant having a sample at 6 months or earlier having detectable EBV DNA by Q-PCR. Immune response to measles vaccination was assessed by an inhouse indirect ELISA measuring anti-measles IgG antibodies from plasma samples taken at 12-months of age. CMV positivity was defined by the presence of IgM or IgG antibodies by an inhouse indirect ELISA from the samples taken at 12-months of age.

Results: Infants who were EBV+ by 6 months had significantly lower normalized OD values (p-value = 0.030; 95% CI = -0.665 to -0.034). Conversely, participants who were CMV+ at 12 months had significantly greater normalized OD values (p-value <0.001; 95% CI = 0.403 to 1.528). Infants who were both EBV+ and CMV+ had greater OD values than infants who were EBV+ and CMV- (p-value = 0.007; 95% CI = 0.264 to 1.623).

Conclusion: Infants infected with EBV by 6 months of age respond worse to measles vaccination than their counterparts not infected with EBV, while those infected with CMV have a more robust response to measles vaccination. Infants with poor responses to measles vaccination could present an opportunity for secondary vaccine failure, and possible measles outbreak which are a greater concern in Sub-Saharan Africa due to the global COVID pandemic.

Primary Presenter: Devon Pino

Project Title: Correlations Between Blood Type and Human Leukocyte Antigen Production in Kidney and Bone Marrow Transplant Patients

Primary Mentor: Nicole Draper

Secondary Mentor(s):

Thematic Area: Clinical Science

Abstract:

Background: Human Leukocyte Antigen (HLA) antibodies are produced by the immune system when exposed to allogeneic tissue, typically through pregnancy, transfusion, or transplant. Relationships have been established between multiple exposures and greater HLA antibody production, but other factors which may predispose an individual to greater HLA antibody production, such as blood type, have yet to be explored.

 Study design and Methods: We analyzed the blood types and calculated panel reactive antibody (cPRA) values of patients in bone marrow transplant (BMT) and kidney transplant populations. Blood type frequencies were compared by chi-squared testing, and the cPRA values of the kidney transplant and BMT groups were compared by t-testing.

 Results: In the kidney transplant population, a lower percentage of blood type A and a higher percentage of blood type AB was seen in patients who had cPRA values of 30 or more. A decreased percentage of blood type A was also seen in patients who had a positive cPRA. In the BMT population, a lower percentage of blood type O was seen in patients who had a positive cPRA.

Conclusion: Blood type A is less common in kidney transplant patients with higher cPRA values, while blood type AB is more common. Although it is not clear why this relationship was not also seen in the BMT population, this could be due to differences in antigen exposure.

Primary Presenter: Do Park

Project Title: Return to Golf After Shoulder Arthroplasty

Primary Mentor: Rachel Frank

Secondary Mentor(s): Hytham Salem

Thematic Area: Clinical Science

Abstract:

Background: The number of golfers aged 65 years has increased in recent years, and shoulder arthritis is prevalent in this age group. Guidelines for return to golf (RTG) after shoulder arthroplasty have not been fully established.

Purpose: To review the data available in the current literature on RTG after shoulder arthroplasty.

Study Design: Systematic review.

Methods: A systematic review based on the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines was performed. Two independent reviewers searched PubMed, Embase, and the Cochrane Library using the terms €˜€˜shoulder," €˜€˜arthroplasty," €˜€˜replacement," and €˜€˜golf." The authors sought to include all studies investigating RTG after total shoulder arthroplasty (TSA), shoulder hemiarthroplasty (HA), and reverse shoulder arthroplasty (RSA). Outcomes of interest included indications for shoulder arthroplasty, surgical technique, rehabilitation protocol, amount of time between surgery and resumption of

golf activity, and patient-reported outcome measures.

Results: A total of 10 studies were included, 2 of which reported on golf performance after shoulder arthroplasty. The other 8 studies described return to sports after shoulder arthroplasty with golf-specific data for our analysis. Three studies that included patients who underwent TSA reported RTG rates ranging from 89% to 100% after mean follow-up periods of 5.1 to 8.4 months. Two studies included patients who underwent TSA and HA and reported RTG rates of 77% and 100% after mean intervals of 5.8 and 4.5 months, respectively. Two studies included patients who underwent RSA, with RTG rates of 50% and 79% after mean postoperative intervals of 5.3 and 6 months, respectively. One study included only patients undergoing HA, with an RTG rate of 54% and a mean RTG time of 6.5 months. Varying surgical procedures and baseline patient characteristics precluded our ability to draw conclusions regarding surgical technique, rehabilitation protocol, or patient-reported outcome measures among studies reporting these data.

Conclusion: Most patients who undergo a shoulder arthroplasty procedure can expect to resume playing golf approximately 6 months after the index procedure. The rate of return may be lower after RSA and HA as compared with anatomic TSA. The data presented in our review can help

physicians counsel patients who wish to continue golf participation after a shoulder arthroplasty procedure.

Primary Presenter: Dorothy Stearns

Project Title: Sex Differences in Violent Death During Incarceration and Legal Intervention

Primary Mentor: Catherine Velopulos

Secondary Mentor(s):

Thematic Area: Public Health and Epidemiology

Abstract:

INTRODUCTION: The pervasiveness of physical violence in the United States justice system often leads to injury and even violent death for those who are incarcerated. The purpose of this project is to better clarify the differences in death during incarceration between males and females, delineating the differences in demographic features and the circumstances of the violent death including location, injury pattern, and perpetrator. This analysis included legal intervention deaths (victim in custody or in process of custody) including homicide and suicide deaths.

METHODS: This is a report utilizing the multi-state National Violent Death Reporting System (NVDRS) data from the years 2003-2019. The NVDRS collects data on all deaths of violent nature. This includes homicides which include legal intervention deaths which apply to any violent death from a police officer, sheriff, guard, or other law enforcement officer. Data are abstracted from both coroner/medical examiner reports as well as legal proceedings on the demographics of both victims and perpetrators, type of weapon used, and other circumstances of fatal injury. Deaths occurring during incarceration or in process of legal intervention were compared for males and females including demographic characteristics of victims and features surrounding the violent death incident.

RESULTS: Overall, there were 4386 victims of violent death in our analysis with 371 female victims and 4015male victims. There were 3440 victims of suicide, with 333 female victims and 3107 male victims; suicide was the most common cause of death during incarceration for both females and males (89.756% vs 77.38%;p<0.001). Homicide was less common in females (1.62% vs 14.79%; p<0.001) and legal intervention only occurred in males (2.17%; p<0.001). Male victims were more likely to be nonwhite race/ethnicity, while females were more likely to be experiencing homelessness and have documented mental illness.

Primary Presenter: Dylan Foley

Project Title: Resuscitative Endovascular Balloon Occlusion of the Aorta as a Bridge to Organ Donation after Blunt Trauma

Primary Mentor: Ernest Moore

Secondary Mentor(s): Josh Sumislawski

Thematic Area: Clinical Science

Abstract:

Solid organ transplantation is limited worldwide by a shortage of donor organs. Trauma patients with unsurvivable injuries comprise a large portion of potential organ donors, but many of them die from cardiovascular collapse before donation can be pursued. We report the use of resuscitative endovascular balloon occlusion of the aorta (REBOA) to stabilize a deteriorating blunt trauma patient who was ultimately able to donate multiple organs and tissues. Survival to organ donation is a tangible and beneficial outcome of REBOA.

Primary Presenter: Dylan Herman

Project Title: Psychotherapy Process Group to Support COVID Patients Post€"ICU

Primary Mentor: Merlin Ariefdjohan

Secondary Mentor(s): Thida Thant

Thematic Area: Clinical Science

Abstract:

Background: Recent studies indicate that individuals infected with COVID-19 developmental health issues even after they have recovered from the infection. Currently, there are limited specialized mental health support services for this patient population. This clinical program and study aimed to evaluate the feasibility and effectiveness of virtual peer-based process group psychotherapy in addressing the mental health needs of long-haul post-ICU COVID patients following ICU admissions.

Methods: A psychotherapy process group was set up in an outpatient specialty clinic operating at an urban teaching hospital. The group co-facilitated by a supervising psychologist, a psychiatry resident, and a fourth-year medical student entering the field of psychiatry, but participants guided the topics and discussion process. Members asked each other questions, provided feedback, and vulnerability shared their unique experiences with each other. Each session was 1.5 hours long occurring on a bi-weekly basis. Patients (N=16) could opt to attend as frequently as they wish. The (Hope) Future Scale (HFS) and the UCLA Loneliness Scale (UCLA-LS) were administered before each member participated in the first session (pre-evaluation), and again after attending at least 6 group sessions (post-evaluation). Plan in place for surveys to be repeated approximately every three months. These scales evaluate participants' level of hope and quality of connection with others, respectively. Scores will be analyzed using descriptive and inferential statistics. Progress will also be measured with qualitative responses summarized as major themes. Participants were interviewed for additional perspectives on the impact that the process group has on their mental health and the degree to which it has helped them.

Results: There were 22 process group sessions occurring during January 2021 to February 2022. The average number of attendees per session ranged from 2 to 5 patients. Majority of patients (74%) attended more than 1 session. Upon interview, participants (n=4) indicated significantly positive sentiments about the impact that participating in the process group has had on improving their mental health, well-being, and outlook on life and the future. Some statements that have stood out include: "It's been comforting to me to hear that someone has kind of been where I've been", "you guys all can relate and understand… it's nice to know I'm not alone", "you guys give me hope", "you guys are accepting", and "the format is great". The virtual sessions were generally well-received by attendees with very little technological barriers.

Conclusion: Participants indicated a spectrum of experiences related to grief and trauma associated with being infected and recovering from COVID-19 following an ICU admission. The

psychotherapy process group provided an outlet for them to find healing through discussing relatable experiences. Logistically, the process group was feasible to be integrated in the clinical operations.

Primary Presenter: Dylan Rakowski

Project Title: Minimum 2-year patient report outcomes following fixation of displaced greater tuberosity fractures: A Matched Cohort Analysis.

Primary Mentor: Frank Scott

Secondary Mentor(s):

Thematic Area: Clinical Science

Abstract:

Background: Isolated greater tuberosity (GT) fractures account for approximately one fifth of all proximal humerus fractures, however, there remains a paucity of research regarding the outcomes of GT fracture fixation. Furthermore, as greater tuberosity fractures are avulsion fractures of the rotator cuff, an acute rotator cuff repair group enables a comparison of the fixation technique under the circumstances of bone-to-bone and tendon-to-bone interfaces.

Purpose and Hypothesis: The purpose of this study was to evaluate and compare patient-reported outcomes following isolated GT fracture fixation to acute rotator cuff repair (RCR) at a minimum of 2 years. It is hypothesized that patients who underwent fixation of GT fractures with a double-row technique would have equivalent patient-reported outcome measures to those treated for an acute rotator cuff tear.

Methods: Patients who underwent isolated GT fracture fixation were compared in a 1-to-3 fashion with patients who underwent arthroscopic RCR for an acute rotator cuff tear by a single surgeon between January 2006 and July 2018. Data was prospectively collected and retrospectively reviewed. Patient-reported outcomes (PROs) were compared pre- and post-operatively as well as between groups (ASES, SF-12 PCS, SANE, QuickDASH, and satisfaction). Reoperation rates were analyzed.

Results: A total of 57 patients, 14 patients with isolated GT fracture fixation, mean age of 45.7 years old, and 43 patients who underwent ARCR for acute tears, a mean age of 56.6 years old, were evaluated (p=0.050). ASES scores significantly improved from 39.7 to 94.0 (p=0.018) in the isolated GT fracture fixation group and from 51.0 to 95.2 (p<0.001) in acute RCR group. At final follow-up, mean QuickDASH scores were 8.9 and 7.9 (p=0.667) and SANE scores were 90.1 and 87.3 (p=0.616) for the GT and acute RCR groups, respectively. The median satisfaction was 10/10 for the GT group and 10/10 for the RCR group. Additional comparison of patients who underwent double-row repair for an acute rotator cuff tear or isolated GT fracture revealed no significant difference in outcomes (p>0.404).

Conclusion: Minimum 2-year patient report outcomes following fixation of isolated GT fractures show relatively high outcome scores whether treated by open reduction and internal fixation or arthroscopic fixation using a double row, bridging suture anchor technique, which relays the importance of selecting a treatment based on fracture morphology but also post-operative goals,

lifestyle, and shared-decision making. The improvements in PROs are similar to those achieved with acute rotator cuff tears that were fixed arthroscopically with RCR. Further analysis of these results suggests that the functional outcomes of tendon-to-bone healing with linked, double-row rotator cuff repairs are similar to those of bone-to-bone healing as seen with GT fractures.

Primary Presenter: Dylan Schoo

Project Title: DJK and Revision Rates in Multilevel Posterior Cervical Fusions Terminating at the Cervicothoracic Junction: A Retrospective Review

Primary Mentor: David Ou-Yang

Secondary Mentor(s):

Thematic Area: Clinical Science

Abstract:

Introduction: Posterior spinal fusion is commonly used to correct cervical pathologies. Following a historical paucity of literature on outcomes regarding posterior spinal fusion surrounding the cervical thoracic junction (CTJ), several recent studies have begun to look at revision rates of fusions ending at C7, versus those continued to thoracic vertebra, and how each technique may be related to adjacent segment disease. Our current study aimed to compare revision rates as well as distal junctional kyphosis between two groups of patients with posterior fusions terminating at C7 versus those terminating at T1, T2, or T3.

Methods: A single center review of medical records was used to identify patients who underwent posterior spinal fusion. Patients were included who had an index procedure within the past 10 years, at least 1 year of follow-up, and at least three segments instrumented. Patients were divided into two groups. Group 1 (G1) included those fusions terminating at C7, and group 2 (G2) included fusions terminating at T1, T2, or T3. Revision rates were accessed, additional procedures were noted, and radiographic measurements were made including cervical lordosis (CL), cervical sagittal vertical axis (cSVA), distal segment kyphosis (DK), and T1 cervical lordosis mismatch (T1S-CL).

Results: A total of 91 patients were identified who met criteria, 53 in group 1, and 38 in group 2. There was no significant difference in revision rate (G1: 9.4% vs G2: 2.6% P=0.39), or in patients who met criteria for distal junctional kyphosis (G1: 5.6% vs G2: 5.2% P=0.9). Radiographic measurements showed no statistically significant differences, except for distal segment kyphosis which showed a significant increase in G2 when compared to G1 (G1: 0.82°, P=0.31 vs. G2: 2.5°, P=0.0001).

Conclusion: This study resulted in no statistically significant difference in revision rates or radiographic parameters detected between patients with posterior cervical fusions terminating at the C7 level compared to those terminating at the first three thoracic levels.

Primary Presenter: Eddie Soto

Project Title: RETROSPECTIVE ANALYSIS OF UNDERSTANDING FIREARM VIOLENCE PREVENTION AFTER SAFETY PRESENTATION IN A COMMUNITY-BASED SETTING

Primary Mentor: Krsitine Rodrigues

Secondary Mentor(s):

Thematic Area: Public Health and Epidemiology

Abstract:

Firearm-related deaths in the United States are the third leading cause of overall death among children and the United States continues to have the highest rate of firearm-related injuries compared to other industrialized countries4. Roughly 1/3 of U.S. homes with children contain firearms. In 2017, at least 285 children got ahold of a gun and inadvertently shot themselves or someone else. Teenagers are at a higher risk for suicide when there is a gun in the home. This project aims to see if giving a presentation on gun violence prevention and facilitating a role-play scenario within the community will increase knowledge of this topic.

We plan on volunteering at various health fairs and community events to give an oral presentation on gun violence prevention in both Spanish and English. We then ask individuals participating in partaking in a role-play scenario with one another pretending to ask other parents about firearms in the home before €œplay-dates.€ The presentation will focus on three objectives: firearm risk, the relationship between firearms and suicide, and safe firearm storage. After the presentation and role-play scenario, we plan on administering a retrospective pre-post survey for volunteer participants to see if the presentation increased knowledge of the three objectives outlined during the presentation.

Primary Presenter: Elaina Van Patten

Project Title: AR expression is a positive prognostic predictor in breast cancer and antiandrogen treatment decreases proliferation across breast cancer subtypes: A review

Primary Mentor: Jennifer Richer

Secondary Mentor(s):

Thematic Area: Clinical Science

Abstract:

Triple Negative Breast Cancer (TNBC) has very few targeted therapy options. The androgen receptor (AR) plays a promising role in the treatment of treatment-resistant breast cancer. There is controversy on whether an AR agonist or antagonist is best for breast cancer treatment. In this review, we analyzed research papers that used animal research, human breast cancer pathology datasets, as well as clinical trials. There was compelling data that AR:ER ratio is a positive prognostic indicator for breast cancer. While there is conflicting data on androgen agonists vs antagonists, the data is currently favoring anti-androgens as a treatment model. Androgens express key elements in the cell cycle and when antiandrogens are combined with CDK4/6 inhibitors, there is a synergistic effect. Our lab has a current clinical trial using anti-androgens in heavily pretreated breast cancer which is showing promising results.

Primary Presenter: Elijah Finer

Project Title: Fort Collins Street Medicine Clinic: Development and Implementation of Student Run Free Clinic During Longitudinal Integrated Clerkship

Primary Mentor: Benjamin Leon

Secondary Mentor(s):

Thematic Area: Public Health and Epidemiology

Abstract:

Background:People Experiencing Homelessness (PEH) have higher morbidity and mortality, associated mental health and psychiatric illness, infectious diseases, age-related conditions and chronic cardiovascular and metabolic diseases compared to the housed population1. PEH who are pet-owners experience increased barriers to care as healthcare facilities, among other public services like transportation and shelters, do not allow pets 2-3. The Fort Collins Street Medicine Clinic (FCSMC) was created in conjunction with the Street Dog Coalition (SDC), a free veterinary services clinic for pets of PEH, and the Murphy Center, a day shelter for PEH, to provide greater access to care for this vulnerable population.

Methods: The FCSMC was created by third year medical students in a Longitudinal Integrated Clerkship (LIC). Development was led by medical students in conjunction with community organizations. Meetings with stakeholders, grant writing, administrative development and clinic hours were held in pre-scheduled LIC independent learning time.

Results / Findings: The FCSMC currently operates weekly. Services provided include wound care, medication refills, referring to social services, and establishing primary care appointments with community clinics. The FCSMC is staffed by volunteer community physicians, advanced practice providers, medical students, and undergraduate students. Informal feedback has been very positive from patients and stakeholders.

Implications / Conclusions: Despite the limitations of the pandemic, FCSMC has proven to be an effective addition to the health services in the community. It has been able to garner the trust and support of PEH with pets and will rely on motivated students to maintain continuity and increase the patient census and services of the clinic. The LIC format lends itself well to the implementation of an interdisciplinary street medicine clinic. Working alongside veterinary and social work professionals provides a unique approach to comprehensive care and engagement with vulnerable populations.

Primary Presenter: Ellen Clark

Project Title: Translabial Ultrasound: An Effective Modality for Evaluation of Midurethral Sling Revision

Primary Mentor: Alison Sheridan

Secondary Mentor(s):

Thematic Area: Clinical Science

Abstract:

Background: Midurethral sling (MUS) surgical procedures, in which a polypropylene synthetic mesh graft is transvaginally placed to support the urethra and manage stress urinary incontinence (SUI), is commonly performed [1, 2]. Within 10 years of sling placement about 1 in 20 women undergo subsequent surgery to revise their mesh, in which the mesh is cut or partially excised [3]. Translabial ultrasound (TLUS) has been described as a sensitive technique for viewing MUS [4]; however, few studies have evaluated the ability of TLUS to view revised MUS. Understanding the anatomy of the MUS, particularly following revision, is critical to urologists and urogynecologists striving to optimize management of patients presenting with lower urinary tract symptoms (LUTS) and history of MUS. It was hypothesized that TLUS would serve as a highly sensitive as well as specific tool for identifying a gap in the hyperechoic mesh and, thus, confirming history of sling revision.

 Objective: To assess the clinical utility and reliability of TLUS as a diagnostic tool in its detection of MUS discontinuity.

Methods: We conducted a retrospective analysis of women who underwent TLUS at a tertiary care center between September 2017 and May 2020 for indication of LUTS and reported history of MUS placement. Patient demographic information, clinical data, operative records and TLUS reports were reviewed. Patients with MUS identified on TLUS confirmed by a radiologist familiar with TLUS assessment of MUS were included. Patients were excluded from analysis if an MUS of transobturator, retropubic or single-incision configuration was not visible on TLUS or if there were records of complete sling excision. TLUS performance was evaluated by comparing findings to operative or clinical records.

Results: 81 women were identified with a mean age of 59.7 ± 13.76 (SD) years. The detection of MUS revision, which was defined as a discontinuity in sling material, had a sensitivity of 84.6% and specificity of 97.1%.

Conclusion: TLUS is an inexpensive, non-irradiating and noninvasive modality that is effective at visualizing midurethral slings. It is a reliable identifier of prior MUS revision, in which it detects a midline discontinuity of the hyperechoic mesh with an average 10mm gap.

Clinical Impact: TLUS may be utilized as part of a urologist's and urogynecologist's optimal management of a patient with history of MUS, particularly with prior revision.

Primary Presenter: Eman Mesgina

Project Title: Racial and Ethnic Microaggressions in Medical School and its Impact on Student Perceptions of their Learning Environment - creating an assessment tool

Primary Mentor: Regina Richards

Secondary Mentor(s):

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

Background: The enrollment, graduation, and advancement of underrepresented minority medical students (URM) has become an increasingly important subject as the United States continues to diversify. Despite certain efforts to increase enrollment, numbers have remained stagnant and many disparities among performance and experience have been identified between URM's and their white counterparts. Recent focus has emphasized the impact of microaggressions on racial minorities and the cumulative burden they can have in impacting learning and attitudes. To date, very few studies have investigated the frequency or type of microaggressions in the medical school educational or clinical setting, likely due to the lack of a well-designed tool to assess these metrics. This study aims to create a novel survey tool based off of the validated REMS tool specific to the medical school environment. This tool can be used in the future to quantify the difference in frequency and types of microaggressions occurring in the medical school environment and its impact on medical student perceptions of the learning environment. Furthermore, findings can promote curricular change and action planning can be initiated at each respective institution to address behaviors identified by this tool. The study is designed to include only the traditional URM groups as defined by the AAMC in 2004 being African American/Black, Latino/Hispanic/Puerto Rican, and Native American/Native Alaskan.

Methods: The survey-based questions were developed after extensive literature review and further focus on the Racial Ethnic Microaggressions Scale (REMS) and the Racial microaggression scale. As REMS is currently recognized as the gold-standard tool, questions were based within this validated framework. This was accomplished by focusing on three major categories of the REMS tool: assumptions of similarity, microinvalidations, and environment.

Primary Presenter: Emily Paton

Project Title: Lipid use and accumulation is defined by BRAF V600 status

Primary Mentor: William Robinson

Secondary Mentor(s):

Thematic Area: Basic Biomedical Science

Abstract:

There is increasing evidence that oxidative metabolism and fatty acids play an important role in BRAF-driven tumorigenesis yet the effect of BRAF mutation and expression on metabolism is poorly understood. We examined how BRAF mutation and expression modulates metabolite abundance. Using NIH3T3 models, we found cells expressing BRAF V600E were enriched with immunomodulatory lipids and had a unique transcriptional signature which were characteristics exclusive to BRAF V600E expression. The BRAF V600E mutation promoted accumulation of long chain polyunsaturated fatty acids and rewired metabolic flux to promote non-Warburg behavior. This cancer-promoting mutation induced the formation of TNT-like protrusions which preferentially accumulated lipid droplets. In the plasma of melanoma patients harboring the BRAF V600E mutation, levels of lysophosphatidic acid, sphingomyelin, and long chain fatty acids were significantly increased in patients who did not respond to BRAF inhibitor therapy post-treatment. Our findings show BRAF V600 status plays an important role in regulating immunomodulatory lipid profile and lipid trafficking which may inform future therapy across cancers.

Primary Presenter: Emily Wolverton

Project Title: Opioid Prescription Monitoring in Pre- and Post-Operative Sacroiliac Joint Fusion Patients

Primary Mentor: Nolan Wessel, MD

Secondary Mentor(s):

Thematic Area: Clinical Science

Abstract:

Introduction: An estimated 15-25% of patients with chronic low back pain may in fact suffer from sacroiliac (SI) joint dysfunction9, 10. SI joint fusion has become a common treatment option for the management of SI joint dysfunction. However, little is known about opioid use prior to and after surgical treatment in this patient population.

Methods: The medical records of 62 patients treated with SI joint fusion at our institution were reviewed in this retrospective study. The Colorado Prescription Drug Monitoring Program (CPDMP) was accessed to gather opioid prescription information for these patients. Only those patients who had received an opioid prescription within 3 months prior to their surgery were included in the study. Patients who had sacroiliac joint fusion but underwent another surgical procedure during the 12 month follow-up period were excluded from analysis. Preoperative (6 and 3 months) and postoperative (3, 6, 9, and 12 months) mean morphine milligram equivalents (MME) were collected from the CPDMP database for each patient. Patient demographic and medical comorbidity data were also documented to identify any correlations or potential risk factors for chronic opioid prescribing. Visual-analog scale (VAS), Oswestry Disability Index (ODI), and Denver SI Joint Questionnaire (DSIJQ)13 scores were recorded for each patient to assess clinical outcomes.

Results: At 3 months prior to surgery, patients were prescribed an average of 47.2 mean MME/day. At no point postoperatively did the quantity of opioids, measured in MME/day, change significantly from the 3 months preoperative prescription quantities (Table 1). There was no significant difference in the quantity of opioids received by men vs. women (Table 2), in patients with vs. without anxiety and/or depression (Table 3) or in younger vs. older patients (Table 4). Low body mass index was correlated with decreased opioid prescriptions at 6 months postoperative but became statistically insignificant again by 9 months postoperative (Table 5).

Significant improvements in VAS scores were recorded for all postoperative clinical evaluation time points (6 weeks, 3 months, 6 months and 12 months) compared to preoperative scores. By 12 months postoperative, VAS scores had decreased from 6.2 to 3.9 (p < 0.001). This change is not only statistically significant but also meets the criteria for minimum clinically important difference (MCID) in scores. Both the ODI and DSIJQ patient-reported outcomes scores also showed significant improvements at 12 months after surgery (ODI: 48.9 preoperative vs 24.6 postoperative, p = 0.02; DSIJQ: 53.2 preoperative vs 17.4 postoperative, p = 0.014). The ODI

improvement also met the MCID criteria. By 6 months postoperatively, there was no significant correlation in VAS or ODI and opioid use. There was no significant correlation between the DSIJQ scores and the daily dose of opioids at any point postoperatively.

Conclusion: Quantity of opioid prescriptions received by patients with SI joint pain did not change significantly from 3 months preoperatively to any point postoperatively despite significant improvements in all patient-reported outcome measures. This discordance between long-term opioid requirements and positive clinical outcomes is concerning and warrants further investigation.

Primary Presenter: Emmanuel Seyoum

Project Title: "The Case of the Silent Abdominal Mass and Elevated alpha-FP in an Infant"

Primary Mentor: Lauren Anderson

Secondary Mentor(s):

Thematic Area: Clinical Science

Abstract:

Abstract: A 9-month-old male is admitted to Children's Hospital Colorado after a right upper quadrant (RUQ) abdominal mass was noted during a well child visit. Parents voice no concerns other than mild constipation over the last few weeks, including no abdominal distention or pain, changes in appetite, fever, weight change, or easy bruising and bleeding. Physical exam is remarkable for a midline crossing, palpable RUQ mass extending from the right costal margin to just above the iliac crest. Lab results are within normal limits but is notable for an elevated Alpha fetoprotein (aFP). Imaging and pathology from surgical resection ultimately confirm the mass to be a mesenchymal hamartoma.

The differential diagnosis for an asymptomatic pediatric liver mass is broad and includes both benign and malignant etiologies. Common causes of hepatic masses in infants and toddlers include hepatoblastoma, hemangioma, and mesenchymal hamartoma, which is a relatively rare, benign cause. aFP, amongst other labs, are critical in the workup of a pediatric hepatic mass; however, aFP is not always indicative of malignancy as it can be elevated in benign processes and physiologically in young children. Imaging findings on ultrasound, CT, and MRI can help identify mesenchymal hamartomas; however, pathology is necessary to confirm the diagnosis.

Primary Presenter: Eniola Ogundipe

Project Title: Prenatal and Early Postnatal Outcomes for Fetuses with Anatomic or Functional Renal Agenesis

Primary Mentor: Vijaya Vemulakonda

Secondary Mentor(s):

Thematic Area: Clinical Science

Abstract:

Introduction: With the advent of novel fetal interventions there has been increased interest in fetal intervention for previously €œlethal€ anomalies such as bilateral renal agenesis or other CAKUT diagnoses associated with in utero renal failure. While there have been rare reports of successful births following intervention in these cases, there is a paucity of data regarding the risks, benefits, and outcomes of intervention. To address this gap, this study reviewed our experience with fetal intervention for anatomic or functional renal agenesis.

Methods: A retrospective review was conducted for patients referred to the Colorado Fetal Care Center (CFCC) between 2013-2019 for evaluation of complex CAKUT anomalies. Eligibility for amnioinfusion was determined by a multidisciplinary team including social work and psychology. Data collected includes parent demographics, details of fetal intervention, post-natal course, and infant mortality.

Results: A total of five cases received fetal amnioinfusion for treatment of bilateral renal agenesis or bladder outlet obstruction. All five cases reached birth. 3/5 cases expired on day one of birth. 1/2 of the remaining infants expired at 3 months secondary to peritoneal dialysis failure. The remaining infant is 3 years and 5 months. Developmentally, she is on track with cognitive and language skills but is behind with general motor skills. She continues to receive treatment for her several comorbidities and is under evaluation for renal transplantation. We observed a 30-day mortality of 60% and one-year mortality of 80%.

Conclusions: Individuals carrying a pregnancy complicated by anatomic or functional renal agenesis face a difficult choice when considering intervention. The sole surviving infant in this case series is 3 years and 5 months. She currently awaits renal transplantation. These findings reinforce that treatment of these cases should remain experimental and large-scale multicenter trials are needed to determine the optimal indications for prenatal intervention.

Primary Presenter: Eric Marty

Project Title: Pain Scores and Activity Tolerance in the Early Postoperative Period After Hip Arthroscopy

Primary Mentor: Omer Mei-Dan

Secondary Mentor(s):

Thematic Area: Clinical Science

Abstract:

Background: Despite the rapid growth in the use of hip arthroscopy, standardized data on postoperative pain scores and activity level are lacking.

Purpose: To quantify narcotic consumption and use of the stationary bicycle in the early postoperative period after hip arthroscopy. Study Design: Case series; Level of evidence, 4.

Methods: In this prospective case series, patients undergoing a primary hip arthroscopy procedure by a single surgeon were asked to fill out a daily survey for 9 days postoperatively. Patients were asked to report their pain level each day on a visual analog scale from 1 to 10, along with the amount of narcotic pain pills they used during those postoperative days (PODs). Narcotic usage was converted to a morphine-equivalent dosage (MED) for each patient. Patients were also instructed to cycle daily starting on the night of surgery for a minimum of 3 minutes twice per day and were asked to rate their pain as a percentage of their preoperative pain level and the number of minutes spent cycling on a stationary bicycle per day.

Results: A total of 212 patients were enrolled in this study. Pain levels (POD1, 5.5; POD4, 3.8; POD9, 2.9; $P < .0001$) and the percentage of preoperative pain (POD1, 51.6%; POD4, 31.8%; POD9, 29.5%; $P < .01$) significantly decreased over the study period. The amount of narcotics used per day (reported in MED) also significantly decreased (POD1, 27.3; POD4, 22.3; POD9, 8.5; $P < .0001$). By POD4, 41% of patients had discontinued all narcotics, and by POD9, 65% of patients were completely off narcotic medication. Patients were able to significantly increase the number of minutes spent cycling each day (POD1, 7.6 minutes; POD4, 13.8 minutes; POD9, 19.0 minutes; $P < .0001$). Patients who received a preoperative narcotic prescription for the affected hip were significantly more likely to require an additional postoperative narcotic prescription ($P < .001$).

Conclusion: Patients can expect a rapid decrease in narcotic consumption along with a high degree of activity tolerance in the early postoperative period after hip arthroscopy.

Primary Presenter: Eric Wagner

Project Title: Racial and Ethnic Microaggressions in Medical School and its Impact on Student Perceptions of their Learning Environment

Primary Mentor: Regina Richards

Secondary Mentor(s):

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

Background: The enrollment, graduation, and advancement of underrepresented minority medical students (URM) has become an increasingly important subject as the United States continues to diversify. Despite certain efforts to increase enrollment, numbers have remained stagnant and many disparities among performance and experience have been identified between URM's and their white counterparts. Recent focus has emphasized the impact of microaggressions on racial minorities and the cumulative burden they can have in impacting learning and attitudes. To date, very few studies have investigated the frequency or type of microaggressions in the medical school educational or clinical setting, likely due to the lack of a well-designed tool to assess these metrics. This study aims to create a novel survey tool based off of the validated REMS tool specific to the medical school environment. This tool can be used in the future to quantify the difference in frequency and types of microaggressions occurring in the medical school environment and its impact on medical student perceptions of the learning environment. Furthermore, findings can promote curricular change and action planning can be initiated at each respective institution to address behaviors identified by this tool. The study is designed to include only the traditional URM groups as defined by the AAMC in 2004 being African American/Black, Latino/Hispanic/Puerto Rican, and Native American/Native Alaskan.

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Primary Presenter: Frankie Jeney

Project Title: Fort Collins Street Medicine Clinic: Development and Implementation of Student Run Free Clinic During Longitudinal Integrated Clerkship

Primary Mentor: Benjamin Leon

Secondary Mentor(s):

Thematic Area: Public Health and Epidemiology

Abstract:

Background: People Experiencing Homelessness (PEH) have higher morbidity and mortality, associated mental health and psychiatric illness, infectious diseases, age-related conditions and chronic cardiovascular and metabolic diseases compared to the housed population1. PEH who are pet-owners experience increased barriers to care as healthcare facilities, among other public services like transportation and shelters, do not allow pets 2-3. The Fort Collins Street Medicine Clinic (FCSMC) was created in conjunction with the Street Dog Coalition (SDC), a free veterinary services clinic for pets of PEH, and the Murphy Center, a day shelter for PEH, to provide greater access to care for this vulnerable population.

Methods: The FCSMC was created by third year medical students in a Longitudinal Integrated Clerkship (LIC). Development was led by medical students in conjunction with community organizations. Meetings with stakeholders, grant writing, administrative development and clinic hours were held in pre-scheduled LIC independent learning time.

Results: Findings: The FCSMC currently operates weekly. Services provided include wound care, medication refills, referring to social services, and establishing primary care appointments with community clinics. The FCSMC is staffed by volunteer community physicians, advanced practice providers, medical students, and undergraduate students. Informal feedback has been very positive from patients and stakeholders.

Implications: Conclusions: Despite the limitations of the pandemic, FCSMC has proven to be an effective addition to the health services in the community. It has been able to garner the trust and support of PEH with pets and will rely on motivated students to maintain continuity and increase the patient census and services of the clinic. The LIC format lends itself well to the implementation of an interdisciplinary street medicine clinic. Working alongside veterinary and social work professionals provides a unique approach to comprehensive care and engagement with vulnerable populations.

Primary Presenter: Freddi Tran

Project Title: Racial disparities in boarding in an urban academic emergency department

Primary Mentor: Sean Michael

Secondary Mentor(s): Daniel Resnick-Ault

Thematic Area: Public Health and Epidemiology

Abstract:

Importance: There are few studies that investigate differential effects of boarding on patient subpopulations. Boarding is associated with numerous patient-centered harms and represents an unstudied opportunity to introduce bias into the healthcare system.

Objective: To describe any observed differences in emergency department (ED) boarding exposure among various racial and ethnic demographic groups.

Design: In this single-center, retrospective cohort study, we used data available through our electronic health record to explore patient-reported demographic data and boarding times for all admitted patients from 2014 through 2019.

Setting: The University of Colorado Hospital is an urban, academic tertiary care center, serving a local community that is 45% non-Hispanic white, 28% Hispanic or Latino, and 16% Black and sees approximately 100,000 ED visits per year

Main Outcome(s) and Measure(s): Our primary outcome was ED boarding time, defined as the time from admission order until a patient moved to an inpatient bed.

Results: From 2014-2019, 132,611 unique individuals were admitted from the ED between 1 and 86 times. The ED population was predominantly white (74.8%), and the majority identified as Non-Hispanic (85.6%). Race was significantly associated with boarding time. All non-white races, on average, had 5.4% to 18.5% longer boarding time compared to whites, corresponding to mean boarding times from 133 minutes to 150 minutes, versus 126 minutes for white patients. Hispanic ethnicity was also associated with a 3.9% (95% CI: 2.9, 5.0) longer boarding time. When compared to white patients, those who identified as a race other than white were more likely to experience boarding time longer than 2 hours.

Conclusions and Relevance: We observed differential exposure to boarding among racial and ethnic minorities, which is gravely concerning as this confers excess mortality risk that is inequitably distributed to these groups and implies biases that are deeply interwoven into the basic functions of hospital operations. Further research should be directed at determining the degree to which these disparities exist within other institutions and elucidating the cause of this disproportionate burden of boarding on racial and ethnic minority groups.

Primary Presenter: Genna Bonfiglio

Project Title: The long journey inside immigration detention centres in the USA

Primary Mentor: Carlos Franco-Paredes

Secondary Mentor(s):

Thematic Area: Global Health

Abstract:

Many individuals from countries affected by war, violence, and persecution seek asylum in the United States. Asylum seekers make the difficult decision to leave their homes in search of a better life, and face great difficulties and danger during travels to the US. Once at the US border, these individuals are placed in detention centers with incarceration-like conditions, and some wait up to years for an immigration hearing.

Inadequate medical care is a well known phenomenon within private, for-profit detention centers. Detainees with underlying illnesses do not receive adequate medical care or proper medications, including insulin for diabetes or antiretroviral drugs for HIV. Isolation and confinement practices also exacerbate mental illness. The private, for-profit nature of some detention centers prevent local public health authorities from ensuring the appropriate medical care of detainees.

The arrival of the Covid-19 pandemic in 2020 made crowded conditions of these detention centers even more dangerous. The number of immigrants and asylum seekers in detention centers has decreased nationally since the beginning of the pandemic; however, language barriers, low implementation of Covid-19 testing, and continued difficulty implementing social distancing continues to put detainees at risk for infection and illness.

Measures can be taken to alleviate suffering related to medical neglect that occurs in detention centers. We recommend ending of private corporations running detention centers and decreasing the population within these facilities. Additionally, we recommend increasing public health agency oversight, medical staff, and Covid-19 testing resources within these facilities.

Primary Presenter: Geoff Markowitz

Project Title: Medication Errors in Pediatric Patients After Implementation of a Field Guide with Volume-Based Dosing

Primary Mentor: Lara Rappaport

Secondary Mentor(s):

Thematic Area: Clinical Science

Abstract:

Background: Several studies have demonstrated the high frequency of medication errors in pediatric patients by prehospital providers during both patient care and simulation. In 2015, our hospital-based urban EMS system introduced the HandtevyTM Field Guide that provides precalculated pediatric doses in milliliters (mL) by patient age. We hypothesized that implementation of the Field Guide would increase the percentage of correct pediatric medication doses to greater than 85%.

Methods: We performed a single center retrospective cohort study of medications administered to patients < 13 years of age from August 2017 €" July 2019 compared to 2014 baseline data through electronic medical record review. We excluded nebulized medications and online medication direction cases. Our primary outcome was the percentage of correct doses defined as a dose within 80-120% of the Field Guide dose recommendation. Each dosing error was reviewed by two investigators.

Results: We analyzed 483 drug administrations in 375 patients for the Field Guide study period. Doses were correct in 89.4% of medication administrations with 68.5% reportedly administered exactly as dictated by the Field Guide compared to 51.1% in the baseline period. (p<0.001) During the Field Guide study period, the following medications had 100% appropriate dosing: adenosine, dextrose 10%, diphenhydramine, epinephrine 1:10,000, glucagon, naloxone and oral ondansetron. Overdoses accounted for 4.4% of medication errors and underdoses accounted for 6.2% of medications errors. The most overdosed medications were intranasal (IN) midazolam (11.8%) and intravenous fentanyl (9.4%). The most underdosed medications were IN midazolam (23.5%) and intramuscular epinephrine 1:1000 (12.5%). The highest percentage of errors (20%) were seen in the zero to one-year-old age group.

Conclusion: After implementation of a precalculated mL dose system by patient age for EMS providers, most pediatric medications were reportedly administered within the appropriate dose range. A field guide with precalculated doses (in mL) may be an effective tool for reducing pediatric medication dosing errors by EMS providers.

Primary Presenter: Hannah Korrell

Project Title: Atypical Symptoms of Trigger Finger in the Adult Population

Primary Mentor: Frank Scott

Secondary Mentor(s):

Thematic Area: Clinical Science

Abstract:

Background: Stenosing tenosynovitis, or trigger finger (TF), classically presents with pain at the A1 pulley, clicking, catching and/or locking of the finger. However, in clinical practice, patients may exhibit symptoms other than those listed above, described as €œatypical€⬚ symptoms. The purpose of the study was to identify €œatypical€⬚ symptoms of TF in the adult population with the hypothesis that these patients undergo more advanced imaging prior to referral

Methods: We conducted a retrospective chart review of adult patients presenting as new patients to a single-institution orthopedic hand surgery clinic over a five-year period. We collected age, sex, medical co-morbidities, advanced testing prior to referral, subjective symptoms, clinical exam findings, number of corticosteroid injections, improvement following injections, and surgical release.

Results: 183 patients were included in the study. 96.7% (N=123) exhibited classic symptoms, 96.1% of whom experienced pain at the A1 pulley, while only 33.6% and 38.3% exhibited catching or locking, respectively. The most common €œatypical€⬚ symptoms were pain with grip (28.9%), finger stiffness (24.2%), and finger swelling (18%). These patients were 2.6 times more likely to undergo radiographs prior to referral (95%CI: 1.11, 6.0, P=0.027). All patients with €œatypical€⬚ symptoms underwent at least one corticosteroid injection but were 53% less likely to have surgery (95%CI: 0.21, 1.11; P=0.08).

Conclusion: Patients with TF can present with a wide range of symptoms outside of those classically associated with the condition. Although TF is diagnosed clinically, €œatypical€⬚ symptoms may confound the diagnosis, leading to increased rates of advanced imaging.

Primary Presenter: Haydar Ibrahim

Project Title: RETROSPECTIVE ANALYSIS OF UNDERSTANDING FIREARM VIOLENCE PREVENTION AFTER SAFETY PRESENTATION IN A COMMUNITY-BASED SETTING

Primary Mentor: Kristine Rodrigues

Secondary Mentor(s):

Thematic Area: Public Health and Epidemiology

Abstract:

Firearm-related deaths in the United States are the third leading cause of overall death among children and the United States continues to have the highest rate of firearm-related injuries compared to other industrialized countries4. Roughly 1/3 of U.S. homes with children contain firearms. In 2017, at least 285 children got ahold of a gun and inadvertently shot themselves or someone else. Teenagers are at a higher risk for suicide when there is a gun in the home. This project aims to see if giving a presentation on gun violence prevention and facilitating a role-play scenario within the community will increase knowledge of this topic.

We plan on volunteering at various health fairs and community events to give an oral presentation on gun violence prevention in both Spanish and English. We then ask individuals participating in partaking in a role-play scenario with one another pretending to ask other parents about firearms in the home before €œplay-dates.€ The presentation will focus on three objectives: firearm risk, the relationship between firearms and suicide, and safe firearm storage. After the presentation and role-play scenario, we plan on administering a retrospective pre-post survey for volunteer participants to see if the presentation increased knowledge of the three objectives outlined during the presentation.

Primary Presenter: Hayley Hawkins

Project Title: Examination of Wnt signaling as a therapeutic target for pancreatic ductal adenocarcinoma (PDAC) using a pancreatic tumor organoid library (PTOL).

Primary Mentor: Todd Pitts

Secondary Mentor(s):

Thematic Area: Basic Biomedical Science

Abstract:

Background: Pancreatic ductal adenocarcinoma (PDAC) commonly presents at advanced stages and is refractory to most treatment modalities, making it one of the most lethal cancers. Although the low tumor cellularity and high desmoplastic response convolutes the relationship between genotype and biological phenotypes, gene mutations associated with PDACs have been identified. Wnt pathway mutations are rarely detected in PDAC, but Wnt signaling is activated by pancreatic duct ligation injury and plays a critical role in the proliferation and chemotherapeutic resistance in other cancers. Patient derived pancreatic tumor organoid libraries (PTOL) allow for more accurate of the biological phenotypes that might lead to therapies that further improve survival. This study aims to subclassify PDAC organoids based on Wnt dependency and determine if combinatory treatment with Wnt inhibitors and chemotherapy would serve as a feasible treatment.

Material and Methods: Minimal media conditions required to maintain growth of nine PDAC organoids grown in Human Pancreatic Stem Cell medium was assessed with depletions of various niche factors. For confirmation of Wnt inhibition, organoids grown in minimal media were treated with Wnt inhibitors (ETC-159, ICG001, C59). Select organoids demonstrating Wnt dependency were treated with the Wnt inhibitor ETC-159 as a single agent and in combination with gemcitabine or paclitaxel in vitro. Growth was assessed with CellTiter Glo 3D and ANOVA was used for statistical analysis. Organoid lines demonstrating response to combinatory treatment in vitro were assessed in vivo as a matched patient-derived xenograft. Wnt (in)dependent gene signatures were identified for each organoid and RT-PCR was used to determine fold change gene expression of key Wnt genes in tumors following in vivo treatment.

Results: Minimal media conditions, growth factor dependency, and Wnt dependency determined via Wnt inhibition were determined as described above for seven patient derived organoids (PDOs): Panc129, Panc193, Panc268, Panc269, Panc272, Panc308, Panc320. Panc269 demonstrated a trend of reduced organoid growth when treated with ETC-159 in combination with paclitaxel or gemcitabine as compared with chemotherapy or ETC-159 alone. Panc320 demonstrated a more pronounced anti-proliferative effect in the combination of ETC-159 and paclitaxel but not with gemcitabine. Panc269 and Panc320 were implanted into nude mice and treated with ETC-159, paclitaxel, and gemcitabine as single agents and in combination. The combination of ETC-159 and paclitaxel demonstrated an anti-tumor effect greater than ETC-159

alone. Extent of combinatory treatment effect were observed to a lesser extent in the Panc320 xenograft. Wnt (in)dependent gene signatures of Panc269 and 320 were consistent with the phenotypes displayed, and gene expression of several key Wnt genes also demonstrated notable fold change following treatment in vivo.

Conclusions: Based on the results obtained, each pancreatic organoid demonstrated varied niche factor dependencies providing an avenue for targeted therapy, particularly with Wnt inhibition, which was supported through growth analysis following combinatory treatment of Wnt inhibitor and standard chemotherapy in vitro. The clinical utilization of this combinatory treatment modality in pancreatic cancer PDOs has thus far been supported in our patient-derived xenograft models treated with Wnt inhibitor plus paclitaxel or gemcitabine. Gene expression analysis suggests that there are key Wnt genes that contribute to the Wnt (in)dependent phenotypes of pancreatic tumors, providing plausible mechanistic explanation for Wnt (in)dependency and susceptibility or resistance to treatment on the genotypic level.

Primary Presenter: Hayley Specht

Project Title: Helicopter Versus Ground Emergency Medical Services: A Scoping Review

Primary Mentor: Mark Deutchman

Secondary Mentor(s):

Thematic Area: Public Health and Epidemiology

Abstract:

Objectives: Efforts to identify which patients benefit most from Helicopter Emergency Services (HEMS) activation can help guide clinical decisions around employing this costly and often risky resource. This scoping review seeks to identify trends in survival outcomes data comparing helicopter and ground emergency services (GEMS) transports directly from trauma scenes to definitive care, critically assess the quality of existing data, and generate questions for further directed study. Methods: Pubmed was the primary database used for this review. Database search was conducted by a matrix approach utilizing MeSH search terms as well as general keyword search criteria. Included studies were published in 2010 or later and directly compared survival in HEMS and GEMS trauma transports from scene. Studies were evaluated by 3 independent reviewers to ensure inclusion criteria were met.

Results: Forty-one retrospective cohort studies were included for review. HEMS and GEMS survival outcomes were compared overall or based on patient physiologic criteria, injury type, injury severity, and patient age. HEMS activation was associated with improved survival overall in both nation-wide and single-institution studies. When comparing HEMS and GEMS survival based on type of injury, results were mixed with the exception of traumatic brain injury which benefited from HEMS activation across several studies. When patient characteristics were compared, those with unstable vital signs at the trauma scene appeared to benefit from HEMS activation. Patient age (pediatrics patients or those >55 years) was not consistently associated with mortality benefit.

Conclusions: After controlling for injury severity and patient characteristics, HEMS is associated with improved survival in patients transported from trauma scenes. Several studies reported that patients with unstable vital signs on scene and those with traumatic brain injuries benefit most from HEMS activation. The quality of the existing evidence is poor, in large part due to methodological limitations and confounding variables that cannot be controlled for on a trauma scene. Further study is needed to elucidate specific factors that lead to the possible survival benefit of HEMS.

COI: All authors declare they have no conflicts of interest.

Primary Presenter: Helio Neves da Silva

Project Title: What Happened and Why: Responding to Racism, Discrimination, and Microaggressions in the Clinical Learning Environment

Primary Mentor: Anna Neumeier

Secondary Mentor(s):

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

Background: Within clinical settings, American medical students are uniquely faced with power differentials that make acts of racism, discrimination, and microaggressions (RDM) challenging to address. Experiences of microaggression and mistreatment are correlated with higher rates of positive depression screening and lower satisfaction with medical training. We developed a curriculum for medical students entering the clinical learning environment to promote the recognition of and response to RDM.

Methods: Guided by generalized and targeted needs assessment, we created a cased-based curriculum to practice communication responses to address RDM. The communication framework, a €œ6-D's approach,€□ was developed through adaptation and expansion of established and previously learned communication upstanding frameworks. Cases were collected through volunteer submission and revised to maintain anonymity. Small group sessions were co-facilitated by faculty and senior medical students. During the sessions, students reviewed the communication framework, explored their natural response strategies, and then practiced all response strategies.

Results: Of the 196 participants in the workshop 152 (77.6%) completed the evaluation surveys. Pre- and post-session assessments demonstrated statistically significant improvement in learner's awareness of instances of RDM (33.8% to 45.5%), knowledge of communication strategies to mitigate RDM (Mpre=3.39, Mpost= 4.62; P<0.05) and confidence to address RDM (Mpre= 3.05, Mpost= 4.38; P<0.01).

Conclusion: Students gain valuable communicative skills from interactive sessions that address RDM using empathy, reflection, and relatability. This session empowers students to feel prepared to enter professional teams and ready to effectively mitigate harmful discourse.

Primary Presenter: Ignasis Gutierrez-Beasley

Project Title: PROCESS AND IMPACT EVALUATION OF AN LGBTQ+ STUDENT-RUN FREE CLINIC (SRFC) ON PATIENT EXPERIENCE

Primary Mentor: Kari Mader

Secondary Mentor(s):

Thematic Area: Public Health and Epidemiology

Abstract:

Those who identify as LGBTQ+ experience a higher degree of marginalization and discrimination within healthcare than those who identify as heterosexual. Though these disparities have been researched upon, actual interventions to address them are scarce. The original purpose of our study was to evaluate the process and impact of an LGBTQ+ Clinic within the interprofessional DAWN Student-Run Free Clinic (SRFC) on patient experience in Aurora, CO. Two years after establishment of this clinic, due to low patient volume and thus low number of patient responses, the leadership team re-evaluated the clinic and decided the clinic would be best served reincorporated into the main DAWN SRFC with patients scheduled with providers more experienced in gender affirming care. In the future, we plan to evaluate patient experience and outcomes with pre and post-visit surveys and evaluate the clinic process with provider surveys we had created. We hypothesize that access to properly trained, experienced, affirming, and knowledgeable providers will increase the trust and respect of patients who identify as LGBTQ+ to clinics and providers, increase comfort in disclosure of Sexual Orientation and Gender Identity (SOGI), improve their relationship with healthcare, and increase access to care overall. We hypothesize this clinic will improve our patient's physical and mental health related to self-esteem, social support, resilience, and coping ability.

Primary Presenter: Ilona Schwarz

Project Title: Bone and body characteristics of freestyle and non-freestyle skiers

Primary Mentor: Jonathan Bravman

Secondary Mentor(s): Viral Shah, Adam Lindsay, Rachel Frank, Eric McCarty

Thematic Area: Clinical Science

Abstract:

Background: Freestyle skiers must optimize their aerial performance by maintaining the strength and coordination to propel themselves in the air and adapt to landings and take-offs on uneven surfaces. The purpose of this study was to investigate the differences in areal bone mineral density (aBMD) and body composition in freestyle skiers and non-freestyle skiing controls. We hypothesized that the unique demands and summation of forces experienced by freestyle athletes would manifest as greater femoral neck aBMD, lower percent body fat, and lower Body Mass Index (BMI) than non-freestyle skiing controls. This is a retrospective cohort study.

Methods: Eighteen freestyle skiers (14 M 4 F, [27.56 ± 5.22 years]) and 15 controls (7 M 8 F, [26.93 ± 3.54 years]) were measured with dual energy X-ray absorptiometry (DXA) to determine total body composition, hip and lumbar spine aBMD, and bone mineral composition (BMC). Height and weight were measured with an in-office stadiometer and scale. Questionnaires were used to determine physical activity and pertinent medical history. Between-group variations were analyzed with an analysis of variance (ANOVA) and stratified by sex.

Results: Percent body fat, hip and lumbar spine aBMD, BMC, and area were all similar between freeski and non-freeski athletes ($P < 0.05$ for all). BMI was significantly lower in male freeski athletes (23.97 kg/m2, 95% CI: 22.75-25.18) compared to non-freestyle skiing controls (26.64 kg/m2, 95% CI: 24.43-28.86) ($P = 0.03$).

Conclusions: Freestyle skiers have a lower BMI than non-freestyle skiers. All skiers in this study have similar percent body fat, aBMD, and BMC. This pilot study supports that there are unique musculoskeletal adaptations based on type of skiing. Skiers endure a variety of intense physical forces yet remain understudied despite high orthopedic injury rates. This study serves to broaden the current sports health literature and explore the physical demands and subsequent physiology of freestyle skiers.

Primary Presenter: Irfan Haider

Project Title: Using Virtual Reality-Based Mindfulness Practice to Improve Emotion Regulation of Patients in Substance Use Treatment

Primary Mentor: Debra Boeldt

Secondary Mentor(s):

Thematic Area: Clinical Science

Abstract:

Mindfulness plays an evidence-based role in the treatment of Substance Use Disorder but with limited success, and Virtual Reality has the potential to improve its training with immersive guided mindfulness practices. To explore the effects of practicing mindfulness via VR on the emotion regulation of patients undergoing Substance Use Treatment, 38 patients were recruited from CeDAR. For quantitative measure, participants were inquired about how they feel on a scale of 1 (worst) to 10 (excellent) before and after each practice. For qualitative measure, participants were then asked to select a mood descriptor. On a per use basis, an increase of +0.95 (SE = 0.08). On a per day basis, an increase of +0.93 (SE = 0.10, p < 0.001). There was also a positive shift in the connotation of the descriptors participants selected to describe their mood. While this study had its limitations, it highlights the potential for novel technology to aid patients with SUD regulating their emotions and potentially cravings. There is a need for further research on the adherence to different therapy modalities presented via VR and the persistence of their effects in non-clinical environments, like their homes, over a longer period of time.

Primary Presenter: Isabelle Chatroux

Project Title: Herpes Simplex Virus Serotyping in Pregnant Women With a History of Genital Herpes and an Outbreak in the Third Trimester of Pregnancy

Primary Mentor: Aimee English

Secondary Mentor(s): Aaron Caughey (at Oregon Health and Science University)

Thematic Area: Clinical Science

Abstract:

OBJECTIVE: To estimate whether serotyping women with a history of genital herpes simplex virus (HSV) and an outbreak during the third trimester of pregnancy is cost effective compared with no serotyping.

METHODS: We designed a decision-analytic model using TreeAge Pro software to assess an approach of routine HSV serotyping in a theoretical cohort of 63,582 women (an estimate of the number of women in the United States with a history of genital HSV and an outbreak during the third trimester of pregnancy).

Outcomes included mild, moderate, and severe neonatal HSV, neonatal death, costs, and quality-adjusted life-years (QALYs) for both the woman and neonate. Probabilities, utilities, and costs were derived from the literature, and we used a willingness-to-pay threshold of $100,000 per QALY. Sensitivity analyses were performed to assess the robustness of the results.

RESULTS: In our theoretical cohort, HSV serology screening resulted in 519, 8, and 15 cases of mild, moderate, and severe neonatal HSV, whereas no serology screening resulted in 745, 65, and 85 cases, respectively. Thus, HSV serology screening led to 226, 57, and 70 fewer cases of mild, moderate, and severe neonatal HSV, respectively, as well as 91 fewer neonatal deaths. Additionally, serology screening saved $61 million and gained 7,900 QALYs, making it a dominant strategy. Univariate sensitivity analysis demonstrated that serology screening was cost effective until the chance of progression from neonatal HSV infection to disease despite empiric antiviral treatment was greater than 23%.

CONCLUSION: Serology screening in pregnant women with an outbreak in the third trimester of pregnancy and a history of genital HSV resulted in improved outcomes and decreased costs.

Primary Presenter: Ishaah Talker

Project Title: Obstructive Sleep Apnea and Early Weight Loss among Adolescents that Undergo Bariatric Surgery at Children's Hospital Colorado

Primary Mentor: Jill Kaar

Secondary Mentor(s):

Thematic Area: Clinical Science

Abstract:

ABSTRACT BODY: Purpose of Study: Adult literature demonstrates impressive results regarding the effect of bariatric surgery in ameliorating obstructive sleep apnea (OSA) however data are scarce in pediatric literature. As morbid obesity and OSA become increasingly common in adolescents, it is important to quantify the prevalence of OSA and the effects of surgical intervention in this unique, growing population.

Methods Used: Retrospective chart review of adolescents enrolled in the Bariatric Surgery Center at Children's Hospital Colorado (CHCO) with pre- and post-surgical polysomnography (PSG) between 06/17- 08/19 (70/83 total patients). Inclusion criteria was based on availability of presurgical PSG results. Variables including age, gender, race, comorbidities, PSG results, and weight were collected. Pediatric OSA criteria were applied to PSG results to determine presence of OSA. Tests for nonparametric data were used to compare baseline characteristics and surgical outcomes between patients with and without preoperative OSA.

Summary of Results: The prevalence of OSA among those with preoperative PSG, defined as apnea hypopnea index ‰¥1, was 77% pre-surgery, with 44% demonstrating severe OSA by OAHI ‰¥10. There were no significant differences in race, gender, BMI, or comorbidities according to diagnosis of OSA. Of 12 patients with preoperative OSA and a postoperative sleep study, 58% resolved their OSA an average of 4.92 months postsurgery. Average preoperative BMI for resolving patients was 45.46 versus 56.76 in those who did not have resolution of OSA (p=0.03). Average change in BMI from pre- to post-operative sleep study was -21.9% in the resolved group and -13.5% in the unresolved group (p=0.12).

Conclusions: The prevalence of OSA in the population of adolescents seen in the Bariatric Surgery Center at CHCO was more similar to the estimated prevalence in adults seeking bariatric surgery (74%) than the general population of adolescent with obesity (43%). Resolution of OSA after surgery correlated with lower preoperative BMI, but sample size limited further analysis.

Primary Presenter: Ivan Trang

Project Title: Improving Transitions of Care Following Acute Ischemic Stroke

Primary Mentor: Jarrett Leech

Secondary Mentor(s): Jarrett Leech

Michelle Hu Leppert

Thematic Area: Clinical Science

Abstract:

Stroke is a leading cause of long-term disability in the United States and accounts for more than 46 billion healthcare dollars annually [1]. Patients who are hospitalized after stroke are at high risk of recurrence and complications that may result in hospital readmission and poor functional outcomes [2,3]. A recent retrospective analysis found that early primary care provider (PCP) follow-up after stroke was associated with a reduction in rehospitalization within 30-days [4]. The primary aim of this project will be to prospectively apply the results from this study by scheduling PCP follow-up for patients who are admitted with a primary diagnosis of acute ischemic stroke and who are discharged with a homebound destination. We will implement PDSA methodology to measure the rate of successful appointment scheduling prior to discharge for eligible patients, perform a root cause analysis of the most common barriers to scheduling, and make adaptations that lead to prompt primary care visits. A secondary aim will be to examine the impact of this intervention on 30-day readmissions.

Primary Presenter: Jacob Gabbay

Project Title: APPS FOR ADOLESCENTS: CREATING A RESOURCE FOR PRIMARY CARE PROVIDERS

Primary Mentor: Paritosh Kaul

Secondary Mentor(s): Bethany Kwan

Thematic Area: Clinical Science

Abstract:

According to the Journal of the American Academy of Child and Adolescent Psychiatry, almost 32% of adolescents will meet criteria for an anxiety disorder by the age of 18[1] and less than 25% will receive appropriate treatment[2]. An emerging solution is behavioral therapy mobile applications that can be easily downloaded and distributed widely[3]. Currently, very few providers endorse consistently recommending these apps, primarily due to a lack of confidence and knowledge in the apps[4]. The objective of this study is to expose primary care providers to a brief educational presentation about apps for patients with anxiety and then measure the changes in their intention to recommend. The presentation content will be based on Technology Acceptance Model Theory[5] which focuses on addressing factors that limit provider usage of technology. The change in intention to use will be determined by distributing the same survey to two groups: one that has been exposed to the presentation, and a control group that has not. The study did not find any statistically significant findings likely due to a small sample size.

Primary Presenter: Jacob Leary

Project Title: Identifying clinical and MRI predictors of functional improvement in patients initiating highly effective disease-modifying therapies in Multiple Sclerosis

Primary Mentor: Timothy Vollmer

Secondary Mentor(s): Kavita Nair

Thematic Area: Clinical Science

Abstract:

Background: Clinical benefit (CB) has been observed in some patients with MS on high-efficacy disease-modifying therapies (DMTs). However, factors contributing to the likelihood of benefit are unknown.

Objective: To assess the impact of patient demographics, MS disease characteristics, and brain volumes on likelihood of CB in patients treated with high-efficacy DMTs, as assessed by patient-reported outcome (PRO) measures.

Methods: This retrospective chart review included 314 adults with MS who completed two Patient-Determined Disease Steps (PDDS) measures and at least 2/10 Neurology Quality of Life (NeuroQOL) Short Form scales across two time points ‰¥10 months apart, taking a high-efficacy DMT at baseline. We examined the influence of various demographics, disease characteristics, and normalized brain volumes on likelihood of CB. PRO measures included the PDDS and 10 NeuroQOL domains. Patients were grouped as CB vs. Clinical Worsening (CW) by change in PDDS score over time. Influence of NeuroQOL baseline and change scores was also investigated. NeuroQuant MRI reports provided volumetric data. Statistical analyses used Spearman correlations and logistic regression.

Results: Factors significantly predicting likelihood of CB included smoking history (Current v. Former: Odds Ratio (OR)=0.799, 95% CI=0.332, 1.922; Current v. Never: OR=0.429, 95% CI=0.187, 0.983; Former v. Never: OR=0.536, 95% CI=0.308, 0.935), body mass index (OR=0.954; 95% CI=0.918, 0.991), and number of clinical relapses within study period (OR=0.611; 95% CI=0.399, 0.934). NeuroQOL scores significantly influencing likelihood of clinical benefit included baseline Fatigue (OR=0.959; 95% CI=0.932, 0.986), Sleep Disturbance (OR=0.957; 95% CI=0.930, 0.986), Positive Affect and Wellbeing (OR=1.045, 95% CI=1.001, 1.068), Emotional and Behavioral Dyscontrol (OR=0.971; 95% CI=0.945, 0.998), and Lower Extremity Function (OR=1.047, 95% CI=1.021, 1.074); and change scores for Upper Extremity Function (OR=1.155, 95% CI=1.052, 1.268), Lower Extremity Function (OR=1.066, 95% CI=1.015, 1.118), and Ability to Participate in Social Roles and Activities (OR=1.089; 95% CI=1.039, 1.141).

Conclusions: Patient demographic and disease characteristics, as well as several NeuroQOL domain scores, appear to better predict clinical benefit than brain volumes.

Primary Presenter: Jacob Michalski

Project Title: Interleukin-6-dependent epithelial fluidization initiates fibrotic lung remodeling

Primary Mentor: David Schwartz

Secondary Mentor(s):

Thematic Area: Basic Biomedical Science

Abstract:

Chronic disease results from the failure of tissues to maintain homeostasis. In the lung, coordinated repair of the epithelium is essential for preserving homeostasis in response to injury. In animal models and human lung disease, airway epithelial cells mobilize in response to lung injury in an attempt to maintain gas exchange and tissue integrity. This remodeling of the distal airspace can result in terminal airway-like honeycomb cysts with persistent loss of functional cell types and parenchymal architecture. However, the dynamic mechanisms and signaling modalities directing the reorganization of injured epithelia remain unclear. Utilizing live-cell in vitro and ex vivo imaging, we demonstrate that distal lung remodeling occurs through fluidization of the epithelium and is conserved across multiple models of lung repair and fibrosis. The phase dynamics of epithelial fluidization are regulated through active interleukin-6 family signaling, and dysregulation of this axis drives persistent biophysical dysfunction. Mesenchymal-derived signals induce fluidization in healthy airway epithelia providing context for the shift from normal repair to extensive remodeling observed in fibrotic lung diseases. Specifically targeting the signaling modalities regulating epithelial fluidization attenuates lung remodeling, including cystic honeycombing and fibrosis. Together our findings illustrate the critical role of cytokine-driven airway epithelial fluidization in coordinating the balance between homeostatic lung repair and fibrotic airspace remodeling.

Primary Presenter: James Duffy

Project Title: Superior Laryngeal Nerve Block for Treatment of Neurogenic Cough

Primary Mentor: Daniel Fink

Secondary Mentor(s):

Thematic Area: Clinical Science

Abstract:

Objectives: This study aimed to add to the body of evidence for efficacy of Superior Laryngeal Nerve (SLN) blocks for treatment of neurogenic cough. Efficacy at short- and long-term intervals are presented as well as relationships with laryngoscopic findings.

Methods: A retrospective chart review of patients treated with SLN block between 2018 and 2020 was conducted. Patient demographics, videostroboscopic findings, and patient-subjective perception of outcomes were recorded and analyzed. Cough Severity Index (CSI) scores from pre-injection, short-term follow-up, and long-term follow-up were compared.

Results: Twenty patients underwent SLN block in the clinic setting. Four patients were excluded for incomplete records. The indication was neurogenic cough refractory to medical management and/or cough suppression therapy. Patients with short-term follow-up (n = 13) had statistically significant decrease in CSI scores, with a mean baseline CSI of 24.3 decreasing to 16.15 (P =€‰.006). Patients with evidence of Vocal Fold Motion/Vibratory Abnormalities (VFA) (n = 8) showed improvement in short-term CSI scores, with a mean baseline CSI of 24.13 decreasing to 14.5 (P€‰= .004). Those without evidence of VFA did not have statistically significant improvement in short-term CSI scores. At long-term follow-up, patients with VFA had improvements that approached statistical significance with a mean baseline CSI of 22.56 decreasing to 14.56 (P =€‰.057), while patients without VFA showed no improvement.

Conclusions: Our results are consistent with previous literature indicating efficacy of SLN block. The presence of VFA may be an indicator of patients who experience increased therapeutic effect.

Primary Presenter: James Tuttle

Project Title: Implementation of REDCap as a Standalone EHR in a Low-Resource Primary Care Clinic

Primary Mentor: Paul Harris

Secondary Mentor(s):

Thematic Area: Public Health and Epidemiology

Abstract:

This project seeks to provide a practical approach to addressing the substantial financial barriers faced by small independent clinics hoping to implement electronic patient health records. Software packages provided by Cerner, Epic, Allscripts, etc. offer robust Electronic Health Record systems (EHR) that facilitate interdepartmental collaboration, robust reporting, and an improved ability to incorporate patients into their own healthcare. However, these packages are often unaffordable and require a full-time IT staff. Despite these obstacles, alternative software solutions may exist for small clinics operating with very limited resources.

In this study, I seek to first describe a novel use of REDCap, a research data collection tool as a platform to perform many of the same operations provided by commercial EHRs. This description seeks to serve as a guide for small clinics seeking to implement a fully-featured EHR while taking into account the incredible financial, technological, and logistical limitations encountered in resource limited environments. I will elucidate   Secondly, I will compare this usage of REDCap to the features provided by commercial EHRs, specifically Epic, and Fusion Practice.

The method of this study is to query available literature in order to delineate and describe the major challenges faced by resource limited healthcare clinics trying to implement an EHR in their clinic for the first time. I will use the literature to define standards for a successful EHR implementation in resource limited environments to drive a comparison between REDCap and other commercial EHRs. The comparison seeks to understand to what degree each EHR platform meets those predefined standards in the hopes of elucidating the potential avenues a developing clinic can take as it seeks to manage patient health information cheaply and effectively.

Preliminary work on this project has focused on delineating and defining the common problems faced by small clinics as they learn to manage large amounts of patient health information (PHI, specifically in environments where electricity and internet connectivity are not consistent. This involves literature reviews on EHR implementations in resource-limited in order to propose standards required by EHR platforms in order to ensure sustainable health information management in less than ideal conditions. Additionally, I will begin to investigate the features offered by other commercial EHRs, such as safeguards present to prevent errors in PHI, and compare and contrast the benefits and limitations of these software packages, to the free-to-use data collection tool REDCap.

Primary Presenter: Jaslyn Erickson

Project Title: Effects of prenatal antibiotics on the infant gut microbiome

Primary Mentor: Sunah Hwang

Secondary Mentor(s): Daniel Frank

Thematic Area: Clinical Science

Abstract:

Background: The infant gut microbiome is important for immune system development and the progression of disease. Exposure to antibiotics during infancy has been shown to cause microbial perturbations that current research has linked with various disease processes, such as obesity, asthma, and eczema. Additionally, antibiotics given to pregnant women around the time of delivery, particularly for the prophylactic treatment of Group B Streptococcus colonization, has been shown to affect the newborn's microbiome. This occurs specifically in relation to microbial diversity and the relative abundances of Bifidobacteriaceae, Bacteroidaceae, and Enterobacteriaceae.

Objective: The purpose of this project was to study the effects of maternal antibiotic exposure during pregnancy, prior to delivery, on the infant gut microbiome. Based on previous research, Bifidobacteriaceae, Bacteroidaceae, and Enterobacteriaceae were the bacterial families of focus for this project, with the hypothesis that the relative abudnacnes of Bifidobacteriaceae and Bacteroidaceae would decrease and that of Enterobacteriaceae would increase in the infants who were exposed to antibiotics in-utero compared to the those not exposed.

Methods: Pregnant women were recruited during the third trimester from the University Hospital (UCH) prenatal clinic, following their screening for GBS colonization at 35-37 weeks gestation. Eligibility criteria included women aged 18-34 years old, with a singleton pregnancy, a pre-pregnancy BMI of 18.5-30, without significant health issues including gestational diabetes and pre-eclampsia, no smoking, alcohol, or other drug use during pregnancy, and who planned to deliver vaginally at UCH. Based on previously published data, the sample size for this project was determined to be 80 women-baby pairs, 40 pairs in each group. Participants were considered exposed if they had a history of systemic antibiotic use during the second or third trimesters of the index pregnancy.

Progress to date: Critical steps completed thus far include: 1)Development of a collaborative mentorship between Dr. Daniel Frank, a basic scientist with expertise in the relationship between the microbiome and infectious diseases, and Dr. Sunah Hwang, a neonatologist with expertise in clinical research study design; 2) Identification of inclusion criteria for the study cohort, balancing the need to minimize confounders between control and exposed groups with expediency; 3) Development of the analytic plan given the complexity of measuring and reporting differences in species of the microbiome; 4) Development of the study design; 5) Recruitment phase has begun and is currently at 1/4th the needed enrollment.

Implications: With the rise in non-communicable diseases, it is important to understand how exposures during pregnancy, such as antibiotics, can affect this risk. The result obtained from this study will help elucidate how antibiotics during pregnancy change the infant gut microbiome, and thus, potentially the risk of developing diseases later in life.

Primary Presenter: Jerry Yang

Project Title: Are Diagnostic Delays Associated with Distress in Breast Cancer Patients?

Primary Mentor: Sarah Tevis

Secondary Mentor(s):

Thematic Area: Clinical Science

Abstract:

Purpose: Receiving a new breast cancer diagnosis can cause anxiety and distress, which can lead to psychiatric morbidity, decreased treatment adherence, and worse clinical outcomes. This study aims to evaluate the relationship between delays in breast cancer diagnosis and patient-reported distress. Secondary outcomes include assessing patient characteristics associated with delay.

Patients and Methods: Newly diagnosed breast cancer patients who completed a distress screening tool at their initial clinic visit to an academic institution between 2014-2019 were retrospectively evaluated. The tool captured distress levels in the emotional, social, health, and practical domains with scores of €œhigh distress€ defined by current clinical practice guidelines. Delay from mammogram to biopsy, whether diagnostic or screening mammogram, was defined as >30 days. Patient characteristics were reviewed in the electronic medical record.

Results: 745 newly diagnosed breast cancer patients met inclusion criteria. Median time from initial abnormal mammogram to core biopsy was 12 days, and 11% of patients experienced a delay in diagnosis. The non-delayed group had higher emotional (p=.04) and health (p=.03) distress than the delayed group. No statistically significant differences in social or practical distress were found between groups. Older age, diagnoses of invasive lobular carcinoma (ILC) or ductal carcinoma in situ (DCIS), and clinical anatomic stages 0-I were associated with diagnostic delay.

Conclusion: Patients with higher emotional or health-related distress were more likely to have timely diagnoses of breast cancer, suggesting that patients with higher distress may seek healthcare interventions more promptly. Improved understanding of sources of distress will permit early intervention and mitigation.

Primary Presenter: Jessica Hall

Project Title: Extracellular vesicles from young women's breast cancer patients drive increased invasion of non-malignant cells via the Focal Adhesion Kinase pathway: a proteomic approach

Primary Mentor: Virginia Borges

Secondary Mentor(s):

Thematic Area: Basic Biomedical Science

Abstract:

Background: Extracellular vesicles (EVs) are small membrane particles that contribute to cancer progression and metastases by transporting biologically significant proteins and nucleic acids. They may also serve as biomarkers of various disease states or important therapeutic targets. Breast cancer EVs have the potential to change the behavior of other cells in their microenvironment. However, the proteomic content of EVs isolated from young women's breast cancer patients and the mechanisms underlying the influence of EVs on tumor cell behavior have not yet been reported.

Methods: In our current translational studies, we compared the proteomic content of EVs isolated from invasive breast cancer cell lines and plasma samples from young women's breast cancer (YWBC) patients and age-matched healthy donors using mass spectrometry. We analyzed the functionality of EVs in two dimensional tumor cell invasion assays and the gene expression changes in tumor cells after incubation with EVs.

Results: We found that treatment with EVs from both invasive breast cancer cell lines and plasma of YWBC patients altered the invasive properties of non-invasive breast cancer cells. Proteomics identified differences between EVs from YWBC patients and healthy donors that correlated with their altered function. Further, we identified gene expression changes in non-invasive breast cancer cells after treatment with EVs that implicate the Focal Adhesion Kinase (FAK) signaling pathway as a potential targetable pathway affected by breast cancer-derived EVs.

Conclusions: Our results suggest that the proteome of EVs from breast cancer patients reflects their functionality in tumor motility assays and may help elucidate the role of EVs in breast cancer progression.

Primary Presenter: Jessica Monishi

Project Title: Middle School to Medical School (M2M):

An outreach program developed and implemented on the Anschutz Medical Campus encouraging underrepresented in medicine (URM) middle school students to pursue careers in medicine

Primary Mentor: Deb Seymour

Secondary Mentor(s): Dominic Martinez

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

Despite Affirmative Action Health Care Policy efforts, the diversity of the U.S. population is not reflected in the composition of the student body, medical school faculty, or physician workforce. Minority groups make up 30% of the U.S. population, but only 13% of medical students, 6% of physicians, and 3% of medical school faculty are members of an underrepresented minority groups.[1]

Research studies demonstrate that increasing the number of URM medical students and practicing physicians, enhances learning outcomes, improves cultural competency, and helps eliminate healthcare disparities.[2,3] Many of the existing medical school pipeline and mentoring programs are focused on high school and undergraduate students, while little research has been done on the impact of these programs on middle school students. [4,5]

Hypotheses: After interacting with medical students and/or faculty from URM backgrounds through a mentorship or after-school program, minority middle school students will have increased interest and increased sense of self-efficacy in entering a career in health care.

Methods: An existing relationship with Skinner Middle School has already been in place. Skinner Middle School agreed to work with authors in developing this outreach program. One-page proposals for potential program designs and potential pre- and post-evaluations were then sent to Skinner stake holders for consideration and review. The program consists of a one day, hands on & interactive curriculum at the Anschutz Medical Campus composed of different workshops led by CU medical students with faculty liaisons present for additional leadership & support. Medical student volunteers helped lead students, facilitated workshops and lectures, and participated in a panel. Once the program participants arrived on campus they were distributed a pre-evaluation survey with 6 core questions using a 5 point Likert scale (1= Strongly Disagree, 5= Strongly Agree), as well as a few other demographic questions. These same survey questions were used in the post-evaluation survey distributed at the end of the program to compare changes in interest and self-efficacy. The post evaluation survey also includes options for students to provide open ended written feedback about the program.

Results/Progress: We have successfully completed three iterations of the program in 2018, 2019, and 2021. From the 2019 program, we had a total of 18 students participate (nine male and nine female) with 88% of participating middle school students from underrepresented minority backgrounds. Statistically significant information included that student interest in becoming a health care provider (non-physician) increased ($p= 0.015$) as well as confidence in having the knowledge/intelligence to become a medical doctor increased ($p= 0.024$). Overall, results show increased interest and improved self-efficacy in pursuing careers in medicine & other health professions. Our 2021 event was virtual in the COVID-19 era and did not have enough data points to statistically analyze, therefore, it was left out of our discussion.

Future Direction: Authors will meet with liaison to determine program design for 2022 iteration. Authors will identify medical school students/faculty to engage with Skinner Middle School participants. Authors will need to identify students from incoming medical school class to lead and sustain program over the subsequent years.

Primary Presenter: JoEllen Fresia

Project Title: Does lymph node dissection impact adjuvant treatment or survival outcomes in high-risk endometrial cancers?

Primary Mentor: Jill Alldredge

Secondary Mentor(s):

Thematic Area: Clinical Science

Abstract:

Objectives: Lymphadenectomy does not improve overall survival outcomes in patients with low-risk endometrial cancers. Sentinel node mapping has a high detection rate and accuracy; however, its prognostic implications have not been well explored. We evaluated the overall survival and therapies received by patients undergoing varied lymph node dissection approaches for high-risk endometrial cancers.

Methods: Retrospective review of grade 3 endometrioid and high-grade non-endometrioid cancers at one institution over ten years. Patients who received neoadjuvant therapy and/or debulking of only grossly abnormal lymph nodes were excluded. Data were abstracted from electronic medical records. Chi squared tests and survival analyses were used to compare groups.

Results: 153 patients with grade 3 endometrioid, serous, clear cell, carcinosarcoma, or mixed high-grade on final pathology were identified; 16 had no lymph node dissection, 26 had sentinel lymph nodes, and 111 had complete lymph node dissection. Patients with open surgery were more likely to have complete nodes than sentinel nodes when compared to a minimally invasive approach ($p<0.001$). Sentinel nodal dissection significantly impacted the utilization of, or modality choice, in adjuvant therapy ($p = 0.051$). Recurrence free survival and cancer-specific overall survival were not significantly different across the three nodal-assessment groups.

Conclusions: Sentinel lymph node dissection in high-risk endometrial cancers led to no significant differences in recurrence free survival or cancer-specific overall. While limited by sample size and its retrospective nature, results from this single-institution study are hypothesis-generating and prompt consideration of non-inferiority trials. Performing the least invasive surgery possible can lead to fewer complications while maintaining overall survival outcomes.

Primary Presenter: John Clinton Olivas

Project Title: Functional Analysis of a Long Non-coding RNA Associated with Lupus Protection

Primary Mentor: Susan Boackle

Secondary Mentor(s):

Thematic Area: Basic Biomedical Science

Abstract:

Background: A single-nucleotide polymorphism (SNP) in the complement receptor 2 (CR2) gene was previously identified in a large lupus association study to be associated with decreased risk of lupus and increased expression of complement receptor 1 (CR1), specifically on B cells. The SNP lies within a putative B cell enhancer and is associated with increased levels of a nearby long non-coding RNA (lncRNA). Previous work has also shown a positive correlation between CR1 expression and mTOR pathway activation in B cells, as well as increased mTOR pathway activation in B cells of individuals with the SNP compared to those without.

Purpose/Hypothesis: To further define the relationship between the CR2 lncRNA, CR1/CR2, and mTOR, and possibly identify new mechanisms by which the lncRNA may confer protection against lupus and be utilized for future treatment studies. We predict that the CR2 lncRNA confers lupus protection by directly modulating the transcription of CR1 in B cells and promoting antigen-specific B cell tolerance via the mTOR pathway.

Methods: Knockdown of mTOR was performed on isolated primary B cells using previously developed siRNAs. RNA transcripts were harvested after a 24-hour incubation period, and expression levels of mTOR, CR1, and Î²-actin, an endogenous gene control, were assessed using qPCR. Relative expressions of each sample were evaluated using the comparative CT method. We then ran a standard curve qPCR protocol using known amounts of RNA template obtained from primary B cells in order to assess our ability to accurately measure expression levels of CR2 and other lncRNAs of interest in anticipation for knocking down the CR2 lncRNA.

Results: Results showed successful knockdown of mTOR for one of the siRNAs at 10nM and 1nM concentrations, with knockdown efficiencies around 50%, which is in line with those seen in previous literature. The other two siRNAs showed no change in mTOR transcription. For CR1, no change was seen in expression levels for all knockdown samples. Additionally, while the CR2 standard curve showed satisfactory results, the assays for the CR2 lncRNA and other lncRNAs displayed high variability and poor efficiencies.

Conclusions: The mTOR knockdown results suggest that CR1 expression may not be dependent on mTOR activity, but more subjects are needed to confirm this hypothesis. The poor efficiencies seen in the standard curve qPCR protocol for the various lncRNAs of interest may be due to a low copy number in the samples, resulting in stochastic error when measuring fold-changes. Another possibility is ineffective assay primers, either by design or due to degradation

from numerous freeze-thaw cycles. Further work is needed to dissect this issue. Once the expression levels of the lncRNAs can accurately be measured, we aim to test our CR2 lncRNA knockdown protocol on subjects with and without the SNP using 3 different siRNAs designed with Integrated DNA Technologies' custom siRNA generator.

Primary Presenter: John-Michael Benson

Project Title: Retrospective Evaluation of High Titer Convalescent Plasma in Hospitalized Patients with COVID-19 Infection in Northern Colorado

Primary Mentor: Steven Schuster

Secondary Mentor(s): Daniel Monkowski, email: daniel.monkowski@uchealth.org

Thematic Area: Clinical Science

Abstract:

Background: The COVID-19 pandemic has caused an unprecedented global health crisis affecting people around the world. As of January 2022, more than five and a half million people globally have died as a result of the disease. Despite rising vaccination rates, inadequate vaccine access and vaccine hesitancy continue to pose a significant healthcare concern. As a result, effective therapies to treat those affected with COVID-19 are being studied. Convalescent plasma (CP) has been studied as a potential therapy but has mixed results in the literature. Studies supporting CP suggest that timing of treatment and high titer status are important variables. This research aims to contribute to the growing body of literature evaluating whether convalescent plasma is a useful adjunct therapy for those with COVID-19 infection. It will also help identify if high titer CP and/or timing of administration impact mortality, intubation status, or days in the hospital.

Methods: From September 17, 2020, to February 3, 2021, 1137 individuals with COVID-19 were hospitalized at Poudre Valley Hospital, Medical Center of the Rockies, or Greeley Hospital in northern Colorado. Among these patients, approximately 587 were transfused with either high titer or low titer convalescent plasma. As existing evidence indicates the importance of high titer CP, we compared the primary endpoint of mortality and secondary endpoints of intubation status and days in the hospital between those receiving high titer CP within three days of symptom onset, to those who received high titer CP after three days and those who did not receive CP. Subjects that received low titer CP were excluded. The list of subjects receiving CP and their respective IgG titer levels were obtained through our blood bank (Garth Englund Blood Center), and our control group was populated through EPIC (EMR) during the same time period.

Results: A total of 238 patients were analyzed in this initial analysis. Of those patients, 138 received high titer convalescent plasma (CPHigh group). In the CPHigh group, 25 received a high titer unit within three days of symptom onset (CP3 group), and 113 received high titer CP after three days of symptom onset (CPLate group). These groups were compared with 100 patients that were admitted with COVID-19 and did not receive CP during the same time period. Analysis of our primary endpoint of mortality in the four groups showed mortality rates of 8% in the CP3 group, 13% in the CPLate group, 12% in the CPHigh group, and 15% in the control group. Mortality data did not result in any statistically significant difference between any of our group comparisons (CP3 vs Control: Odds ratio: 0.49 (p=0.36); CP3 vs CPLate: Odds ratio: 0.57

(p=0.47); CPLate vs Control: Odds ratio: 0.87 (p=0.72); CPHigh vs Control: Odds ratio: 0.80 (p=0.55). Evaluation of hospital admission duration resulted in no statistically significant difference between our CPHigh and CPLate vs control group (p>0.05) and no difference between our CP3 group and control group (p=0.49). Analysis of intubation status of in our CP3 group was 8%, 15% in CPLate, 14% in CPHigh, and 11% in our control group, and resulted in no significant difference between our groups (CP3 vs Control: p=0.66; CP3 vs CPLate: p=0.35; CPLate vs Control: p=0.38; CPHigh vs Control: p=0.53).

Conclusions: The literature surrounding CP use as a treatment for COVID-19 is mixed and controversial, but recent studies have emphasized the importance of using only high titer units early in the disease course. While not statistically significant, there is a positive trend in our results to support the claim that those transfused early have the best outcomes. This is best demonstrated by a 51% lower likelihood of mortality in the CP3 group versus control group, and only a 13% reduction in mortality in the CPLate group versus control group. Additionally, our results highlight the importance of using date of symptom onset, as opposed to admission date, as a critical metric to stratify if a patient will benefit from high titer CP administration in treating COVID-19.

Primary Presenter: Joseph Fore

Project Title: Recruitment of Caregivers of Dementia Patients: A Research Study Utilizing Social Media

Primary Mentor: Marian Betz

Secondary Mentor(s):

Thematic Area: Public Health and Epidemiology

Abstract:

Social media has proven successful in recruiting potential participants for a wide variety of research studies. However, the current body of literature has little data on the effect of social media on the recruitment of dementia patients' caregivers for the purpose of research. The goal of this study is to determine the effectiveness of using Facebook as a recruitment tool for enrollment in a study, specifically recruiting those that are caregivers to persons with dementia. To accomplish this, four versions of an advertisement were made that addressed general dementia safety and possible enrollment in a safety in dementia study. These were advertised through Facebook. This study utilized Facebook's advertising program to reach out to the caregivers to enroll them in the advertised €œPatient-Centered Injury Prevention€☐ study. Efficacy for this study was defined as the number of successful enrollments obtained because of social media advertisements. Ultimately, advertisements reached 312,682 people with a high click-through rate to the Facebook page created by the study group. However, the number of successful enrollments was 2 out of 312,682 (0.00064%). It was concluded that social media advertising is effective in reaching large numbers of people, but in this feasibility study there were a large number of limitations preventing it from being an effective recruitment tool. Should these be successfully addressed enrollment via social media should be seen as an effective recruitment tool.

Primary Presenter: Joshua Abolarin

Project Title: Effect of Metformin on Vascular and Mitochondrial Function in Type 1 Diabetes

Primary Mentor: Irene Schauer

Secondary Mentor(s):

Thematic Area: Clinical Science

Abstract:

Introduction: Cardiovascular (CV) disease remains the leading cause of mortality in type 1 diabetes (T1D) despite advances in glycemic control and to a greater extent than predicted by traditional CV risk factors. Metformin is generally thought to have vascular benefit in T2D and other insulin resistant states, though conclusive data for CV outcomes is lacking. In T1D metformin has been studied for glycemic control, but little attention has been paid to CV effects. We hypothesized that metformin would improve insulin sensitivity (IS), vascular function and compliance, and mitochondrial function in T1D.

Materials and Methods: T1D participants (n=17) underwent a placebo-controlled, double-blind, random order, cross-over design intervention with 6 weeks of metformin vs placebo. Glycemic control (CGM), cardiac function (echocardiography), vascular stiffness (Sphygmacor and Dynapulse), autonomic function, IS (hyperinsulinemic euglycemic clamp with glucose tracer), and mitochondrial function in vivo (31P MRS) and ex vivo (muscle biopsy with high resolution respirometry) were measured after each phase.

Results: Glucose control and IS by clamp were not improved with metformin. Oxidative phosphorylation was increased in vivo, but ex vivo mitochondrial function was not improved. Cardiac contractility and output, arterial stiffness, systemic vascular resistance, and possibly autonomic function, were improved with metformin.

Conclusions: Metformin may provide CV benefit in T1D through improvements in vascular resistance and mitochondrial efficiency.

Primary Presenter: Joshua Smith

Project Title: Small Polyp (6-9mm) Resection: Adoption Of Optimal Technique Over Time

Primary Mentor: Swati Patel

Secondary Mentor(s):

Thematic Area: Clinical Science

Abstract:

IMPORTANCE: Cold snare polypectomy (CSP) is the preferred polyp resection technique for small (6-9 mm) polyps due to lower rate of incomplete resection compared to cold forceps polypectomy (CFP) and improved safety profile over hot snare polypectomy (HSP). Despite CSP being the standard of care, there is significant variability in techniques used in actual practice.

OBJECTIVE: Describe resection techniques for small (6-9 mm) polyps and determine factors associated with sub-optimal technique.

DESIGN: A single center retrospective cohort study of colonoscopies performed from 2012-2019.

SETTING: Academic Veterans Affairs Medical Center.

PARTICIPANTS: Colonoscopies performed by gastroenterologist and surgeon endoscopists.

EXPOSURES: Colonoscopies that included removal of at least one 6-9 mm polyp.

MAIN OUTCOMES AND MEASURES: Patient characteristics, endoscopist characteristics, procedure findings, and polypectomy technique were collected. Univariate and multivariate regression analyses were performed to determine predictors of using a technique other than cold snare polypectomy.

RESULTS: 773 colonoscopies where 1,360 6-9 mm polyps removed by 21 endoscopists (17 gastroenterology and 4 surgeons) were included. CSP was used for 1,122 (82.5%), CFP for 61 (4.5%), and HSP for 177 (13%) of polyps. Surgeon specialty was associated with CFP use (aOR 7.81; 95% CI 3.02-20.16). Polyp location in left colon (aOR 1.65; 95% CI 1.17-2.33) and pedunculated morphology (aOR 12.76; 95% CI 7.24-22.50) were associated with HSP. There was a significant increase in overall CSP use from 30% in 2012 to 97% in 2019, though this change in practice was a result of less HSP use among gastroenterologists and less CFP use among surgeons over time.

CONCLUSIONS AND RELEVANCE: There was increasing use of standard of care CSP for the resection of small polyps from 2012 to 2019. Differences in how optimal technique was adopted over time based on specialty highlights the need for standardized practice guidelines and quality monitoring.

Primary Presenter: Julia Nyiro

Project Title: Nanostring Prognosis Panel for Progression of Persistent Bronchial Dysplasia to Squamous Cell Lung Cancer

Primary Mentor: Dan Merrick

Secondary Mentor(s):

Thematic Area: Basic Biomedical Science

Abstract:

To provide prognostic information for patients with premalignant airway disease in a clinical setting, it is important to classify whether patients will experience persistent or regressive behavior relative to baseline. Baseline biopsies from patients with bronchial dysplasia (BD) were collected between 1997 and 2017 to determine whether 19 select gene ratios from a Nanostring panel were predictive of persistent BD. Each patient had biopsies collected from multiple sites and were followed over time to determine whether their BD persisted or regressed. Patients who had two or more sites of BD that persisted at a high grade[[1]] (#_ftn1) or progressed from a low grade to a high grade were categorized as persistent. All other patients were categorized as regressive. Baseline demographic variables including age, sex, smoking status, tobacco pack-years, ASD and inflation score were also collected. The primary aim of this report is to identify a prognostic panel of baseline gene ratios to predict the persistence of BD. Specifically, this report seeks to address the following aims:

* Identify a prognostic panel of baseline gene ratios to predict whether patients will experience persistent or regressive BD.

* Develop a prediction model that utilizes baseline gene ratios in conjunction with baseline demographics to predict whether patients will develop persistent or regressive BD.

Primary Presenter: Kaitlin Roth

Project Title: Building a new Spanish Elective in CUSOM Trek Curriculum: Spanish Acquisition Begets Enhanced Services (S.A.B.E.S.)

Primary Mentor: Steven Lowenstein

Secondary Mentor(s):

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

Language and cultural differences create significant barriers when establishing patient-physician relationships and several studies show that patients with limited English proficiency (LEP) are more likely to receive suboptimal healthcare leading to worse healthcare outcomes. Despite these known challenges, the Association of American Medical Colleges (AAMC) does not offer official guidelines for medical schools to integrate medical language proficiencies curriculum in non-English languages. Nonetheless, a recent national survey and medical Spanish national summit developed unofficial recommendations for core medical Spanish curriculum. With the turnover of the curriculum, CUSOM no longer offers a medical Spanish elective. This is a proposal for an improved medical Spanish elective to be built into the Trek Curriculum.

Primary Presenter: Katelyn Johnson Wegerson

Project Title: A Qualitative Evaluation of Direct Parent/Caregiver Involvement and Perception of

Engagement in Care of Premature Infant through the DEFINE Colorado Study

Primary Mentor: James Barry

Secondary Mentor(s):

Thematic Area: Clinical Science

Abstract:

Background: Preterm births are increasing in frequency and come with a number of health consequences. Studies have shown parent engagement positively impacts infants and their parents/caregivers. The goal of this study is to evaluate current parent/caregiver direct involvement and perception to subsequently implement changes with the goal of increasing family engagement, either in person or virtually.

Methods: This study focuses on measuring baseline data to compare subsequent interventions to. Parent engagement was measured through parent-reported surveys as well as chart-abstracted measures. The study focused on infants at the University of Colorado Hospital level III NICU born at ‰¤34 weeks, targeting a stay of at least 14 days. Analysis of the baseline data was completed through REDCap and Microsoft Excel.

Results: All three primary outcome measures as well as chart-abstracted outcome measures currently show high levels of family engagement. Other parent/caregiver-reported outcome measures show barriers exist to family engagement.

Conclusions: The current data works to provide a baseline of family engagement in the NICU. However, the data is based on a limited sample size. Further enrollment to provide more baseline data may give a more complete picture of current engagement,

especially in regard to parent-reported social/financial barriers, to which the effect of the potential change concepts can be compared.

Primary Presenter: Katherine Belanger

Project Title: Concomitant Temozolomide Plus Radiotherapy for High-grade and Recurrent Meningioma: A Retrospective Chart Review

Primary Mentor: Ryan Ormond

Secondary Mentor(s):

Thematic Area: Clinical Science

Abstract:

Background: High-grade and recurrent meningiomas are often treatment resistant and pose a therapeutic challenge after surgical and radiation therapy (RT) failure. Temozolomide (TMZ) is a DNA alkylating agent that appears to have a radiosensitizing effect when used in combination with RT and may be worthwhile in meningioma treatment. Thus, we investigated the potential efficacy of concomitant RT plus TMZ compared to historical controls of just RT used in the treatment of high-grade and recurrent meningiomas.

Methods: We performed a retrospective analysis of patients with meningioma treated at the University of Colorado with TMZ chemoradiation. Progression free survival (PFS) and overall survival (OS) were calculated from the start of chemoradiation to local recurrence or death, respectively.

Results: Eleven patients (12 tumors) were treated with chemoradiation with a median follow-up of 41.5 months. There were two WHO grade 1, eight grade 2 and two grade 3 meningiomas. Three patients died during the follow-up period€"one being disease related (11.1%). Two patients had meningioma recurrence - at 2.3 months (WHO grade 3), and 5.4 years (WHO grade 2). Three-year OS and PFS for grade 2 meningiomas were each 88%. Historical controls demonstrate a 3-year median OS and PFS of 83% and 75.8%, respectively.

Conclusions: Treatment options are limited for meningiomas after local failure. In this study, TMZ chemoradiation demonstrated no statistical significance in PFS and OS in the treatment of grade 2 meningiomas compared to historic controls. Further study is warranted to find novel methods for the treatment of malignant and recurrent meningiomas.

Primary Presenter: Katherine Drexelius

Project Title: Outcomes Following Ankle Fracture Fixation With or Without Ankle Arthroscopy

Primary Mentor: Kenneth Hunt

Secondary Mentor(s):

Thematic Area: Clinical Science

Abstract:

Purpose: Rotational ankle fractures are among the most commonly treated orthopedic injuries, yet there is no consensus on the role of arthroscopy in the management of acute ankle fractures. The purpose of this study is to investigate the rate of chondral pathology and other intra-articular injuries in ankle fracture patients and compare the clinical and radiographic outcomes of the patients who underwent arthroscopy at the time of ankle fracture open reduction internal fixation (ORIF) with those patients who did not. Our hypothesis was that patients who underwent arthroscopy at the time of ankle fracture ORIF would have better patient reported outcomes scores compared to ORIF without arthroscopy.

Methods:We recorded each patient's demographic data, injury characteristics, surgical details, and follow-up radiographs to determine the degree of osteoarthritis and to assess the final outcome of the fracture. We then contacted the study patients via an email or telephonic survey. We utilized the PROMIS Global Health Short Form and the two question PASS scale as our selected patient reported outcome scores.

Results: Among patients who received ORIF with arthroscopy, there was a 47.9% rate of arthroscopic intervention beyond the standard debridement of synovitis and fracture hematoma. The mean PROMIS physical function score was higher in the ORIF plus arthroscopy group compared to the traditional ORIF group (p value 0.064). 78% of the traditional ORIF group is satisfied with the function of their ankle compared to 89% satisfaction in the ORIF plus arthroscopy group. Patients with Weber B fibula fractures or tibiotalar joint dislocations that underwent arthroscopy plus ORIF had a statistically significant higher PROMIS physical function score at final follow up (p value 0.01).

Conclusions: We found that patients treated with ankle arthroscopy in addition to ORIF for a rotational ankle fracture had superior patient reported outcomes for all tested metrics and across all specific fracture mechanisms and characteristics. Ankle arthroscopy is a useful adjunct to traditional ORIF and can improve outcomes without a significant increase in operative time and no change in complication rate.

Primary Presenter: Kelly Wigglesworth

Project Title: Lack of Follow-up Mental Health Care in Youth and Young Adults with Type 1 Diabetes After Positive Depression Screen or Suicidal Ideation

Primary Mentor: Shideh Majidi

Secondary Mentor(s):

Thematic Area: Clinical Science

Abstract:

Objective: Individuals with type 1 diabetes have higher rates of depression and suicidal ideation (SI) compared to the general population, and those with depression have higher A1C levels and increased complications. However, there is a paucity of literature on rates of mental health follow-up after screening positive for depressive symptoms or SI in diabetes clinics. This study evaluated mental health follow-up rates in youth and young adults with type 1 diabetes after a positive screen and identified differences in those who obtained follow-up mental health care versus those who did not.

Methods: Patients who scored positive for depressive symptoms or SI using the Patient Health Questionnaire-9 between January 2016-July 2018 were identified via retrospective chart review. Demographic, type 1 diabetes data, and mental health follow-up after positive screen were obtained from chart review. T-tests and chi-squared tests were used to compare groups. Logistic regression and piecewise linear mixed models were used to examine predictors of obtaining mental health care and A1C change.

Results: Of 1376 screened, 200 patients (14.5%) had positive depressive symptoms or SI. Of these, 53% (n=106) obtained mental health follow-up care. Males were less likely to obtain follow-up ($p<0.01$). Those who had mental health follow-up had decreasing A1C over the following year.

Conclusion: Increased assistance and monitoring is needed to ensure follow-up mental health care is obtained, particularly in males. Further research is needed to identify barriers in obtaining mental health care and to identify methods to improve access to mental health care for this population.

Primary Presenter: Keshari Shrestha

Project Title: Impact of Surgical Timing on Neurological Outcomes for Spinal Arachnoid Cyst: A Single Institution Series

Primary Mentor: Gregoire Chatain

Secondary Mentor(s):

Thematic Area: Clinical Science

Abstract:

Background: Spinal arachnoid cysts (SACs) are rare lesions that often present with back pain and myelopathy. There is a paucity of literature evaluating the impact of surgical timing on neurological outcomes for primary SAC management.

Objective: To compare long-term neurological outcomes in patients with SAC who were managed conservatively, surgically, or conservatively followed by surgery and to understand natural progression of SAC.

Methods: We conducted a retrospective analysis of adult patients treated for SAC at our institution from 2010 to 2021, stratified into three groups (conservative management only, surgical management, or conservative followed by surgical management). Study outcome measures were neurological outcomes as measured by modified McCormick Neurologic Scale, cyst recurrence, and postoperative complications. Nonparametric analysis was performed to evaluate differences between groups for selected endpoints.

Results: In total, 36 patients with SAC were identified. Eighteen patients were managed surgically. The remaining 18 patients were managed conservatively with outpatient serial imaging, 7 of whom (38.9%) ultimately underwent surgical treatment due to neurological decline. Most common presenting symptoms included back pain (50.0%), extremity weakness (36.1%), and numbness/paresthesia (36.1%). Initial/preoperative (p=0.017) and one-year post-operative (p=0.006) McCormick scores were significantly different between the three groups, but not at 6 weeks or 6 months postoperatively (p>0.05). Additionally, at one year, there was no difference in McCormick scores between patients who were managed surgically and those who were managed conservatively but ultimately underwent surgery (p>0.99). Postoperative cyst recurrence rates were similar in patients who underwent preoperative MRI alone vs MRI+CT myelogram (p>0.99).

Furthermore, the use of intraoperative ultrasound did not significantly decrease postoperative cyst recurrence rates (p=0.73).

Conclusions: A significant proportion of patients who were initially managed conservatively underwent surgery secondary to neurological decline. Delayed surgical intervention in minimally symptomatic patients does not seem to result in worse long-term neurofunctional outcomes. At 1-year, postoperative MNS were noted to be significantly higher in both surgical groups, when

compared to the conservative group highlighting the potential long-term worsening neurological symptoms of patients regardless of pre-operative observational status.

Primary Presenter: Kris Simon

Project Title: Groundwork for a Testable Communication Training Curriculum to Improve Outcomes for LGBTQ+ Patients in Hospice and Palliative Care Settings

Primary Mentor: Carey Candrian

Secondary Mentor(s):

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

Purpose Emerging research in lesbian, gay, bisexual, transgender, queer, and other gender and sexual identities (LGBTQ+) patient experiences in hospice and palliative care (HPC) has shown disparities in access and quality of care compared to patients who are not sexual and gender minorities, such as increased discrimination and stigma resulting in increased psychological distress culminating in poor health outcomes including delayed seeking of palliative/hospice/end-of life care. While much current research has made recommendations to address these disparities, there is a paucity of research data to demonstrate the strength of evidence behind these recommendations in practice. This paper proposes elements for a medical school communication training curriculum based on current communication recommendations and existing general HPC and LGBTQ+-focused curricula to improve interactions between physicians and LGBTQ+ patients in need of end-of-life/palliative/hospice care. To ensure its relevancy and scalability, the future curriculum will be iteratively designed by collecting and analyzing survey data from learners, session facilitators, administrators of curriculum, and eventually patients' experiences to provide evidence of efficacy or otherwise.

Methods Available literature on recommendations for improving LGBTQ+ HPC/end-of-life care was searched on PubMed and Web of Science as well as consultations with faculty from the University of Colorado School of Medicine (CUSOM) involved in the Health and Society curriculum, Foundations of Doctoring (FDC) Communication Skills curriculum, faculty from CUSOM's internal medicine residency and palliative care fellowship programs, and an assistant professor and a post-doc fellow from the Colorado Clinical and Translational Sciences Institute (CCTSI).

Results Common communication themes in current LGBTQ+ HPC recommendations centered around history-taking that thoughtfully gathers sexual orientation and gender identity (SOGI) information and who the patient regards as members of their family of choice. Curriculum elements would be administered over different years of medical school and included in existing HPC/end-of-life care curriculum. Elements include a problem-based learning (PBL) style patient case featuring a same-gender dyad held at the end of the first year of medical school following a lecture on the basics of advance care planning (APC), a communication session during clinical year with (a) standardized patient(s) and facilitator, and further small-group and communication

sessions during Integrated Clinicians Courses (ICC) held during the fourth year of medical school.

Rationale Choice of curriculum elements builds upon familiarity with PBL-format and foundational communication skills taught via FDC. Gauging progress and quality of the curriculum would depend on feedback from learners and facilitators through post-session surveys, and this can lead to further improvement and refinement of the curriculum. Surveys can also generate quantitative and qualitative data to provide evidence to bolster recommendation. It may be of further benefit to select a number of willing learners to follow longitudinally, and to have them survey the experience of any LGBTQ+ patients they encounter during their clinical training year of medical school and beyond into residency and/or fellowship.

Current Status and Future Directions The first element of the curriculum (in the form of a PBL-style patient case for small-group discussion) has been developed in collaboration with palliative care faculty and will be administered to CUSOM's class of 2025 in February 2022. Later elements of the curriculum have not yet been written and approved by CUSOM curriculum faculty. Survey questions for longitudinal investigations of learners' experience have not yet been written. Future directions for studying LGBTQ+ disparities in HPC include investigating the experiences of LGBTQ+ people of color in HPC settings for additional disparities from the intersection of multiple minority attributes.

Primary Presenter: Kristen (KC) Moore

Project Title: Student perspectives on the diversity climate at a U.S. medical school: a 13-year follow-up

Primary Mentor: Steven Lowenstein

Secondary Mentor(s): Regina Richards

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

Background: Diversity, equity, and inclusiveness (DEI) play important roles in medical education, as they help build a respectful, inclusive, and supportive learning environment, increase students' awareness of healthcare disparities, and prepare students to serve diverse patient populations. In 2008, a Student Climate Survey was sent to students at one medical school to assess their perspectives on the climate of the school with respect to DEI and cross-cultural understanding. The authors conducted an updated version of this survey in 2021 to assess changes in campus climate from the prior baseline, efficacy of diversity efforts in the intervening years, and level of support felt by various groups on campus.

Methods: All students in the doctor of medicine (MD), physical therapy (PT), and physician assistant (PA) programs at a public medical school were asked to complete a Student Climate Survey consisting of 33 Likert-scale, short-answer, and open-ended questions, some of which were new and some of which were drawn from the 2008 survey. The questions were designed to measure student experiences and attitudes regarding general diversity culture, witnessed negative speech or behaviors, diversity in the learning environment, and effectiveness of current diversity efforts. Participation in the survey was entirely voluntary. Survey responses were summarized using proportions and 95 percent confidence intervals (95% CI). To test for associations between participants' characteristics (for example, demographic attributes or program) and key survey responses, odds ratios and 95% CIs were calculated. To test for statistical significance, chi square values and p values were calculated.

Results: Of 1,004 eligible students across the MD, PA, and PT programs, 178 (18%) participated in the survey. Most participants agreed that the school of medicine (SOM) campus is friendly (89%, 95% CI 84 to 94) and welcoming to people from minority groups (78%, 95% CI 72 to 85). Sixty-one percent of students (95% CI 53 to 68) agreed that the campus is diverse, an increase from 37% in 2008. Almost all students (99%, 95% CI 97 to 100) of students agreed that their learning is enhanced by having a diverse student body and faculty, versus 90% who agreed in 2008. Nearly all participants (98%, 95% CI 96 to 100) believed the SOM is welcoming to those with liberal views, while only 49% (95% CI 47 to 51) believed it to be welcoming to those with conservative views. Many students reported witnessing other students, residents, or faculty make disparaging remarks or exhibit offensive behaviors toward minority groups, most often targeting people with conservative political views or ideologies, those with strong religious beliefs, those

of low socioeconomic status, women, or racial or ethnic minority groups. Fewer students reported other students or residents making disparaging remarks or exhibiting offensive behaviors targeting non-English speakers and gay/lesbian, bisexual, or transgender (LGBT) individuals than in 2008 (12% [95% CI 7 to 18] in 2021 versus 34% in 2008 and 12% [95% CI 6 to 18] versus 25%, respectively). Students who identified as underrepresented minorities were 5- to 25-times more likely to feel isolated on campus because of their race/ethnicity than non-minority white students. When asked about potential efforts to enhance the DEI climate on campus, most survey participants endorsed recruitment of more diverse faculty (80%), students (76%), residents and fellows (61%), and SOM leadership (61%) as well as increased efforts to ensure that the curriculum reflects and respects diversity (70%).

Conclusions: Students increasingly value a climate that promotes DEI in supporting their own learning as well as the school's educational and clinical care missions. A higher percentage of students believed the campus to be diverse in 2021 compared to 2008. Based on these results, the SOM should continue to embrace a broad definition of diversity that encompasses race, ethnicity, gender, age, socioeconomic status, sexuality, political views, religious beliefs, and other background characteristics and life experiences. Importantly, the SOM should identify new ways to respond when students experience or witness comments that are disrespectful or marginalizing.

Primary Presenter: Kylie Van Hoesen

Project Title: An analysis of the factors associated with the greatest disease burden in the pediatric population seen at Khayelitsha Emergency Department between 2014-15.

Primary Mentor: Madiha Abdel-Maksound

Secondary Mentor(s): David Richards

Thematic Area: Global Health

Abstract:

Khayelitsha District Hospital (KDH) is a district level tertiary hospital that opened in February 2012. The hospital serves the partially informal township of Khayelitsha which means our new home in the Xhosa language. The 47-bed Emergency Department (ED) in the hospital serves more than 120 patients daily, with the pediatric patient population making up a significant percentage of the total number of patients seen in the ED. This study was conducted retrospectively to determine whether there is an association that exists between pediatric patients diagnosed with acute gastroenteritis (AGE), pneumonia and neonatal sepsis, and the following variables: sex, nature of referral, prematurity, and duration of time spent in the ED. A database which was collected over a span of six months from 1 November 2014 through 30 April 2015 and contained data for 325 pediatric patients seen in the Resuscitation Zone of KDH was analyzed to determine the associations noted above. The understanding of these associations will help to streamline protocols, make efficient use of limited resources, and implement system level changes at KDH to provide a higher standard of care for pediatric patients seen in the ED. The goal of this study is to shed light on opportunities available to minimize the morbidity and mortality of a vulnerable population.

Primary Presenter: Lauren Heery

Project Title: Computable Phenotype and Severity Outcomes Validation of Adult Patients Admitted to the Hospital with Confirmed Coronavirus Disease 2019 (COVID-19)

Primary Mentor: Kristine Erlandson

Secondary Mentor(s): Lisa Schilling

Thematic Area: Clinical Science

Abstract:

The COVID-19 pandemic presented an opportunity to apply clinical informatics advances in real-time to answer clinical questions with patient-level data. EHR-computed phenotypes of patient cohorts have been used to characterize the natural history of COVID-19, the impact of therapeutic interventions, and outcomes of healthcare systems. Despite the widespread use of these methods, it is often unknown the extent to which this data is valid and high quality. This study aims to validate an EHR-computed phenotype of patients hospitalized for COVID-19 with a database of manually abstracted patient charts. We hypothesize that the cohort definition phenotype will accurately identify patients hospitalized for COVID-19 at University of Colorado Hospital who were admitted for the first time March 18, 2020 to April 26, 2020. The EHR phenotype generated 438 patient encounters, while the chart review database included 415 patient records. There were 379 overlapping patient records. The EHR phenotype dataset had 32 false negatives, resulting in a 92.2% sensitivity compared to the REDCap database. After ETL updates and modifications of the phenotype to 1) remove date restrictions on the new COVID-19 ICD-10 code and 2) remove a requirement for a second diagnosis code specifying disease caused by COVID-19, this sensitivity increased to 99.1%. These high rates of sensitivity indicate that the construction of computable phenotypes is reliable even within the context of shifting use of diagnosis codes and viral tests for a new disease process. This work has important implications for future EHR-based phenotypes and observational research methods.

Primary Presenter: Layne Anderson

Project Title: Medical Volunteerism

A Curriculum on: Ethical Constructs, Sustainability, and Personal Implications

Primary Mentor: Daniel Goldberg

Secondary Mentor(s):

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

Many articles have been published regarding the topic of medical volunteerism or €œvoluntourisim€ and the potential implications, positive or negative. As a medical student who has been involved in medical volunteerism, there is little formally or widely taught to medical students or even undergraduate students about their role in medical mission work. Additionally, there are no clear legal guidelines that cross international borders. This has left many to rely on the precedent set before them or their own judgement. There has been growing involvement in medical volunteerism, consisting of €œup to 10 million volunteers [who] travel abroad annually, spending approximately $4 billion€ (Sullivan 2017). With the growing involvement and lack of widespread formal training, there has been a concurrent increase in concerns regarding the outcomes from international medical volunteer work. The purpose of this project is to critically review the literature that has been published regarding medical volunteerism and use the themes repeated most to compose a formal curriculum geared for undergraduate and medical students considering involvement in medical volunteerism. The University of Colorado Anschutz €" Strauss Health Sciences Library journal collection was searched using terms such as €œmedical volunteerism€ and €œinternational volunteering.€ The most common themes within the literature reviewed included ethics, sustainability, and personal implications. The development of these important themes in this review can be used to provide supplementary information when utilizing the accompanying lesson plan and PowerPoint. Ultimately, students interested in partaking in medical volunteerism will preemptively consider their personal motivations, become fully aware of the bounds of their role clinically, become educated on the community being served, plan for potential challenges, gain tools for reflection, and promote future research on outcomes. Ideally, through the development, dissemination, and enforcement of a curriculum conveying clear guidelines for ethical and sustainable medical volunteerism, we as a medical community can improve the care we provide both at home and abroad.

Primary Presenter: Leighton McCabe

Project Title: Plantar Flexion-Induced Entrapment of the Dorsalis Pedis Artery in a Teenaged Cross-Country Runner

Primary Mentor: Brett Reece

Secondary Mentor(s): Max Wohlauer

Thematic Area: Clinical Science

Abstract:

Background: Symptomatic peripheral artery disease of the lower extremity rarely affects young adults and, when present, typically has a nonatherosclerotic etiology. Anatomical variants have manifested as symptomatic foot ischemia in four cases in the literature. We describe the case of a 17-year-old girl presenting with foot pain upon plantar flexion due to dynamic dorsalis pedis (DP) artery entrapment by fibrous bands and the extensor hallucis brevis (EHB) tendon.

Methods: The patient was a 17-year-old girl who presented with right foot pain upon plantar flexion, which resolved upon returning to the neutral position. The potential site of compression was identified on MRI where the DP artery ran deep to the EHB tendon near the first and second tarsometatarsal joints. On diagnostic arteriogram, there was notching of the dorsalis pedis over the talus bone. The dorsalis pedis Doppler signal was obliterated upon plantar flexion. A longitudinal incision was made over the artery in the area of compression. The flexor retinaculum was incised. Abnormal fibrous bands were identified, which were lysed anterior to the artery. The EHB tendon was released and transferred distally to the extensor hallucis longus tendon.

Results: A completion angiogram showed a persistently patent dorsalis pedis artery with plantar flexion. She was discharged one day postoperatively without issues. On follow-up, the patient was ambulatory with complete resolution of her pain. Arterial duplex demonstrated normal velocities through the dorsalis pedis in all positions.

Conclusions: Symptomatic peripheral artery disease is a rare presentation in young adults and is usually due to nonatherosclerotic pathophysiology. We present a rare case of dorsalis pedis artery entrapment syndrome. Given the mechanical nature of obstruction, surgical correction was an effective treatment.

Primary Presenter: Madison Hanson

Project Title: Ethical Challenges with Treating Adolescent Patients with Eating Disorders as they Transition to Adulthood

Primary Mentor: Jackie Glover

Secondary Mentor(s): Beau Carubia, Karen Jones, Curtis Coughlin, Brian Jackson, Thida Thant

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

Eating disorders are defined in the American Psychiatric Association's Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) as a persistent disturbance of eating that impairs health or psychosocial functioning.1 The treatment of eating disorders typically brings up several ethical challenges, particularly in adolescents as they are transitioning into making their own healthcare decisions. The aim of this manuscript is to explore several topics that have sparse literature including: how the treatment of eating disorders differs between adolescents and adults, capacity and the right to decline treatment in the setting of eating disorders, involuntary treatment of eating disorders, the ethics of using restraints in eating disorder treatment, and how to prepare adolescents with eating disorders for the transition into adult medical care. With mental health diagnoses on the rise, bioethicists are busy with consultations regarding declination of treatment and transitions of care in this population.

Primary Presenter: Madison Harrison

Project Title: Accuracy of Current Equations and Development of a New Predicative Equation for Resting Energy Expenditure for Overweight and Obese Adolescents

Primary Mentor: Melanie Green

Secondary Mentor(s):

Thematic Area: Clinical Science

Abstract:

Objective: Nutritional counseling is a critical component of healthcare for overweight and obese adolescents. To provide this counseling, clinicians rely on equations to calculate resting energy expenditure (REE), however, the data used to construct these equations was created from a database of normal-weight children using outpatient indirect calorimetry (IC). Our goal was to determine the accuracy of these equations and create a novel, more accurate REE equation. Methods: Secondary analysis of overweight and obese female participants who underwent monitored, inpatient REE. Ten predictive equations were used to calculate REE for each subject and performance was evaluated using mean absolute error. A Backward stepwise model was performed to create a new predictive equation for REE using multiple variables. Results: Data from 142 overweight and obese female ages adolescents was used to compare measured REE to REE predicted by 10 established equations. All but one of the equations overestimated REE. Our novel equation more accurately predicted REE. Conclusion: Previous predictive equations have been over-predicting REE in overweight and obese adolescent girls. Our novel equation will allow clinicians to more accurately estimate REE and aid in nutrition counseling and weight loss.

Primary Presenter: Maggie McGing

Project Title: Assessing First-Year Medical Students' Understanding of Race and Medicine

Primary Mentor: Tai Lockspeiser

Secondary Mentor(s): Daniel Goldberg, Janet Meredith

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

INTRODUCTION: Research suggests that medical students hold false beliefs about biological differences between Black people and white people and that these false beliefs may impact the care they provide.7 This study investigates the beliefs of first-year medical students as they start their medical training in order to gauge incoming students' understanding of race as a social construct rather than a biological concept as well as the effect of social determinants and racism on health outcomes of Black people.

METHODS: An 11-item survey designed to assess incoming first-year medical students' false beliefs on the connection between race and biology was administered to students during their incoming student orientation. Of the 11 items in the survey, two were true statements of racial health disparities related to the social determinants of health and nine were false statements of perceived biological differences between Black and white individuals. Students' responses were divided into tertiles: true, false, and uncertain. The €˜uncertain' category was designed to capture participants who answered under the possibly true/untrue category. Once the results were analyzed, students were sent a summary of the results and correct answers as a teaching tool.

RESULTS : Of the 143 respondents only 5% (n = 7) correctly answered all 11 survey statements (responded either €œdefinitely true€ or €œprobably true€). Of the two questions designed to gauge students' understanding of social determinants of health 50.3% answered both questions incorrectly and 16.8% of respondents answered one of the questions incorrectly. When analyzing the number of participants with false beliefs regarding biology and race, 5.6% (n = 8) of respondents had one false belief and 2.1% (n = 3) held two or more false beliefs. 33.6% (n = 48) of students expressed uncertainty in one or more false biologic statements with 14% (n = 20) holding uncertainty for three or more false biologic statements out of nine total false statements.

CONCLUSION: Our results demonstrate that first-year medical students hold some false beliefs pertaining to the connection between race and biology and may have an inadequate or flawed understanding of the effects of social determinants on the health of Black people. These results illustrate the importance of educating medical students about the role of systemic racism in medicine, emphasizing the social and political etiologies of health disparities.

Primary Presenter: Marcus Marable

Project Title: Usage of Mongolian and Arabic Infographics to Improve Patient Health Literacy in an Outpatient Setting

Primary Mentor: Yasmin Sacro

Secondary Mentor(s):

Thematic Area: Public Health and Epidemiology

Abstract:

Approaches to improve patient health literacy and thereby empower patients and improve health outcomes is an area of ongoing research. This is especially relevant in the outpatient setting, where limited time, and potential lack of resources can lead to limited conversations and knowledge sharing. This project seeks to uncover whether patient health literacy can be improved is through the creation and provision of infographics concerning common health concerns in Arabic and Mongolian in select Denver Health and University of Colorado primary care sites. Site staff members reported that these documents provided value to both providers and patients, and emphasized how further improvements could be made.

Primary Presenter: Margaret Nguyen

Project Title: Granulomatosis with polyangiitis: An example of diagnostic (confirmation) bias

Primary Mentor: Marina Mutter

Secondary Mentor(s):

Thematic Area: Clinical Science

Abstract:

A 58-year-old woman presented to the emergency department with progressively worsening malaise, headache, and mastoid tenderness. She had a history of chronic bilateral mastoiditis and underwent bilateral mastoidectomies and nerve decompression two months prior. On this admission, the patient's clinical presentation was concerning for either vasculitis or an infectious process. Given the clinical history, elevated inflammatory markers, and nuclear medicine bone scan concerning for osteomyelitis, the patient was started on empiric antibiotic therapy and underwent an extensive infectious workup. After the workup failed to reveal an infectious etiology and her condition worsened despite treatment, the team reconsidered vasculitis. An elevated c-ANCA titer along with a PR3 >30, a urinalysis without RBC casts, and a computerized tomography (CT) without pulmonary nodules confirmed the diagnosis of granulomatosis with polyangiitis (GPA) with limited involvement. The patient was treated with high-dose intravenous steroids and Rituximab infusions with good effect. This case highlighted the impact of diagnostic (confirmation) bias in clinical decision-making as the clinical history and imaging findings led to an extensive infectious workup despite negative microbiology.

Primary Presenter: Maggie Stalker

Project Title: Preeclampsia Alters Insulin Signaling Pathway Protein Expression in the High-Altitude Placenta

Primary Mentor: Colleen Julian

Secondary Mentor(s):

Thematic Area: Global Health

Abstract:

Background: Preeclampsia (PE) is associated with maternal morbidity and mortality globally, but especially in Bolivia where rates are third highest worldwide. The exact pathophysiology of PE is still unknown, but previous studies have shown insulin signaling pathway dysfunction and hypoxia as plausible mechanisms in PE development. This study aimed to examine protein expression of the insulin signaling pathway and correlate the proteins with hypoxia in PE placentas compared to normotensive controls at high-altitude to discover more about the PE pathogenesis.

Methods: Patients were recruited from the Hospital Materno-Infantil in La Paz, Bolivia (3,600-4,100m). Maternal blood samples were taken to measure erythropoietin receptor (EpoR) as a marker of hypoxia. Umbilical venous and arterial blood was sampled along with placental biopsies. Western capillary electrophoresis was used to measure protein expression of IRS1, pIRS1, IRS2, AKT, pAKT, and pGSK3B.

Results: 65 maternal-infant pairs with 29 PE cases and 36 controls were recruited for this study Compared to controls, PE placentas were found to have greater pAKT, greater pIRS1, and lower pGSK3B expression levels. There was also a trend seen in PE placentas having greater IRS2 expression levels, although not statistically significant. There was no significant difference in IRS1 or AKT protein expression between PE cases versus normotensive controls. There was a negative correlation between IRS1, pIRS1, IRS2 with EpoR. There was a positive correlation seen between pGSK3B with EpoR. There was no correlation between Akt and EpoR.

Conclusion: PE placentas showed dysfunction in the insulin signaling cascade concerning for insulin resistance. Hypoxia was determined to be a significant factor in this insulin signaling pathway, suggesting that hypoxia can interfere with normal functioning of this cascade. This study demonstrated how insulin signaling disruption and hypoxia can play a role in the pathophysiology of PE at high altitude.

Primary Presenter: Matt Golub

Project Title: Creating an Effective Clinic Model for Post-COVID Mental Health Treatment

Primary Mentor: Thida Thant

Secondary Mentor(s):

Thematic Area: Public Health and Epidemiology

Abstract:

Background: The University of Colorado (UCH) Consultation-Liaison Psychiatry (CLP) service and Psychiatric Consultation for the Medically Complex clinic (PCMC) are developing a brain health outreach program for those hospitalized with COVID. Patients with COVID have increased risk of cognitive and psychiatric sequelae due to intrinsic viral properties, hyperinflammatory state, and increased disposition to ICU level care. Development of a post COVID brain health program has become paramount and UCH is not alone in creation of new clinic protocols to meet the needs of this population. Hospitals around the globe are developing new screeners to identify patients at higher risk of neuropsychiatric sequelae and refer them to appropriate resources. This project aimed to determine which patients infected with COVID-19 are vulnerable to neuropsychiatric sequelae and contribute towards developing improved methods of reaching these populations for care. We hypothesized that patients with multiple psychiatric/medical comorbidities and lower socioeconomic status would be more likely to display neuropsychiatric sequelae after infection with COVID-19. Furthermore, we hypothesized that patients of lower socioeconomic status and minority identification would prove to be barriers to successful outreach.

Methods: The program makes use of two arms: The first assesses those discharged from the hospital using a screener developed by the UCH post-COVID hospitalization program. The second screens patients currently admitted to the hospital with COVID using psychiatric and neurocognitive screeners. Both allow patients to be referred to PCMC for evaluation and treatment. Evaluation includes psychiatric interview and additional screeners including: Hospital Anxiety and Depression Scale (HADS), Montreal Cognitive Assessment (MoCA) and PTSD Checklist for DSM-5 (PCL-5). Additional neuropsychiatric evaluation via Repeatable Battery for the Assessment of Neuropsychological Status (RBANS), and cognitive rehabilitation referral, are available. Clinic treatment includes pharmaceuticals, individual therapy referral, or referral to the PCMC COVID Survivorship Support Group.

Results: To date, 100 patients have been screened in arm 1 (outpatient outreach) and arm 2 (inpatient outreach). In arm 2, about 54% of the population identifies as female, 46% as male, 61% identified as non-hispanic white, and 86% spoke English. Of those in arm 2 that agreed to full participation, 26% agreed to future check-ins and 6% were seen in the clinic. There was a difference in those who did and didn't fully participate based on ethnicity, language, and

insurance status; though not of statistical significance. HADS scores demonstrated different trends based on these same demographic factors, though also not statistically significant.

Discussion: By using this two-armed approach, the service has been able to more effectively outreach patients and refer them to appropriate care. Though data is not complete, referral needs seem to differ based on demographic data.

Conclusions: As data continues to be collected, the clinic model is expanding to outreach high risk patients for neuropsychiatric sequelae. This will strengthen our existing system, with risk of reoccurrence of similar events, and inform a new standard of care for COVID survivors.

Primary Presenter: Mattie Kerns

Project Title: Attitudes, activities, and motivations of pro-vaccine advocates

Primary Mentor: Jessica Cataldi

Secondary Mentor(s):

Thematic Area: Clinical Science

Abstract:

Background: Vaccine hesitancy is a growing public health concern and has been classified as a major threat to global health by the WHO. While there has been extensive research on the attitudes of vaccine-hesitant individuals, little is known about the attitudes of pro-vaccination advocates.

Objective: To describe among vaccine advocates: 1) vaccine attitudes, including attitudes about primary care clinic vaccine policies, 2) vaccine advocacy activities, and 3) motivations for vaccine advocacy.

Design/Methods: An internet survey was conducted July-November 2019. Vaccine advocacy groups across the US were invited to partner in survey distribution and participants were recruited from a convenience sample of their members. Advocacy activities were categorized as either policy-related, in-person, or online.

Results: Response rate was 8% (1,239/15,475). Respondents were mostly female, white, and highly educated (Table 1). Most reported Democratic Party affiliation and the most common occupation was healthcare practitioner. The majority of the respondents were from California (45%), Colorado (18%), and Ohio (5%). The majority of respondents (90%) strongly or somewhat agreed that a policy that did not allow patients to refuse or spread-out vaccines would encourage them to join a primary care clinic. The most common policy-related activities were contacting an elected official about vaccines, signing petitions to change vaccine policy, and attending a rally or other organized event to promote vaccine policy (Figure 1). Participants also described €˜other' policy-related advocacy activities including occupational advocacy work (e.g., physician, nurse, or public health worker) and testifying for pro-vaccine legislation. The most common in-person activities to advocate for vaccines were speaking with a friend or family member, speaking at a school, or speaking at a community event. The most commonly reported online activities to advocate for vaccines were using social media, email and text messages, and interacting with news. The most common motivation for vaccine advocacy was a sense of responsibility as a community member (Figure 2).

Conclusions: Our sample of vaccine advocates engaged in a variety of different advocacy activities and appeared to be a highly motivated by responsibility to their community as well as a range of other factors. Continued work to better understand vaccine advocates may help inform

efforts to curb vaccine hesitancy and influence those who accept vaccines to advocate for vaccines.

Primary Presenter: May Tay

Project Title: COMPARING ADVERSE CHILDHOOD EXPERIENCES (ACE) OF PARENTS OF CHILDREN IN TREATMENT IN OUTPATIENT PSYCHIATRY TO ADULTS IN THE GENERAL POPULATION.

Primary Mentor: Steven Berkowitz

Secondary Mentor(s):

Thematic Area: Clinical Science

Abstract:

Hypothesis: We hypothesized that parents of children requiring psychiatric services were more likely to have experienced more adversity during childhood than adults in the general population.

Study design: A modified Adverse Childhood Experiences (ACE) Questionnaire about adverse childhood experiences was administered to parents of children receiving treatment at the UCH pediatric psychiatry outpatient setting over the course of four months from September 2019 to December 2019. Scores were compared to 2014 data from the Colorado Behavioral Risk Factor Surveillance System and Child Health Survey (BRFSS), a federally funded random health telephone survey of residents 18 or older. Data was analyzed by a statistician using SPSS v27. Pearson Chi-Square crosstabs were run for each ACE question, comparing the UCH Psychiatry group with the BRFSS data.

Results: As children, parents of children at the UCH clinic were more likely to have lived with someone who was depressed, mentally ill, or suicidal ($p<0.001$), have parents who were separated or divorced ($p=0.004$), been physically hurt by a parent or adult at home ($p=0.029$), been verbally harmed ($p=0.002$), coerced to touch an adult sexually ($p=0.021$), and/or forced to have sex by an adult ($p=0.020$). Due to sample size, no significant difference was found between the average ACE score for parents at the UCH clinic and the general population.

Conclusions: Parents of children receiving psychiatric services have undergone more traumatic events during childhood than parents of the general population. This finding may explain the intergenerational transmission of stress and trauma. This small study provides further evidence supporting the importance of caregiver involvement in the mental health care of children.

Primary Presenter: Megan Foy

Project Title: PCOS presentation in girls with a history of premature adrenarche does not differ from those without premature adrenarche

Primary Mentor: Melanie Cree-Green

Secondary Mentor(s):

Thematic Area: Clinical Science

Abstract:

Two common endocrine system disorders are polycystic ovary syndrome (PCOS) and premature adrenarche (PA). PCOS occurs later in puberty whereas PA develops at the start. Given both are associated with elevated levels of androgens, it is questionable if the two disease processes overlap or if PA is a precursor to PCOS. This study aims to determine if PA could be a precursor to PCOS or simply a benign variant of normal puberty. Since PCOS is a condition associated with many comorbidities like diabetes, fatty liver disease, and metabolic syndrome, it would be helpful to know those who were more likely to develop the disorder to enact earlier interventions. The physical, hormonal, and metabolic characteristics of adolescent girls with PA at the time of their PCOS diagnosis was compared to similarly aged girls who had a history of normal pubertal development at the time of their PCOS diagnosis. This was done via a retrospective chart review of EMRs at pediatric centers in Colorado and Florida. It was found that PCOS biochemical and physical presentation in girls with a history of PA does not differ from those without PA. This study further supports the view of PA as a benign deviation from normal pubertal development. There are no conflicts of interest to disclose.

Primary Presenter: Melissa Johnson

Project Title: Relationship Between Biomarkers of Tubular Injury and Intrarenal Hemodynamic Dysfunction in Youth with Type 1 Diabetes

Primary Mentor: Petter Bjornstad

Secondary Mentor(s): Kalie Tommerdahl

Thematic Area: Clinical Science

Abstract:

Background: Early identification of youth with type 1 diabetes (T1D) at risk for diabetic kidney disease may improve clinical outcomes. We examined the cross-sectional relationship between kidney biomarkers copeptin, interleukin-18 (IL-18), chitinase-3-like protein-1 (YKL-40), neutrophil gelatinase-associated lipocalin (NGAL), monocyte chemoattractant protein-1 (MCP-1), and kidney injury molecule-1 (KIM-1) and intrarenal hemodynamic function in adolescents with T1D.

Methods: Glomerular filtration rate (GFR), renal plasma flow (RPF), afferent arteriolar resistance (RA), efferent arteriolar resistance (RE), renal vascular resistance (RVR), intraglomerular pressure (PGLO), and urine albumin-to-creatinine ratio (UACR), and the above indicated biomarkers were assessed in youth aged 12-21 years with and without T1D of <10 years duration.

Results: Fifty adolescents with T1D (16.1±3.0 years, HbA1c 8.6±1.2%) and 20 adolescents of similar BMI without T1D (16.1±2.9 years, HbA1c 5.2±0.2%) were enrolled. Adolescents with T1D demonstrated significantly higher GFR, RPF, RE, and PGLO than controls (39%, 33%, 74%, and 29%, respectively, all $p<0.0001$). Adolescents with T1D also exhibited significantly lower RVR and RA than controls (25% and 155%, respectively, both $p<0.0001$). YKL-40 and KIM-1concentrations, respectively, were positively associated with GFR (r: 0.43, p=0.002; r: 0.41, p=0.003), RPF (r: 0.29, p=0.08; r: 0.34, p=0.04), UACR (r: 0.33, p=0.02; r: 0.50, p=0.0002), and PGLO (r: 0.45, p=0.006; r: 0.52, p=0.001) in adolescents with T1D.

Conclusions: Higher concentrations of biomarkers YKL-40 and KIM-1 may help define the risk for intraglomerular hemodynamic dysfunction in youth with T1D.

Primary Presenter: Michelle Vo

Project Title: Post-Discharge Health Resource Use in Pediatric Survivors of Prolonged Mechanical Ventilation for Acute Respiratory Disease

Primary Mentor: Aline Maddux

Secondary Mentor(s):

Thematic Area: Clinical Science

Abstract:

We aimed to identify characteristics associated with post-discharge health resource use in children without medical complexity who survived an episode of prolonged mechanical ventilation for respiratory disease. We hypothesized that longer durations of mechanical ventilation, non-complex chronic conditions, and severe acute respiratory distress syndrome (ARDS) would be associated with readmission or an Emergency Department (ED) visit. In this retrospective cohort, we evaluated children without a complex chronic condition who survived a respiratory illness that required > 3 days of mechanical ventilation and who had insurance eligibility within the Colorado All Payers Claims Database. We used insurance claims to characterize health resource use and multivariable logistic regression to identify characteristics associated with readmission or an ED visit. We evaluated 82 children, median age 12.8 months (interquartile range 4.0-24.1), 20 (24%) with a non-complex chronic condition and 62 (76%) without any chronic conditions. Bronchiolitis (60%) and pneumonia/aspiration pneumonitis (17%) were the most common etiologies of respiratory failure and 47 (57%) patients had severe ARDS. During the post-discharge year, 46 (56%) patients had an ED visit or readmission including 16/18 (89%) readmissions for respiratory illness. Forty (49%) patients had > 2 outpatient pulmonary visits and 45 (55%) filled a pulmonary medication prescription. In analyses controlling for age, illness severity and durations of mechanical ventilation and ARDS, severe ARDS was predictive of ED visit or readmission (OR 5.53 [95% CI: 1.79, 19.09]). Children who survive prolonged mechanical ventilation for respiratory disease experience high rates of postdischarge health resource use, particularly those surviving severe ARDS.

Primary Presenter: Minh Do

Project Title: Effect of Nutrition Classes at Urban Peak On Dietary Patterns of Unhoused Youth

Primary Mentor: Janet Meredith

Secondary Mentor(s):

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

Background: Unhoused youth represent a significant proportion of the underserved population and face substantial nutritional challenges due to various factors, including lack of knowledge, food insecurity, and insufficient intake. Studies have examined nutritional deficiencies and implications on health of unhoused youth, however the effect of nutritional education on dietary patterns of unhoused youth has not been fully evaluated.

Objective: The aim of this project is to implement nutrition classes at Urban Peak, a homeless shelter for youth ages 15-24, and evaluate the impact of nutritional education on the nutritional status and dietary patterns of this population.

Methods: Following discussions with Urban Peak youth and staff, the project will rotate through eight weekly lesson plans focused on particular topics from nutritional education. Prior to the lesson, participants will complete a €œPre-Survey€⬜ to assess their current understanding about the topic. After the lesson is completed, participants will then complete a €œPost-Survey€⬜ to evaluate their understanding and retention of subject matter. Nutritional status and dietary patterns will be further evaluated qualitatively in additional €œPost-Surveys€⬜ administered one month following each lesson. This project will focus on the first four lesson plans and the data respectively collected.

Conclusion: Following completion of the first four lessons, it is clear that the majority of youth have a rudimentary understanding of nutritional concepts and retain a significant proportion of the lesson materials. However, given the high turnover rate of youths at Urban Peak, there is a significant limitation in analysis of long-term nutritional status and dietary patterns, and the post-survey at the one month timepoint was unable to be administered. Additionally, more barriers have been identified after thematic analysis of participants' responses, most importantly accessibility to healthy foods. In spite of these challenges, we remain optimistic that youth will have the knowledge to make more informed decisions about their nutrition when given the choice and be cognizant of the impact of their diet on their health. With Urban Peak now established as a €œService Learning€⬜ site, we aim to build upon the longitudinal relationship between CU School of Medicine and Urban Peak to offer guidance and mentorship to the youth beyond nutrition.

Disclosure: I have no financial ties or other relevant interests/conflicts to disclose.

Primary Presenter: Minodora Adriana Buliga-Stoian

Project Title: Student perspectives on the diversity climate at a U.S. medical school: a 13-year follow-up

Primary Mentor: Regina Richards

Secondary Mentor(s): Steven Lowenstein.

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

Background: Diversity, equity, and inclusiveness (DEI) play important roles in medical education, as they increase students' awareness of healthcare disparities and prepare students to serve diverse patient populations. In 2008, a Student Climate Survey was sent to students at one medical school to assess their perspectives on the climate of the school with respect to DEI and cross-cultural understanding. The authors conducted an updated version of this survey in 2021 to assess change in campus climate from the prior baseline, efficacy of diversity efforts in the intervening years, and level of support felt by various groups on campus.

Methods: Students in the doctor of medicine (MD), physical therapy (PT), and physician assistant (PA) programs at a public medical school were asked to complete a Student Climate Survey consisting of 33 Likert-scale, short-answer, and open-ended questions, some of which were new and some of which were drawn from the 2008 survey. The questions were designed to measure student experiences and attitudes regarding general diversity culture, witnessed negative speech or behaviors, diversity in the learning environment, and effectiveness of current diversity efforts. Participation in the survey was entirely voluntary. Survey responses were summarized using proportions and 95 percent confidence intervals (95% CI), as well as inductive content analysis.

Results: 178 eligible students (18%) participated in the survey. Most participants agreed that the school of medicine (SOM) campus is friendly (89%) and welcoming to people from minority groups (78%). 61% of students agreed that the campus is diverse, an increase from 37% in 2008. 99% of students agreed that their learning is enhanced by having a diverse student body and faculty, versus 90% who agreed in 2008. Nearly all students (98%) believed the SOM is welcoming to those with liberal views, while only 49% believed it to be welcoming to those with conservative views. Many students reported witnessing other students, residents, or faculty make disparaging remarks or exhibit offensive behaviors toward minority groups, most often targeting people with conservative political views or ideologies, those with strong religious beliefs, those of low socioeconomic status, women, and racial or ethnic minority groups. Fewer students reported other students or residents making disparaging remarks or exhibiting offensive behaviors targeting non-English speakers and gay/lesbian, bisexual, or transgender (LGBT) individuals than in 2008 (12% in 2021 versus 34% in 2008 and 12% versus 25%, respectively).

Students who identified as underrepresented minorities were 5- to 25-times more likely to feel isolated on campus because of their race/ethnicity than white students.

Conclusions: Students increasingly value a climate that promotes DEI in supporting their own learning as well as the school's educational and clinical care missions. A higher percentage of students believed the campus to be diverse in 2021 compared to 2008. Per survey responses, the SOM should continue to embrace a broad definition of diversity that encompasses race, ethnicity, gender, age, socioeconomic status, sexuality, political views, religious beliefs, and other background characteristics and life experiences.

Primary Presenter: Mehdi Bandali

Project Title: An analysis of the factors associated with the greatest disease burden in the pediatric population seen at Khayelitsha Emergency Department between 2014-15.

Primary Mentor: Leana May

Secondary Mentor(s): Madiha Abdel-Maksoud, David Richards

Thematic Area: Global Health

Abstract:

Khayelitsha District Hospital (KDH) is a district level tertiary hospital that opened in February 2012. The hospital serves the partially informal township of Khayelitsha which means our new home in the Xhosa language. The 47-bed Emergency Department (ED) in the hospital serves more than 120 patients daily, with the pediatric patient population making up a significant percentage of the total number of patients seen in the ED. This study was conducted retrospectively to determine whether there is an association that exists between pediatric patients diagnosed with acute gastroenteritis (AGE), pneumonia and neonatal sepsis, and the following variables: sex, nature of referral, prematurity, and duration of time spent in the ED. A database which was collected over a span of six months from 1 November 2014 through 30 April 2015 and contained data for 325 pediatric patients seen in the Resuscitation Zone of KDH was analyzed to determine the associations noted above. The understanding of these associations will help to streamline protocols, make efficient use of limited resources, and implement system level changes at KDH to provide a higher standard of care for pediatric patients seen in the ED. The goal of this study is to shed light on opportunities available to minimize the morbidity and mortality of a vulnerable population.

Primary Presenter: Naomi Kelley

Project Title: Acromioclavicular joint injuries at a Colorado ski resort

Primary Mentor: Morteza Khodaee

Secondary Mentor(s):

Thematic Area: Public Health and Epidemiology

Abstract:

Purpose: Acromioclavicular joint (ACJ) injuries are amongst the most common injuries in winter sports. The purpose of this study was to determine trends with respect to injury mechanism, environmental factors, associated injuries, and demographics amongst patients treated for acute ACJ injuries at the Winter Park Ski Resort clinic in Colorado.

Methods: This was a retrospective descriptive analysis, specifically using an injured patient cohort from the Winter Park Ski Resort clinic. The timeframe used was from 2012 to 2017. All patients diagnosed with an ACJ injury when seen at the ski clinic at the mountain's base were included in the patient cohort. Chart review was performed to confirm diagnosis and obtain case details.

Results: A total of 341 acromioclavicular joint injuries (6.7% of total visits) were encountered during the study period. The majority of ACJ injures were grade I (41.3%) and mainly occurred in men (86.5%). The majority (96.8%) of the cases were primary ACJ injuries on the right shoulder (56.9%). The average age of patients with ACJ injuries was 30.0 years (range 10-72). More than half (62.2%) of ACJ injuries occurred due to snowboarding injuries and the remaining due to skiing injuries (37.8%). The most common mechanism of injury (93.5%) was fall to snow while skiing/boarding. Women were more likely to have a grade I ACJ injury than men (80.4% vs 35.4%; P < 0.001). Women with ACJ injuries were more likely to suffer the injury due to skiing than snowboarding (71.7% vs 28.3%; P < 0.001), compared to men who were more likely to suffer the injury due to snowboarding than skiing (67.5% vs 32.5%; P < 0.001).

Conclusions: Most of the ACJ injuries were Class I and occurred mostly in men. Snowboarders were more likely to have an ACJ injury than skiers.

Primary Presenter: Natalie Lays

Project Title: An analysis of the factors associated with the greatest disease burden in the pediatric population seen at Khayelitsha Emergency Department between 2014-15

Primary Mentor: Madiha Abdel-Maksoud

Secondary Mentor(s):

Thematic Area: Global Health

Abstract:

Khayelitsha District Hospital (KDH) is a district level tertiary hospital that opened in February 2012. The hospital serves the partially informal township of Khayelitsha which means our new home in the Xhosa language. The 47-bed Emergency Department (ED) in the hospital serves more than 120 patients daily, with the pediatric patient population making up a significant percentage of the total number of patients seen in the ED. This study was conducted retrospectively to determine whether there is an association that exists between pediatric patients diagnosed with acute gastroenteritis (AGE), pneumonia and neonatal sepsis, and the following variables: sex, nature of referral, prematurity, and duration of time spent in the ED. A database which was collected over a span of six months from 1 November 2014 through 30 April 2015 and contained data for 325 pediatric patients seen in the Resuscitation Zone of KDH was analyzed to determine the associations noted above. The understanding of these associations will help to streamline protocols, make efficient use of limited resources, and implement system level changes at KDH to provide a higher standard of care for pediatric patients seen in the ED. The goal of this study is to shed light on opportunities available to minimize the morbidity and mortality of a vulnerable population.

Primary Presenter: Nguyen Lu

Project Title: Cardiac Surgery Publications in Africa Over the Last 20 years: A Literature Review

Primary Mentor: Yihan Lin

Secondary Mentor(s):

Thematic Area: Global Health

Abstract:

There is a significant burden of surgically correctable cardiovascular disease in Africa. The goal of this research was to review the last 20 years of literature on this topic. A systematic search was performed using PubMed, Embase and African Index Medicus for the period 1996€"2016. Publications came from 29 countries, all of different income brackets. Research output increased by 15-fold over the 20-year time period, with the majority of publications authored by local teams (71.4%) compared to visiting (4.9%) and mixed teams (23.7%). Although increasing, clinical reporting on cardiac surgery is still limited. Increased publication of results should be encouraged to better benchmark capacity and improve research capacity.

Primary Presenter: Nick Mason

Project Title: Comparative Assessment of Patient Surgical Risk by Surgeons vs. a Universal, Parsimonious Statistical Risk System

Primary Mentor: Robert Meguid

Secondary Mentor(s):

Thematic Area: Clinical Science

Abstract:

Introduction: The literature lacks evidence on preoperative prediction of surgical outcomes by surgeons. The Surgical Risk Preoperative Assessment System (SURPAS) provides accurate procedure-specific preoperative risk prediction of 30-day postoperative adverse outcomes including mortality, overall morbidity, & 9 other surgical complications. SURPAS predicts these values using 8 variables including procedure-specific risk and American Society of Anesthesiologists Physical Status Classification (ASA class). These risk algorithms were developed from American College of Surgeons National Surgery Quality Improvement Program (NSQIP) data.

Methods: We compared the surgeons€™ predictions of morbidity & mortality for a variety of surgical procedures to SURPAS predicted values, and the postoperative outcomes. 30 patients€™ NSQIP data was presented to surgeons in standardized vignettes, including the procedure performed & each patient€™s comorbidities. Vignettes in ASA classes I-V were randomly presented to the participants. Surgeons were asked to predict each patient€™s 30-day postoperative mortality & morbidity.

Results: Preliminary results from general surgery residents show that surgeons were able to accurately & precisely predict both the morbidity & mortality risk amongst low risk patients (ASA class 1-2). In high risk patients (ASA class 3-5) the agreement amongst surgeons on both mortality & morbidity was variable. Surgeons were also less accurate at predicting risk in the high risk patient pool.

Conclusion: The data supports continuing the study in attending surgeons of different specialties. Each subspecialty will be administered a survey using the same vignette format that includes common procedures from within their field of expertise. We will measure surgeon accuracy in risk prediction.

Primary Presenter: Nisha Pradhan

Project Title: Attitudes about use of preoperative risk assessment tools: a survey of surgeons and surgical residents in an academic health system

Primary Mentor: Robert Meguid

Secondary Mentor(s):

Thematic Area: Clinical Science

Abstract:

Background: Formal surgical risk assessment tools have been developed to predict risk of adverse postoperative patient outcomes. Such tools accurately predict common postoperative complications, inform patients and providers of likely perioperative outcomes, guide decision making, and improve patient care. However, these are underutilized. We studied the attitudes towards and techniques of how surgeons preoperatively assess risk.

Methods: Surgeons at a large academic tertiary referral hospital and affiliate community hospitals were emailed a 16-question survey via REDCap (Research Electronic Data Capture) between 8/2019-6/2020. Reminder emails were sent once weekly for three weeks. All completed surveys by surgical residents and attendings were included; incomplete surveys were excluded. Surveys were analyzed using descriptive statistics (frequency distributions and percentages for categorical variables, means, and standard deviations for continuous variables), and Fisher's exact test and unpaired t-tests comparing responses by surgical attendings vs. residents.

Results: A total of 108 surgical faculty, 95 surgical residents, and 58 affiliate surgeons were emailed the survey. Overall response rates were 50.0% for faculty surgeons, 47.4% for residents, and 36.2% for affiliate surgeons. Only 20.8% of surgeons used risk calculators most or all of the time. Attending surgeons were more likely to use prior experience and current literature while residents used risk calculators more frequently. Risk assessment tools were more likely to be used when predicting major complications and death in older patients with significant risk factors. Greatest barriers for use of risk assessment tools included time, inaccessibility, and trust in accuracy.

Conclusions: A small percentage of surgeons use surgical risk calculators as part of their routine practice. Time, inaccessibility, and trust in accuracy were the most significant barriers to use.

Primary Presenter: Oluwatosin Adebiyi

Project Title: What Happened and Why: Responding to Racism, Discrimination, and Microaggressions in the Clinical Learning Environment

Primary Mentor: Regina Richards

Secondary Mentor(s):

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

Background: Within clinical settings, American medical students are uniquely faced with power differentials that make acts of racism, discrimination, and microaggressions (RDM) challenging to address. Experiences of microaggression and mistreatment are correlated with higher rates of positive depression screening and lower satisfaction with medical training. We developed a curriculum for medical students entering the clinical learning environment to promote the recognition of and response to RDM.

Methods: Guided by both generalized and targeted needs assessment, we created a case-based curriculum to practice communication responses to address RDM. The communication framework, a €œ6-D's approach,€☐ was developed through adaptation and expansion of established and previously learned communication upstanding frameworks. Cases were collected through volunteer submission and revised to maintain anonymity. Small group sessions were co-facilitated by faculty and senior medical students. During the sessions, students reviewed the communication framework, explored their natural response strategies, and then practiced all response strategies.

Results: Of the 196 participants in the workshop 152 (77.6%) completed the evaluation surveys. Pre- and post-session survey cohort comparison demonstrated a significant increase in students' awareness of instances of RDM (33.8% to 45.5%), knowledge of communication strategies to mitigate RDM (Mpre=3.39, Mpost= 4.62; $P<0.05$), and confidence to address RDM (Mpre= 3.05, Mpost= 4.38; $P<0.01$).

Discussion: Students gain valuable communicative skills from interactive sessions that address RDM using empathy, reflection, and relatability. This session empowers students to feel prepared to enter professional teams and ready to effectively mitigate harmful discourse.

Primary Presenter: Paul Glasheen

Project Title: Sensory processing deficits in Parkinson's Disease: localizing auditory evoked p50 responses during awake deep brain stimulation surgery

Primary Mentor: Judith Gault

Secondary Mentor(s):

Thematic Area: Clinical Science

Abstract:

Parkinson's Disease (PD) is a neurodegenerative disorder characterized by motor deficits, with secondary cognitive and sensory symptoms. Previous studies using magnetoencephalography (MEG) and electroencephalography (EEG) have revealed dysfunctions in sensory gating and processing that occur in PD. This study used intraoperative local field potentials (LFPs) to study dysfunction of auditory gating in patients undergoing awake deep brain stimulation surgery (DBS) to treat motor symptoms of PD. Intraoperative measurement of LFPs permits more precise spatial localization of sensory gating deficits and anatomical characterization of the implicated deep brain networks. Data were collected on eight DBS implantations, with LFP measurements of P50 auditory evoked potentials (AEPs) correlated to intraoperative imaging. The P50 paradigm is an AEP used to understand auditory electrophysiology and mechanisms of gating, a filtering process that attenuates cognitive response to redundant sensory stimuli. We correlated P50 responses with neuroanatomical structures in the thalamus and basal ganglia, with abnormal responses originating primarily from within the subthalamic nucleus and the thalamic reticular nucleus. These results may improve understanding of the deep brain networks involved in PD. Additionally, detailed characterization of these networks will facilitate the development of DBS protocols for other disorders of dopaminergic dysregulation.

Primary Presenter: Peter Boxley

Project Title: Prostate Cancer Central Nervous System Metastasis in a Contemporary Cohort

Primary Mentor: Thomas Flaig

Secondary Mentor(s):

Thematic Area: Clinical Science

Abstract:

Introduction: Central nervous system (CNS) metastasis from prostate cancer (PCA) is a rare event, but one with significant prognostic impact for those affected. There are limited data on its impact in contemporary cohorts treated with modern agents.

Patients and methods: A retrospective institutional review was performed to characterize the occurrence/outcome of PCA CNS metastasis on all cases of PCA from 2011 to 2017. A manual chart review was performed to confirm PCA CNS metastases in all cases identified through a diagnostic code screening of the health data.

Results: A total of 6596 cases of PCA were identified, with 29 (20 dural and 9 intraparenchymal) confirmed cases of CNS metastases from PCA. The median survival from the time of diagnosis of CNS metastasis was 2.6 months (95% confidence interval, 2.04-10.78 months) and 5.41 months (95% confidence interval, 3.03 months to not reached) for dural and parenchymal metastases, respectively. Among those who developed CNS metastases, approximately 79% of patients had prior exposure to abiraterone and/or enzalutamide, of whom 50% had ‰¥ 6 months of exposure. Four (0.07%) of the 5841 patients developed CNS metastases prior to the initiation of therapy or on androgen deprivation therapy alone. In contrast, 24 (8.6%) of the 279 patients with 2 or more lines of medical therapy developed CNS metastases.

Conclusions: Our analysis highlights the continued poor prognosis of parenchymal and dural CNS metastases from PCA. CNS metastases in PCA remain a rare event with a 0.4% incidence in this series, but this incidence is considerably increased in patients who receive medical therapy beyond first-line androgen deprivation therapy.

Primary Presenter: Rachel Murphy

Project Title: Overcoming COVID-19 vaccine disparities among disadvantaged older adults

Primary Mentor: Sarah Tietz

Secondary Mentor(s):

Thematic Area: Public Health and Epidemiology

Abstract:

When the COVID-19 vaccination roll-out began at UCHealth in January 2021, patients were offered vaccination scheduling via online portals. They received an invitation for scheduling by lottery, and invitations expired after 48 hours. Despite well-intentioned equal opportunity via this method, the process was not equitable, particularly for older adults with lack of access to technology or limited English proficiency. To address these inequities, we rapidly deployed a patient-centered approach through student outreach. Thirty-two students from the School of Medicine, Nursing, and Pharmacy at University of Colorado donated over 500 hours to call 2,263 patients to offer COVID-19 vaccination. Over the course of 3 months, the expected growth of vaccination proportion per day was significantly greater in all subgroups targeted by students. Vaccination proportion for individuals with limited English proficiency grew 1.035 [95% CI: (1.029, 1.042)] times faster per day than patients proficient in English; vaccination proportion among persons of color grew 1.012 (1.009, 1.015) times faster per day than white patients; and patients without portal access had a faster vaccination proportion growth per day than those with portal access, 1.038 (1.031, 1.045). This outreach project is a successful example of a person-centered approach led by students to overcome health inequities in vaccine access. With the recommendation for COVID-19 booster vaccinations, we advocate for overcoming systems that may unintentionally cause gaps in vaccination proportions among vulnerable groups.

Primary Presenter: Becca Fuhlbrigge

Project Title: Correlation between A1c and Continuous Glucose Monitor Time in Range in a Cohort of Pediatric Patients with Type 1 Diabetes

Primary Mentor: Todd Alonso

Secondary Mentor(s):

Thematic Area: Clinical Science

Abstract:

Hemoglobin A1c (A1c) is the standard of care for evaluating glycemic control in patients with type 1 diabetes. As diabetes technology improves and becomes more accessible, patients and providers are also using other metrics such as time in range, provided by continuous glucose monitoring (CGM) systems. Time in range correlates with A1c in adult patients, but there are few published data in pediatric patients. We evaluated the association between A1c and time in range, as well as the influence of age, duration since diagnosis, and DKA at diagnosis in a large pediatric cohort.

We evaluated patients who were seen at the Barbara Davis Center for Diabetes between January 2018 and December 2020, who were <22 years old, and who used CGM at least 70% of the time (n=1952).

There was a linear correlation between A1c and time in range, and the correlation coefficient was comparable to previous studies in adult patients. For each 1% increase in A1c, CGM TIR decreased by 10.6%. There was no statistically significant difference when correcting for age, duration of diabetes, or DKA at diagnosis. Time in range reliably correlates with A1c in pediatric patients with type 1 diabetes.

Primary Presenter: Reilly Quist

Project Title: ADHD Education in Medical School

Primary Mentor: Christine Waasdorp Hurtado

Secondary Mentor(s):

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

Background: It has previously been demonstrated that both residents and attending physicians have deficiencies in knowledge and comfort in diagnosing and treating ADHD. One of the contributing etiologies of this deficit is the lack of behavioral health training/rotations in residency programs given their emphasis on inpatient and critical care training.

Objective: To determine if this deficit is evident at the medical student level and if so, work to address the knowledge gap through the first PDSA cycle of a quality improvement project. Methods: Third year medical students in the University of Colorado School of Medicine Colorado Springs Branch were recruited and given pre-session surveys addressing both attitudes and knowledge of ADHD. They then participated in a didactic course consisting of both remote pre-session work and a live virtual didactic session followed by a post-session survey.

Results: Initial survey results confirmed gaps in student knowledge of ADHD and low comfort level in diagnosing and treating ADHD. Following the intervention there was a small yet significant improvement in both perceived comfort and knowledge with ADHD as well as objective knowledge of ADHD measured with multiple choice and true/false questions at a $p < 0.05$.

Conclusions: This study showed the need for increased training in pediatric mental health conditions including ADHD beginning at the medical school level. It showed that a flipped classroom style didactic session addressing this deficit was both well received by students and worked to improve student knowledge and comfort with treating and diagnosing ADHD.

Primary Presenter: Robert Foster

Project Title: Developing an Advanced Sciences Module on Inflammation, Obesity and Metabolic Syndrome for the University of Colorado School of Medicine Trek Curriculum

Primary Mentor: Aimee Bernard

Secondary Mentor(s):

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

BACKGROUND: The ability to intertwine basic science knowledge with clinical disease is essential to the practice of medicine. Providers who understand both the foundational and clinical science that underlie disease processes and therapeutic interventions are best positioned to provide optimal care as it evolves throughout their careers. In this module, the concepts of biochemistry and immunology are introduced alongside the clinical experience to enhance learning and decrease the stigma associated with obesity.

OBJECTIVES: To design an introduction to the non-behavioral etiology of obesity and metabolic disease to reduce provider bias, improve the quality of care for patients with obesity, and highlight future research needs concerning our understanding and treatment of metabolic disease. To add clinical relevance to the module a fictionalized case study of a patient with insulin resistance and other features of metabolic syndrome was introduced at the beginning and followed throughout the module as related to clinical presentation, diagnosis, treatment options, and outcomes.

METHODS: A literature review was conducted to include high-quality systematic reviews, randomized controlled trials, and case-cohort studies. Searches were conducted through Pubmed with cross reference to primary sources. Controversial or unsettled claims were excluded from the aggregated teaching materials. An example of an unsettled topic is highlighted by competing claims as to the source phylum of inflammatory inducers versus suppressors within the gut. A pilot of the module was delivered on November 18, 2021, after coordination with the Departments of Immunology and Endocrinology at the University of Colorado School of Medicine. A pre/post survey was administered to participants to assess levels of confidence related to module learning objectives.

RESULTS: The module provides an overview of inflammation, obesity, and metabolic syndrome through examining the underlying basic science of inflammatory mechanisms, cellular components, and molecular signaling. The discussion further integrates advanced topics including inflammation and the gut, dietary effects on gut microbiota, inflammatory markers of obesity and metabolic syndrome, inflammation in insulin-sensitive tissues, and anti-inflammatory therapeutics in the treatment of insulin resistance.

Results of the pre-post survey indicate that participants confidence increased describing the pathophysiology of inflammation in the context of metabolic syndrome. Furthermore, respondents more confidently identified clinical and pharmacological research opportunities surrounding inflammation and metabolic syndrome.

DISCUSSION: To improve the care of patients with obesity and alter the underlying provider bias that inhibits proper care of these individuals, it is important to incorporate education for future providers that explores the non-behavioral drivers of obesity and metabolic disease. Given the growing body of evidence alluding to the multifactorial etiology of metabolic disease, the role of inflammation in the context of obesity and metabolic syndrome is an area of physiology that requires attention by those involved in teaching future physicians. Using an evidence-based approach to adult education, we can increase the confidence of future providers to treat patient with metabolic syndrome.

Primary Presenter: Ronald Truong

Project Title: Choledochoduodensotmy is a safe alternative to choledochojejunostomy for biliary reconstruction in liver transplantation.

Primary Mentor: Trevor Nydam

Secondary Mentor(s): Hunter Moore

Thematic Area: Clinical Science

Abstract:

Introduction: Choledochocholedochostomy (duct-to-duct, D2D) is the standard biliary reconstruction in liver transplantation. When D2D is contraindicated or not possible, a choledochojejunostomy (CDJ) is traditionally used. CDJ has associated complications such as post-operative cholangitis, strictures, and difficult endoscopic biliary access. Choledochoduodenstomy (CDD) is an alternative to Roux-en-Y reconstruction that has a simple exposure, does not require a jejunojejunostomy, and provides easier postoperative endoscopic biliary access. However, concerns for higher rates of cholangitis and other complications persist with CDD. We previously reported initial results using CDD in liver transplantation. The objective of this study was to evaluate a larger, 10-year, experience of the different biliary reconstruction techniques at our center. We hypothesized that CDD has comparable complication rates to D2D and CDJ reconstructions.

Methods: Retrospective review was conducted from September 2011 to March 2020 on patients that underwent liver transplantation at our center. Patients were categorized by their biliary reconstruction. The primary outcome of interest was the rate of cholangitis. Secondary outcomes included utilization of ERCP in post-operative setting, post-ERCP complications, and biliary strictures. Outcomes were adjusted based on severity of recipient liver disease (MELD score) and type of donor (living versus cadaveric) and included in a regression analysis.

Results: 590 patients were included in the analysis. The median MELD 27 with 36% of recipients being female, and 16% receiving living donors. Within the cohort, 328 recipients received liver transplant with D2D reconstruction while 189 and 73 recipients received a CDD or CDJ anastomosis, respectively. The rate of cholangitis was significantly higher in CDJ compared to D2D and CDD (34% vs 21% vs 21%, p=0.042), respectively. When controlling for MELD and graft type, CDJ had a OR of 2.5 for developing cholangitis (p=0.005) compared to D2D and no increased risk was associated with CDD (p=0.738) compared to D2D. ERCP rates were comparable between groups, but endoscopic complication rates were higher in the D2D group (21% vs 9.6% CDJ, vs 13.2% CDD p=0.014). However, in regression analysis, MELD score and graft type were significant for complication rates, not biliary reconstruction. Biliary strictures were higher in the CDJ group 38% vs D2D 14% vs CDD 19%, p<0.001), which persisted as a significant risk factor after controlling for MELD and graft type (OR 2.2 p=0.021) but no increased risk in CDD to D2D (p=0.438).

Conclusion: CDD has lower rates of cholangitis and stricturing compared to CDJ. CDD has lower rates of endoscopic complications compared to D2D. CDD continues to be a safe alternative to CDJ biliary reconstruction when traditional D2D anastomosis cannot be performed.

Primary Presenter: Rosa Malloy Post

Project Title: Perioperative Clerkship Design for Students with Physical Disabilities: A Model for Implementation

Primary Mentor: Teresa Jones

Secondary Mentor(s):

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

OBJECTIVE: Disability inclusion is an important and growing area of focus for medical education that may be stymied by stereotypes about disabilities, lack of knowledge about accommodations for students with physical disabilities, or outdated technical standards that preclude participation of people with mobility disabilities. To support the inclusion of students with physical disability in surgical clerkships, we describe a proactive, progressive approach to the accommodations process for a student with a thoracic spinal cord injury entering a surgical clerkship.

DESIGN: Working proactively, medical school leadership, disability professionals and the clerkship team collaborated on the development of reasonable accommodations for a student with a thoracic spinal cord injury entering a surgical clerkship.

SETTING: University of Colorado, Department of Surgery and Department of Medical Education, Aurora, CO.

PARTICIPANTS: A third-year medical student and faculty from the medical school and surgical clerkship leaders.

RESULTS: An M3 student with a thoracic spinal cord injury successfully completed an eightweek surgical clerkship completing all required procedural and clinical skills utilizing reasonable accommodation. The student achieved a grade of honors for the rotation.

CONCLUSION: Early communication and planning for disability-related adjustments are critical to ensure an accessible experience for students with physical disabilities. The addition of a student with a disability adds to a better understanding of inclusive practices for surgical education and.

Primary Presenter: Roxana Tabrizi

Project Title: Sharp Recanalization with the Upstream GoBack Catheter for Chronic Occlusive Ilio-Caval Thrombosis

Primary Mentor: Donald Jacobs

Secondary Mentor(s):

Thematic Area: Clinical Science

Abstract:

Recanalization of chronic iliofemoral deep vein thrombosis is indicated to reduce symptoms and improve quality of life. However, recanalization is dependent on the ability to cross chronic obstructions. We present a case of chronically thrombosed inferior vena cava and common iliac veins that failed conventional crossing techniques but were successfully recanalized using the recently approved Upstream GoBack Crossing Catheter.

Primary Presenter: Ryan Calkins

Project Title: Successful Conservative Management of Kienbock's Disease in a 7-year-old: A Case Report

Primary Mentor: Frank Scott

Secondary Mentor(s):

Thematic Area: Clinical Science

Abstract:

* Case: We present the case of a 7-year-old female with two months of atraumatic right wrist pain who was found to have edematous signal change within the lunate on wrist MRI consistent with Kienbock's disease. She was treated with rigid immobilization for 12 weeks and transitioned to a custom orthotic splint for another 3 months during activities. At her 6-month follow-up, she reported minimal wrist pain with repeat MRI demonstrating resolution of lunate edema.

* Conclusion: We report a case of Lichtman stage I Kienbock's disease successfully treated with conservative management resulting in clinical and imaging resolution.

Primary Presenter: Ryan Ward

Project Title: Nervus Intermedius Outcomes after Vestibular Schwannoma Surgery and Radiosurgery: A Single Institution Experience

Primary Mentor: A. Samy Youssef

Secondary Mentor(s):

Thematic Area: Clinical Science

Abstract:

Objective: Nervus intermedius outcomes are under reported in the management of vestibular schwannoma (VS) and are experienced by patients undergoing stereotactic radiosurgery and surgical resection. We present our NI outcomes in our series of patients that have undergone all treatment modalities for vestibular schwannoma and a review of the existing literature.

Methods: We performed a retrospective review of all patients with VS who were treated at our institution between January 1, 2008 and December 31, 2018. Demographic data were collected, in addition to tumor size, Koos grade, treatment modality, extent of resection (EOR), postoperative facial nerve function and hearing function. NI outcomes were determined from phone interview using a pre-existing functional questionnaire.

Results: 222 patients were reviewed and a total of 98 patients responded to the questionnaire. Patients were stratified into three groups: Group 1 included 54 patients who underwent radiation, Group 2 with 27 patients who underwent surgical treatment, and Group 3 with 17 patients who underwent both radiation and surgery. Twenty-eight percent of patients presented with pre-operative NI dysfunction; most commonly dry eye followed by taste dysfunction and dysfunction with lacrimation. Following treatment, 79% of patients experienced NI dysfunction most commonly dry eye. Statistical differences in dry eye and taste were observed when comparing the treatment groups.

Conclusion: NI dysfunction is common following treatment for VS. NI dysfunction should be included in patients' pretreatment counseling as it may impact treatment choice and quality of life. Additional studies are warranted to fully characterize NI dysfunction after treatment.

Primary Presenter: Sabrina Nesladek

Project Title: Food Education and Environmental Development Aurora: Lessons Learned in Community Organizing through the Lens of a Food Intervention Program

Primary Mentor: Joseph Johnson

Secondary Mentor(s):

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

Aurora, Colorado has been a long-standing target area for community organizing efforts due to its high proportion of very low income, immigrant, and undocumented communities. The adult population faces disproportionately high rates of diabetes, hypertension, and obesity while the pediatric population faces high rates of childhood obesity and asthma compared to those living in more affluent cities of the Denver-metro area. For this reason, numerous community organizations are working to address the social determinants of health that are contributing to these poor health outcomes. Food Education and Environmental Development (FEED) Aurora is one such program. Created in 2016, the overarching goal of FEED Aurora is to improve eating attitudes and behaviors of food insecure or at-risk populations through a dual gardening and nutrition education program. Several iterations of the program have approached this goal in different ways with the most recent 2021 program year focusing on the entire family. Through education of adults around the importance of healthy eating, giving them the skills to increase the availability of fresh produce, and exposing entire families to more nutritious meals, FEED aimed to affect the food environment and thus health of entire households. Despite evidence-based program design, sufficient funding, a diverse group of volunteers, and strong community partnerships, FEED 2021 only had one of five recruited families able to engage in the programming. This paper reviews recent changes to the program, observations of FEED leaders, and survey data from community stakeholders to determine weaknesses in the current program schema and how to improve our outreach to the community moving forward.

Primary Presenter: Samuel Payne

Project Title: CREATIVITY IN MEDICAL SCHOOL €" A LOOK AT THE ROLE OF CREATIVE WRITING IN MEDICAL EDUCATION

Primary Mentor: Tess Jones

Secondary Mentor(s):

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

Jay Baruch writes that an education in creative writing contributes to the success of a health care provider. This study seeks to explore the impact of creative writing on undergraduate medical education. Methods include a lit review of articles exploring creativity in medical education and personal publication of creative nonfiction and fiction pieces. Lit review has elucidated a need for health humanities programs throughout the nation as a means to educate empathy in medical students. However, it has also highlighted large barriers to requiring humanities programs in medical school including time constraints and lack of tangible competencies instilled by this material. Publication of my personal essay Gratitude in Intima's Journal of Narrative Medicine 2020 Spring Edition compliments the lit review. The results of this study will be further extrapolated to an impact of creativity in medical school. In their article on ambiguity in medicine, Vera Luther proposes that providers more resistant to uncertainty in medicine experience burnout to a greater degree. While this project focuses primarily on personal experience, the knowledge gained from the lit review will be used to reflect on this creative process' impact on medical school education as a whole. These reflections will contribute to the growing body of evidence for health and humanities benefits in medical education.

Primary Presenter: Samantha Conner

Project Title: Patients' Self-Reported Outcomes after Engagement in a Women's Integrative Pelvic Health Program

Primary Mentor: Kathryn Witzeman

Secondary Mentor(s):

Thematic Area: Clinical Science

Abstract:

Chronic pelvic pain is a common condition seen in medicine. Research has looked into risk factors, medical and surgical outcomes, and impact on quality of life. However, there is a gap when looking at integrative, holistic treatment programs. This study seeks to examine patients' beliefs about their condition after engagement in an integrative pelvic health program. Using a six month time frame, patients were sent a survey examining four aspects that the program seeks to address. The goal of this study is to have patients' perspectives drive the creation or modification of pelvic pain treatment plans.

Primary Presenter: Samuel Altman

Project Title: Assessing the Benefit to Students From the Patient Companion Program Design

Primary Mentor: Janna Hardland

Secondary Mentor(s):

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

Background: Patients are often encouraged to bring companions like a spouse, significant other, or friend to their medical visits to provide a variety of supportive functions and elderly patients with multiple health issues are more likely to bring a companion. Companions have shown a variety of benefits for patients at medical visits ranging from increased understanding of their physician's advice to increased patient involvement. It stands to reason companions could also be beneficial for patients in long term care facilities who have unique risk factors for social isolation. The Patient Companionship Program (PCP) seeks to partner undergraduate and post-graduate students from Colorado universities with patients from the Veteran Community Living Center at Fitzsimmons and assess the impact of this patient companionship model on both the veteran patients and student volunteers.

Additionally, the program serves as clinical experience for students pursuing careers in healthcare and a service to veteran patients in long term care who are at risk of feeling isolated, developing or worsening mood disorders, and experiencing a large burden of illness and healthcare utilization (1, 2). Students gain experience communicating with older adults, often chronically ill, and practice goal setting, visit navigation, and providing companionship.

The program's first cohort of student volunteers completed their involvement in 2019 and participated in a focus group to facilitate improvements in the program design and generate future research avenues. The second cohort is scheduled to complete their involvement in 2022.

Objectives: The primary objective is to provide meaningful volunteer opportunities to pre-health students while benefitting their patient companions living in the Colorado state veteran's home. The secondary objective is to assess volunteer feedback regarding the program to improve upon the design and generate future avenues of research for the PCP.

Methods: Student volunteers applied for positions as patient companions with requirements to visit their patients at least once per month, log their patient interactions, attend monthly meetings with staff, and participate in a focus group at the end of their two-year obligation. Orientation for the program included lectures on patient confidentiality, recognizing medical emergencies and how to report them, the purpose of the program, and evaluation methods for the program and student participants. To gather information regarding the feasibility of the Patient companionship Program, collect feedback from our student volunteers about strengths and weaknesses of the current design, assess the program's ability to provide meaningful clinical experiences for the

student volunteers, and to generate ideas for future research avenues, an audio recorded focus group session was conducted with the student volunteers from the first cohort. The focus group was conducted using a templated discussion format found in appendix A.

Results: A transcript of the focus group is documented in appendix B. Strengths of the program included: student volunteers felt valuable to their patient when attending medical visits with them and helping their patient understand the medical care they received, student volunteers derived value from setting goals with their patient and helping them achieve several of those goals, student volunteers enjoyed and learned from the lectures given during their two year obligation, student volunteers derived value from learning and utilizing motivational interviewing techniques with their patients, and student volunteers derived value from interacting with elderly patients in long term care facilities and identified disparities in our healthcare system.

Weaknesses of the program included: lack of clearly defined staff roles which caused delays in communication and action, changes in program design and goals were not effectively communicated to student volunteers, student volunteers wished to have more direction from staff to direct volunteer interactions with their patients toward the program goals, and lack of data and measurable effect of student volunteers on patients.

Ideas to improve the program design and future research avenues included: creating ways to measure companion impact on patients (depression scores, satisfaction scores, changes in outlook, improvements in health, and improvements in health literacy were discussed), tailoring lectures to student interests and goals they set with their patients, formal lectures or seminars related to helping students with their healthcare career ambitions (assistance with applications was discussed).

Conclusions and Next Steps: The feedback received from the focus group conducted with the first cohort of student volunteers indicated students found the program provides avenues for meaningful clinical experiences. Student volunteers discussed examples of attending important life events with their patients, setting goals with their patients, and using motivational interviewing to help their patients achieve those goals as some of the experiences that were most meaningful.

The focus group also elucidated strengths and weaknesses of the current program design and the dialogue generated many ideas for ways the PCP leadership can improve upon the design. PCP leadership worked to implement changes to the program consistent with the feedback received from cohort one such as tailoring lecture topics to student interests and clarifying both staff roles and the goals of the PCP.

Assessing the ability of the program to impact students' views of our healthcare system, long term care facilities, geriatric healthcare, and veteran healthcare are potential next steps to be conducted with formal surveys. Additionally, formal surveys to assess the impact of student companions on outlook, mood, and understanding of healthcare decisions are potential next steps to be conducted with our veteran patients. At this time, IRB approval has not been sought for surveys. No data has been claimed to be generalizable. A focus group will be conducted with the

second cohort of student volunteers using the same format to evaluate the same end points discussed in this paper. Using information gathered from these focus groups we aim to improve the program design and generate a hypothesis to be assessed using surveys with future cohorts.

Primary Presenter: Samuel Maltby

Project Title: Development and Validation of a New Clinical Assay: T cell Proliferation with PHA Mitogen Stimulation Detected by Flow Cytometry

Primary Mentor: Vijaya Knight

Secondary Mentor(s):

Thematic Area: Clinical Science

Abstract:

Clinical decision making is often guided by lab results. As knowledge of diseases and disease processes have expanded, so too has the need for changes in our clinical laboratory assays. One example where considerable progress in diagnostics has been made is for Severe Combined Immunodeficiency (SCID), now known to be a collection of adaptive immunodeficiencies with many gene variants and various clinical presentations. SCID is screened for in the US via the newborn screening process, and then confirmed with additional laboratory testing, including analysis of peripheral blood lymphocytes and the lymphocyte stimulation assay (LSTIM). While the LSTIM has been used for many years, it has limitations both from a laboratory standpoint and clinical application standpoint. As the knowledge of SCID has grown, the same assay has been used in confirmatory testing panels, without incorporating a renewed understanding of what the test measures. A new assay based upon the same principles of lymphocyte proliferation as a marker of a functioning immune system using flow cytometry allows for more specific information to be obtained in terms of T-cell proliferation that can help guide clinical decision making. This paper will demonstrate the need for an updated assay and its applications as well as demonstrate good laboratory practices in validating a new clinical assay.

Primary Presenter: Sanaa Ahmad

Project Title: The Efficacy and Impact of Health Career Exploration and Guidance Programs on Diversity and Equity in the Healthcare Workforce

Primary Mentor: Matthew Hess

Secondary Mentor(s):

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

Programs that expose high school students to healthcare careers and medical opportunities are widely implemented. These programs provide students guidance for academic courses, standardized test-taking, research opportunities, and career development. The objective of this study is to estimate the proportion of healthcare professionals that benefit from these programs. We assessed this by surveying current graduate students in healthcare doctoral/advanced practice degree programs. We hypothesized that at least 20% of the health professional students surveyed utilized these programs at least once. We also assessed survey data to examine the efficacy and equity of these programs and hypothesized that they disproportionately advantage students based on factors of socioeconomic status, race, and resource availability. Of 136 respondents, 44% stated that they had participated in a health career guidance program, 93% of whom stated it was influential in their ability to successfully pursue their career. At the time of their participation in these opportunities, 65% of respondents reported living in urban settings vs. 35% in rural settings. 62% of the rural locations were designated as medically underserved vs. only 21% of the urban locations. Lastly, white students were overrepresented in the group, making up 68% of the respondents who participated in a career guidance program. We aim to further study these programs' curriculum and methods so that we can compile a comprehensive guide to implementing an effective and equitable health career guidance program.

Primary Presenter: Sanjana Bukkapatnam

Project Title: The effects of ephrinB2 signaling on proliferation and invasion in glioblastoma multiforme

Primary Mentor: Sana Karam

Secondary Mentor(s):

Thematic Area: Basic Biomedical Science

Abstract:

The aggressive nature of glioblastoma multiforme (GBM) may be attributed to the dysregulation of pathways driving both proliferation and invasion. EphrinB2, a membrane-bound ligand for some of the Eph receptors, has emerged as a critical target regulating these pathways. In this study, we investigated the role of ephrinB2 in regulating proliferation and invasion in GBM using intracranial and subcutaneous xenograft models. The Cancer Genome Atlas analysis suggested high transcript and low methylation levels of ephrinB2 as poor prognostic indicators in GBM, consistent with its role as an oncogene. EphrinB2 knockdown, however, increased tumor growth, an effect that was reversed by ephrinB2 Fc protein. This was associated with EphB4 receptor activation, consistent with the data showing a significant decrease in tumor growth with ephrinB2 overexpression. Mechanistic analyses showed that ephrinB2 knockdown has anti-invasive but pro-proliferative effects in GBM. EphB4 stimulation following ephrinB2 Fc treatment in ephrinB2 knockdown tumors was shown to impart strong anti-proliferative and anti-invasive effects, which correlated with decrease in PCNA, p-ERK, vimentin, Snail, Fak, and increase in the E-cadherin levels. Overall, our study suggests that ephrinB2 cannot be used as a sole therapeutic target. Concomitant inhibition of ephrinB2 signaling with EphB4 activation is required to achieve maximal therapeutic benefit in GBM.

Primary Presenter: Saori Haigo

Project Title: Gold Tokens of Humanity: Using visual memoirs to reconnect and heal the heart of healthcare during the COVID-19 pandemic

Primary Mentor: Steven Lowenstein

Secondary Mentor(s):

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

The COVID-19 pandemic has taken a negative toll on patient well-being with increasing social isolation during hospitalizations due to infectious disease containment protocols. For example, daily visitor restrictions have contributed to increased distress to patients and families. Likewise, the COVID-19 pandemic has taken a toll on the healthcare workforce, leading to PTSD, compassion fatigue, and burnout among medical providers and non-clinical staff. The Gold Tokens of Humanity is a new, multi-year initiative started by the CUSOM Gold Humanism Honor Society enabling medical students to provide social visits to patients identified by the primary medical teams to get to know the person and family beyond the patient, and if the moment feels right, create HIPAA compliant visual tokens. These Gold Tokens come in the form of photographs, drawings, and paintings that represent the core value(s) of our patients and are created at bedside through the use of portable photo printers. Gold Tokens aim to reaffirm our common humanity, promote healing of patients by getting to know them as people, not simply their myriad illnesses, and to unify our student body through narrative medicine. Through our activities, we hope Gold Tokens will rejuvenate the heart of healthcare by reinforcing the values that recruited us into this profession.

Primary Presenter: Sarah Hirner

Project Title: Potential solutions for screening, triage, and severity scoring of suspected COVID-19 positive patients in low-resource settings: a scoping review

Primary Mentor: Corey Bills

Secondary Mentor(s):

Thematic Area: Global Health

Abstract:

Objectives: Purposefully designed and validated screening, triage, and severity scoring tools are needed to reduce mortality of COVID-19 in low-resource settings (LRS). This review aimed to identify currently proposed and/or implemented methods of screening, triaging, and severity scoring of patients with suspected COVID-19 on initial presentation to the healthcare system and to evaluate the utility of these tools in LRS.

Design: A scoping review was conducted to identify studies describing acute screening, triage, and severity scoring of patients with suspected COVID-19 published between 12 December 2019 and 1 April 2021. Extracted information included clinical features, use of laboratory and imaging studies, and relevant tool validation data.

Participant: The initial search strategy yielded 15 232 articles; 124 met inclusion criteria.

Results: Most studies were from China (n=41, 33.1%) or the United States (n=23, 18.5%). In total, 57 screening, 23 triage, and 54 severity scoring tools were described. A total of 51 toolsˆ'31 screening, 5 triage, and 15 severity scoring€"were identified as feasible for use in LRS. A total of 37 studies provided validation data: 4 prospective and 33 retrospective, with none from low-income and lower middle-income countries.

Conclusions: This study identified a number of screening, triage, and severity scoring tools implemented and proposed for patients with suspected COVID-19. No tools were specifically designed and validated in LRS. Tools specific to resource limited contexts is crucial to reducing mortality in the current pandemic.

Primary Presenter: Scott Stuart

Project Title: "Intermittent Treatment of BRAFV600E Melanoma Cells Delays Resistance by Adaptive Resensitization to Drug Rechallenge"

Primary Mentor: Leanna May

Secondary Mentor(s): Natalie Ahn at University of Colorado, Boulder

Thematic Area: Basic Biomedical Science

Abstract:

Melanoma patients receiving drugs targeting BRAFV600E and MEK1/2 invariably develop resistance and continue progression. Based on preclinical studies, intermittent treatment involving alternating periods of drug withdrawal and rechallenge has been proposed as a method to delay the onset of resistance. The beneficial effect of intermittent treatment has been attributed to drug addiction, where drug withdrawal reduces the viability of resistant cells due to MAP kinase pathway hyperactivation. However, the mechanistic basis of the intermittent effect is incompletely understood. We show that intermittent treatment with the BRAFV600E inhibitor, LGX818/encorafenib, suppresses growth compared to continuous treatment in human melanoma cells engineered to express BRAFV600E, p61-BRAFV600E, or MEK2C125 oncogenes. Analysis of the BRAFV600E-overexpressing cells shows that, while drug addiction clearly occurs, it fails to account for the advantageous effect of intermittent treatment. Instead, growth suppression is best explained by resensitization during periods of drug removal, followed by cell death after drug readdition. Continuous treatment leads to transcriptional responses prominently associated with chemoresistance in melanoma. By contrast, cells treated intermittently reveal a subset of transcripts that reverse expression between successive cycles of drug removal and rechallenge, and include mediators of cell invasiveness and the epithelial to mesenchymal transition. These transcripts change during periods of drug removal by adaptive switching, rather than selection pressure. Resensitization occurs against a background of sustained expression of melanoma resistance genes, producing a transcriptome distinct from that of the initial drug-naïve cell state. We conclude that phenotypic plasticity leading to drug resensitization can underlie the beneficial effect of intermittent treatment.

Primary Presenter: Sofia Simina

Project Title: The Effects of Marijuana Use During Pregnancy on Fetal Growth Outcomes

Primary Mentor: Heather Straub

Secondary Mentor(s):

Thematic Area: Clinical Science

Abstract:

Introduction: The aim of this study is to investigate fetal growth parameters and neonatal outcomes in babies born to mothers using marijuana during pregnancy.

Methods: Women with a positive urine drug screen for marijuana in pregnancy during even years between January 2012 and December 2018 were included. Women were excluded if they were <18 years old at conception, had multiple gestations, had no delivery data, or no 16€"23-week ultrasound data. Fetal ultrasound biometrics were noted if they were <10% for gestational age. A nuchal fold measurement ‰¥6 mm was considered abnormal. COMIRB approved study (IRB #: 19-1021)

Results: The analysis included 211 women. Most were non-Hispanic White (59%), nulliparous (40%), had public insurance (85%), and self-reported marijuana use in pregnancy (61%). The average maternal age at time of delivery was 26 years ±4.8 years. Few ultrasound parameters measured <10% for gestational age with the following frequencies: biparietal diameter (27%), humerus length (19%), head circumference (5%), femur length and abdominal circumference (3%). 4% had NSF ‰¥6 mm. The median gestational age at delivery was 38 weeks 6 days ±3 weeks 6 days. The median birth weight was 2890 grams±768. Among neonates, 22% required oxygen and 25% were admitted to the NICU. Of the neonates tested for illicit substances, 67% were positive for marijuana.

Conclusion: Marijuana use in pregnancy does not appear to affect second trimester biometric parameters but may affect neonatal outcomes. Selection of matched controls is planned to further investigate these findings.

Primary Presenter: Solana Archuleta

Project Title: Increased mortality associated with uncontrolled diabetes mellitus in patients with pulmonary cryptococcosis: a single US cohort study

Primary Mentor: Andres Henao-Martinez

Secondary Mentor(s):

Thematic Area: Clinical Science

Abstract:

Background: Diabetes mellitus is an established risk factor for bacterial infections, but its role in cryptococcosis is unclear. The study aimed to determine whether uncontrolled diabetes (HbA1c >7%) was an independent risk factor for mortality in cryptococcosis.

Methods: A retrospective case€"control study partially matched by age and gender was performed in patients tested for Cryptococcus infection at the University of Colorado Hospital from 2000 to 2019. A multivariable logistic regression model was used to identify mortality predictors. Cox proportional hazard model was used for survival analysis.

Results: We identified 96 cases of cryptococcosis and 125 controls. Among cases, cryptococcal meningitis (49.0%) and pneumonia (36.5%) constituted most infections. Cases with pulmonary cryptococcosis with uncontrolled diabetes had a higher mortality at 10 weeks (50% versus 7%, p = 0.006) and 1 year (66.7% versus 13.8%, p = 0.005) compared to pulmonary cases with controlled or no diabetes. Unadjusted Cox proportional hazard model found an increased

rate of death for uncontrolled diabetes at 10 weeks [hazard ratio 8.4, confidence interval (CI): 1.4€"50.8, p = 0.02] and 1 year (hazard ratio 7.0, CI: 1.7€"28.4, p = 0.007) among pulmonary cryptococcosis cases. Multivariable analysis showed a significantly increased odds of 10

weeks [odds ratio (OR) = 4.3, CI: 1.1€"16.5, p = 0.035] and 1 year (OR = 5.0, CI: 1.4€"18.3, p = 0.014) mortality for uncontrolled diabetes among pulmonary cryptococcosis cases. After adjustment for gender, age, and case/control, for every 1% increase in HbA1c levels, the odds of pulmonary cryptococcosis mortality at 1 year increased by 11% (OR = 1.6, CI 95%: 1.1€"2.3, p = 0.006).

Conclusion: Uncontrolled diabetes is associated with worse outcomes in pulmonary cryptococcosis, including a 4-fold and 6-fold increased odds of death at 10 weeks and 1 year, respectively. Glucose control interventions should be explored to improve clinical outcomes in patients with pulmonary cryptococcosis.

Primary Presenter: Sophia Wolfe

Project Title: Discontinuation of Tumor Necrosis Factor Inhibitors in Psoriasis and Psoriatic Arthritis

Primary Mentor: Liron Caplan

Secondary Mentor(s):

Thematic Area: Clinical Science

Abstract:

Tumor necrosis factor inhibitors (TNFi) are first-line agents for the treatment of moderate to severe psoriasis and psoriatic arthritis. However, current research describing TNFi discontinuation rates is inconsistent and incomplete. This study examined characteristics associated with discontinuation and response to TNFi, as well as reasons for TNFi discontinuation. United States veterans enrolled in the Program to Understand the Longterm Outcomes in Spondyloarthritis from 2007 €" 2017 who 1) were diagnosed with psoriasis or psoriatic arthritis and 2) had been treated with a TNFi were included in the study. Stata was used to conduct time-to-event and multivariate analyses. The study included 320 individuals with 927 TNFi courses. The mean age was 55.4 years, and 83.8% of the cohort continued at least one TNFi course at one year. Tumor necrosis factor inhibitor course order (HR 1.100, p<0.001) was significantly correlated with increased discontinuation of a TNFi. Infliximab had a lower discontinuation rate than adalimumab (HR 2.678, p<0.001), etanercept (HR 2.667, p<0.001), golimumab (HR 2.405, p=0.001), and certolizumab (HR 3.097, p<0.001). The most frequently reported reason for discontinuing TNFi treatment was secondary failure (32.7%), defined as a loss of prior efficacy after >6 months of treatment.

Primary Presenter: Spencer Knierim

Project Title: Helicopter Versus Ground Emergency Medical Services: A Scoping Review

Primary Mentor: Mark Deutchman

Secondary Mentor(s):

Thematic Area: Public Health and Epidemiology

Abstract:

Purpose: Efforts to identify which patients benefit most from Helicopter Emergency Services (HEMS) activation can help guide clinical decisions around employing this costly and often risky resource. This scoping review seeks to critically assess and identify trends in survival outcomes data comparing (HEMS) vs ground emergency transport services (GEMS) transport directly from trauma scene to definitive care.

Methods: Pubmed was the primary database used for this review. Database search was conducted by a matrix approach utilizing MeSH search terms as well as general keyword search criteria. Included studies were published in 2010 or later and directly compared survival in HEMS and GEMS trauma transports from scene. Studies were evaluated by 2 independent reviewers to ensure inclusion criteria were met.

Results: Forty studies were included for review. HEMS and GEMS survival outcomes were compared based on patient physiologic criteria, injury type, injury severity, and patient age.

Conclusions: While HEMS activation is associated with worse trauma survival overall, a survival benefit is revealed when patient and injury characteristics are controlled for. Several studies have demonstrated that patients with unstable vital signs on scene and those with traumatic brain injuries benefit most from HEMS activation. The existing body of literature regarding HEMS vs GEMS is of poor quality and further study is needed to elucidate specific factors that lead to the possible survival benefit of HEMS.

Primary Presenter: Stephanie Cung

Project Title: In-vivo skeletal muscle mitochondrial function in Klinefelter syndrome

Primary Mentor: Shanlee Davis

Secondary Mentor(s):

Thematic Area: Clinical Science

Abstract:

Klinefelter syndrome (XXY) occurs in 1 in 600 males, resulting in testosterone deficiency and a high prevalence of insulin resistance. Testosterone deficiency in men is a known cause of insulin resistance, and mitochondrial dysfunction is hypothesized to mediate this relationship. The aim of this cross-sectional study was to evaluate muscle mitochondrial function in XXY compared with male controls. Twenty-seven boys with XXY (age 14.7 ± 1.8 years) were compared with 87 controls (age 16.9 ± 0.9). In-vivo calf muscle mitochondrial function was assessed via phosphorus magnetic resonance spectroscopy (31P-MRS) following 90 s of isometric 70% maximal exercise. Multiple linear regression was used to compare 31P-MRS outcomes (ADP and phosphocreatine (PCr) time constants, rate of oxidative phosphorylation (Oxphos), and Qmax or the maximal mitochondrial function relative to mitochondrial density) between groups after adjusting for age differences. There were no statistically significant differences in the mitochondrial outcomes of ADP, Oxphos, PCr, and Qmax between the groups. There were also no differences in a sensitivity analysis within the XXY group by testosterone treatment status. In this study, in-vivo postexercise skeletal muscle mitochondrial function does not appear to be impaired in adolescents with XXY compared with controls and is not significantly different by testosterone treatment status in XXY.

Primary Presenter: Stephanie Nwagwu

Project Title: Optimizing Postpartum Care: How Ariadne Labs Can Use Health System Innovation and Tool Design Principles to shift the conversation on Postpartum care

Primary Mentor: Chloe Zera

Secondary Mentor(s):

Thematic Area: Public Health and Epidemiology

Abstract:

Birthing people experience multiple barriers that prevent continued engagement in care postpartum, particularly engagement in primary care after giving birth. Since the adoption of the Affordable Care Act (ACA), Medicaid expansion has emerged as a clear policy solution for expanding health care access to pregnancy and postpartum care. While there is an opportunity to continue engagement with care after birth, there are multiple barriers that prevent access. Medicaid expansion only addresses part of the issue. A framework exists for the ideal transition from obstetric care to primary care following delivery, but there is a €œknow-do€ gap: clear guidelines on how to provide better care, but unclear steps on how to get the desired outcome. Ariadne Labs is a joint center for health systems innovation that develops simple, scalable solutions that dramatically improve the delivery of health care at critical moments to save lives and reduce suffering. We focus our work on the Know-Do gap €" areas where we can translate evidence on what should be done into better practice using human-centered design, rigorous testing, and implementation strategies; thus, Ariadne Labs is perfectly situated to design a solution to the know-do gap concerning the transition from obstetric care to primary care.

Using tool design methods centering reproductive justice, we've designed a shared patient and provider facing €œPostpartum Care Plan Workbook.€ This workbook is designed to empower patients with a comprehensive postpartum care plan that will guide them through the transition from pregnancy care to ongoing primary health care and is to be reviewed by both patient and provider at timepoints during the pregnancy.

Primary Presenter: Stephanie Serva

Project Title: Application of sodium fluorescein for spinal cord lesions: intraoperative localization for tissue biopsy and surgical resection

Primary Mentor: Michael Finn

Secondary Mentor(s):

Thematic Area: Clinical Science

Abstract:

Introduction: Sodium fluorescein (NaFL) has been used to aid in the resection of primary and secondary lesions within the brain. Comparatively, there is limited research on clinical applications for lesions within the spinal cord. Fluorescein-guided microsurgery may increase the ability to localize and safely surgically treat spinal lesions.

Objective: To describe our first-hand experience using sodium fluorescein for spinal lesions and the surgical advantages obtained

Methods: Twelve patients with spinal cord lesions received fluorescein sodium 10% (Alcon Laboratories INC, Fort Worth, TX, USA) at 3 mg/kg prior to surgical resection. Intraoperative visualization of fluorescence was performed using a Zeiss Pentero (Carl Zeiss AG, Oberkochen, Germany) microscope equipped with a Yellow560 filter or a Leica OH6 (Leica Microsystems, Wetzlar, Germany) equipped with a FL560 filter.

Results: Administration of sodium fluorescein resulted in lesional fluorescent contrast extravasation and facilitated surgical resection and localization in all patients. The addition of sodium fluorescein allowed for identification in all twelve patients. In patients with a goal of complete resection, NaFL aided in complete resection of the spinal lesions in seven patients. In surgical resection patients, pathology was consistent with WHO grade I myxopapillary ependymoma in one patient, WHO grade II ependymoma in five patients, and nerve sheath tumor in one patient. In the other five patients, NaFL allowed for intraoperative tissue identification and successful tissue biopsy. In patients undergoing biopsy, tissue samples were positive for an intramedullary abscess, EBV driven lymphoproliferative disease, and primary glial neoplasms.

Conclusion: Fluorescein is a helpful microsurgical tool in guiding surgical resection and in the localization of intramedullary spinal lesions. Further research is necessary to explore fluorescein sodium applications in the resection of spinal cord lesions.

Primary Presenter: Steven Lada

Project Title: A Survey of Article Types in Dermatology Literature

Primary Mentor: Robert Dellavalle

Secondary Mentor(s):

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

 Over 30,000 scientific journals currently exist, with >100 primarily treating topics in dermatology. To address this issue, we collected data on the article types accepted by all 142 dermatology journals listed in Scimago for 2018. To address this issue, we collected data on the article types accepted by all 142 dermatology journals listed in Scimago for 2018. Out of the 142 journals, a vast majority allow original articles and research letters (127, 89%), followed by review articles (123, 87%), and case reports (99, 70%). Our study provides valuable insight into a wide spectrum of dermatology article types, as well as the types favored for publication by particular journals. Primary Presenter: Susie Choi

Project Title: Donor Site Morbidity in Phalloplasty Reconstructions

Primary Mentor: Matthew Iorio

Secondary Mentor(s):

Thematic Area: Clinical Science

Abstract:

Background: The radial artery forearm free flap (RFFF) is the workhorse technique for phallus reconstruction. The RFFF provides good cosmesis and potential sensory recovery. However, the donor site is large in comparison to other applications of the RFFF which may increase the potential for donor site morbidity, such as nerve injury, delayed wound healing, and decreased hand strength. This study systematically reviewed the current literature to assess the donor site morbidity associated with RFFF phalloplasty (RFFFP).

Methods: A systematic review utilizing Preferred Reporting Items for Systematic Review and Meta-Analyses guidelines was completed of the current literature pertaining to donor site morbidity after RFFFP. Two investigators independently reviewed the literature to determine eligibility for inclusion. Two hundred sixty-seven studies were reviewed and 10 were included in the final analysis after application of exclusion criteria.

Results: Nine hundred forty flap reconstructions were identified. Gender affirming surgery was the indication in 77.7% (n = 730) of patients. The overall donor site complication rate was 7.9% (n = 74). Skin graft failure occurred in 41 patients (4.5%) and was the most frequent complication. Donor site infection (n = 3, 15.8%), hematoma (n = 1, 0.8%), neuroma (n = 1, 10%), compartment syndrome (n = 1, 0.8%), decreased strength or sensation (n = 15, 4.9%), lymphedema or limb swelling (n = 10, 3.9%), and contracture (n = 2, 6.5%) were also found.

Conclusions: The most common donor site complication after RFFFP is skin graft failure. Decreased forearm sensation and strength affected a significant proportion of patients within each reported cohort. Prospective studies should continue to evaluate donor site morbidity with objective measures, such as grip strength evaluation, and long-term follow-up for vascular changes following radial artery harvest.

Primary Presenter: Taylor Davis

Project Title: REDCap for National Rheumatic Heart Disease Registry

Primary Mentor: Yihan Lin

Secondary Mentor(s): R. Morton Bolman, MD, Ceeya Bolman, RN

Thematic Area: Global Health

Abstract:

Background: Rheumatic heart disease (RHD) is the most common cause of acquired cardiovascular disease (CVD) among young populations in low-income countries. Team Heart began performing cardiac surgical interventions in Rwanda in 2007, necessitated by the large burden of severe disease. The growing population of post-operative patients and of patients screened for RHD require a method for collecting high-quality, epidemiologic data. Disease registries have been shown to improve health outcomes, enhance disease surveillance, increase healthcare utilization, and strengthen health systems globally. We sought to create a rheumatic heart disease registry for Rwanda.

Methods: The methodology of registry development followed stages outlined by Evatt (2005). 1) Establish goals of the registry and prepare action plan. 2) Selection system of data collection. 3) Determine data content and design data collection form. 4) System trainings. 5) Collect and analyze data. 6) Review the registry system.

Discussion: The objectives of the registry are to create a centralized system for comprehensive disease data, improve healthcare access and outcomes for RHD patients, and provide a source of aggregate data to better inform policy change and further research with the goal of eradication of endemic RHD in Rwanda. With the initial surgical registry now accessible, future directions include collaborating with the Rwanda Biomedical Center (RBC) on projects and research including investigating pregnancy outcomes of post-operative patients in the context of their anticoagulation regimens.

Primary Presenter: Taylor South

Project Title: American Indian & Alaskan Native Health, Creation of an Elective Course for Medical Students in the Rural Track at The University of Colorado School of Medicine

Primary Mentor: Deborah Seymour

Secondary Mentor(s): Mark Deutchman

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

Introduction. American Indians and Alaskan Natives (AI/AN) face some of the largest health disparities in the United States. Sources of these disparities result from geographic isolation, racial microaggressions from health care providers, or mistrust and dissatisfaction with Westernized medicine. The objective of this study is to increase cultural humility and interest in indigenous health among rural track students at the University of Colorado School of Medicine.

Methods. A four-hour lecture series was developed and delivered to University of Colorado School of Medicine students who are members of the rural medicine track. A nine-question assessment tool was given to students before and after the course. The questionnaire included 5 Likert-style, 1 multiple choice, and 3 open response questions. Students were asked to provide a code name so that individual and group changes could be assessed. The Wilcoxon Sign Rank Test was used to assess for change between pre and post-course assessments. Keyword analysis was used to assess open response questions.

Results. Analysis of individual Likert scores showed significant changes in two of three questions designed to assess base knowledge. Although not significant on statistical testing, interest in including AI/AN content into the medical school curriculum remained high before and after the course. Keyword analysis of two free-response questions showed improvement of understanding.

Conclusion. The incorporation of American Indian and Alaskan Native Health content into the rural track curriculum at the University of Colorado School of Medicine significantly increased student knowledge about health and healthcare-specific to this medically underserved population.

Primary Presenter: Theresa Hennesy

Project Title: Cross-Modal Reorganization from both Visual and Somatosensory Modalities in Cochlear Implanted Children and its Relationship to Speech Perception

Primary Mentor: Anu Sharma

Secondary Mentor(s): Herman Jenkins

Thematic Area: Clinical Science

Abstract:

Hypothesis: We hypothesized that children with cochlear implants (CIs) who demonstrate cross-modal reorganization by vision also demonstrate cross-modal reorganization by somatosensation, and that these processes are interrelated and impact speech perception.

Background: Cross-modal reorganization, which occurs when a deprived sensory modality's cortical resources are recruited by other intact modalities, has been proposed as a source of variability underlying speech perception in deaf children with CIs. Visual and somatosensory cross-modal reorganization of auditory cortex have been documented separately in CI children, but reorganization in these modalities has not been documented within the same subjects. Our goal was to examine the relationship between cross-modal reorganization from both visual and somatosensory modalities within a single group of CI children.

Methods: We analyzed high-density EEG responses to visual and somatosensory stimuli and current density reconstruction (CDR) of brain activity sources. Speech perception in noise testing was performed. CDR patterns were analyzed within the entire subject group and across groups of CI children exhibiting good vs. poor speech perception.

Results: Positive correlations between visual and somatosensory cross-modal reorganization suggested that neuroplasticity in different sensory systems may be interrelated. Further, CI children with good speech perception did not show recruitment of frontal or auditory cortices during visual processing, unlike CI children with poor speech perception.

Conclusion: Our results reflect changes in cortical resource allocation in pediatric CI users. Cross-modal recruitment of auditory and frontal cortices by vision, and cross-modal reorganization of auditory cortex by somatosensation, may underlie variability in speech and language outcomes in CI children.

Primary Presenter: Tiffany Lien

Project Title: Assessing for gender bias in ophthalmology resident evaluations

Primary Mentor: Jasleen Singh

Secondary Mentor(s):

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

Importance: Gender bias may affect the evaluation of resident physicians.

Objective: To assess for the presence of gender bias in ophthalmology resident surgical evaluations.

Design: Cross-sectional study.

Setting: Single institution.

Participants: Participants were faculty cataract surgery attending physicians and postgraduate year 4 (PGY-4) residents.

Exposures: Faculty attending physicians were given anonymous videos of cataract surgeries performed by the residents to evaluate the residents' surgical skills using the International Council of Ophthalmology's Ophthalmology Surgical Competency Assessment Rubric (ICO-OSCAR) for phacoemulsification surgery.

Main Outcome and Measures: ICO-OSCAR scores (gender unknown to evaluators) were compared to the residents' PGY-4 year surgical evaluation scores by female and male cataract surgery attendings (gender known to evaluators) using independent two sample t-tests. Two way ANOVA was used to determine the effect of resident gender and evaluator gender and the interaction between the two variables on residents' scores.

Results: Participants included 6 faculty evaluators (3 women, 3 men) and 10 residents (5 women, 5 men). A total of 120 scores were recorded in both the masked and unmasked groups. Two way ANOVA found no significant interaction between resident gender and evaluator gender in both masked and unmasked data ($F_{(1,116)} = .088$, $P = .77$ and $F_{(1,116)} = .229$, $P = .63$), respectively. No significant difference was found between female and male residents' masked scores ($P = .45$). However, a significant difference was found when gender was unmasked with female residents scoring lower than male residents ($P < .001$). Female residents' unmasked scores were significantly lower than their masked scores ($P < .001$), whereas no significant difference was found between male residents' masked and unmasked scores ($P = .49$).

Conclusions and Relevance: When gender was known to evaluators, female residents were scored significantly lower than both their own scores when gender was masked and their male

peers. While this study had low statistical power, our findings suggest that masking gender and other identifiers to evaluators may uncover implicit bias in resident evaluations. Further research

Primary Presenter: Troy Kincaid

Project Title: Unpacking the Effectiveness of Flipped Classroom: Positive Learning Outcomes but Evaluation Fallouts from Flipping the Embryology Curriculum in an Integrated Medical Gross Anatomy Course

Primary Mentor: Lisa Lee

Secondary Mentor(s):

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

Introduction: Flipped classroom (FC) is a pedagogical innovation with increasingly broad adoption among medical schools. However, the effectiveness of this pedagogy is poorly understood beyond student satisfaction and exam scores, which limit understanding of what designs work for whom in educational innovations.

Methods: This mixed-methods, retrospective study engaged the theoretical lens of layered analysis for a Fall 2019 (n=184) FC implementation. This IRB-approved study sought to understand the learning experience and outcomes for FC that entailed pre-work videos and quizzes, where quiz results guided in-class, custom interactive sessions. Results were compared to 2018 cohort (n=184) exam scores and instructor ratings using t-tests; 2018 cohort received identical embryology content but in a didactic format. Results were triangulated with qualitative deductive analysis of open-ended responses on an optional end-of-course survey and required lecturer evaluations to assess student learning experience.

Results: The 2019, flipped-classroom cohort demonstrated higher average embryology ability levels on all four exams, compared to the 2018 cohort. The 2019 cohort significantly outperformed the 2018 cohort on the 2nd exam ($P < .01$) and the comprehensive final ($P < .05$).

Layered analysis allowed identification of specific educational design elements impacting learning. Students perceived the pre-work videos positively and the instructor experienced and expert. Video content was too deep and in-class events needed more sequential ordering of content to foster learning.

Conclusions: As more schools continue to move toward implementation of novel teaching methodologies, emphasis should be placed on providing effective introduction to and rational for change to the new curricula.

Primary Presenter: Vasilisa Kormendi

Project Title: Research Participation Influences

Primary Mentor: Kevin Deane

Secondary Mentor(s):

Thematic Area: Public Health and Epidemiology

Abstract:

Clinical research participation in Rheumatology has historically suffered from lack of power due to low prevalence of rheumatic disease in the population. In the Research Participation Influences (RPI) study, we looked at the factors that contribute to an individual's decision to participate in clinical research to improve future study design and enrollment. Those who were screened through StopRA, a rheumatoid arthritis prevention study, were asked to take part in a survey that assessed demographics and personal influences for their decision to participate or not to participate in clinical research. We found that having first degree relatives with RA, wanting benefit to self, family, and others, as well as a perceived personal risk of developing RA were motivating influences for study enrollment, whereas the potential of side effects from the medication was a deterrent. Furthermore, among those who had first degree relatives with RA, wanting the study to benefit their family and a high perceived risk of developing RA were found to be motivators for participation. With these findings, we can increase study participation by directly asking first degree relatives of people with RA to take part in research and improve study design by more thoroughly addressing motivators for enrollment.

Primary Presenter: Vikasini Mahalingam

Project Title: What Happened and Why: Responding to Racism, Discrimination, and Microaggressions in the Clinical Learning Environment

Primary Mentor: Anna Neumeier

Secondary Mentor(s):

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

Background: Within clinical settings, American medical students are uniquely faced with power differentials that make acts of racism, discrimination, and microaggressions (RDM) challenging to address. Experiences of microaggression and mistreatment are correlated with higher rates of positive depression screening and lower satisfaction with medical training. We developed a curriculum for medical students entering the clinical learning environment to promote the recognition of and response to RDM.

Methods: Guided by both generalized and targeted needs assessment, we created a case-based curriculum to practice communication responses to address RDM. The communication framework, a €œ6-D's approach,€ was developed through adaptation and expansion of established and previously learned communication upstanding frameworks. Cases were collected through volunteer submission and revised to maintain anonymity. Small group sessions were co-facilitated by faculty and senior medical students. During the sessions, students reviewed the communication framework, explored their natural response strategies, and then practiced all response strategies.

Results: Of the 196 participants in the workshop 152 (77.6%) completed the evaluation surveys. Pre- and post-session survey cohort comparison demonstrated a significant increase in students' awareness of instances of RDM (33.8% to 45.5%), knowledge of communication strategies to mitigate RDM (Mpre=3.39, Mpost= 4.62; P<0.05), and confidence to address RDM (Mpre= 3.05, Mpost= 4.38; P<0.01).

Discussion: Students gain valuable communicative skills from interactive sessions that address RDM using empathy, reflection, and relatability. This session empowers students to feel prepared to enter professional teams and ready to effectively mitigate harmful discourse.

Primary Presenter: Vincent Fu

Project Title: Digital MD: A Novel Undergraduate Medical School Elective for Social Media and Digital Scholarship

Primary Mentor: Matthew Zuckerman

Secondary Mentor(s):

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

Introduction: Seventy-five percent of medical students are using social media to engage with colleagues and patients. The current medical curriculum lacks coursework to support student doctors in such digital scholarship and to educate them about the importance of patient confidentiality, online professionalism, and using social media as part of their careers. Furthermore, many medical schools implement restrictive policies without formal mentorship or curriculum to foster professional and successful social media engagement. This starkly contrasts the rest of the practice of medicine, which is built upon structured mentorship and reflective practice. To that end, students at our medical school identified a need for a structured mentorship experience that incorporates strategies for professional social media communication and digital scholarship creation.

Methods: The Digital MD curriculum was formulated based on student survey, pre-existing materials, and discussion with key stakeholders (physicians, campus digital media, national social media leaders). We recruited first- and second-year medical students to participate in a 7-week elective, during which they engaged in live didactic sessions and small group discussions while completing a tiered series of asynchronous exercises to gain comfort and skills in digital literacy. Students were assessed with an assessment map and course assignments for each of the modules. Speakers included physicians who had integrated social media into their teaching, advocacy, and public health portfolios, as well as members of the campus social media department and faculty with social media presence. Throughout the course, students used Adobe Creative Cloud and strategies learned in class to create a digital media capstone project.

Results: Over a period of two academic years, we enrolled 9 undergraduate medical students. We evaluated students' attitudes and knowledge with a multiple choice and free text survey taken before and after the course. Following the course, 100% of respondents agreed or strongly agreed that they were able to define concepts of social media and digital scholarship, understood the role of advocacy, and found the course made them more likely to engage in social media and digital scholarship.

 Conclusions: We demonstrated the feasibility of an undergraduate medical student elective on social media and digital scholarship. Through this initiative, we also addressed a curricular gap identified through needs assessment. Survey data suggests that social media is an important and increasingly critical part of communication and professionalism in the profession of medicine,

and that resources in digital scholarship are available, expanding, and proven to be feasible. Overall, Digital MD brings unique value to students through the creation of capstone projects and enhanced social media engagement with real world impact.

Primary Presenter: Vishal Krishnan

Project Title: Risk Factors for Unchanged Ventricles During Pediatric Shunt Malfunction

Primary Mentor: Todd Hankinson

Secondary Mentor(s):

Thematic Area: Clinical Science

Abstract:

Introduction: Children whose ventricles do not change during shunt malfunction are a diagnostic dilemma. This study identifies risk factors for unchanged ventricular size at shunt malfunction.

Methods: This retrospective 1:1 age-matched case-control study identified children with shunted hydrocephalus who underwent shunt revision with intraoperative evidence of malfunction at one of the three participating institutions from 1997-2019. Cases were defined as patients with a change in the frontal-occipital horn ratio (FOR) between malfunction and baseline of < 0.05, while controls included FOR changes ‰¥ 0.05. The presence of infection, abdominal pseudocyst, pseudomeningocele, wound drainage, and lack of baseline cranial imaging at the time of malfunction warranted exclusion.

Results: Of 450 included patients, 60% were male, 73% were Caucasian, 67% had an occipital shunt, and median age was 4.3 [IQR 0.97, 9.21] years at malfunction. On univariable analysis, unchanged ventricles at malfunction were associated with a: frontal shunt (41% vs 28%, p<0.001), programmable valve (17% vs 9%, p=0.011), non-siphoning shunt (85% vs 66%, p<0.001), larger baseline FOR (0.44 ± 0.12 vs 0.38 ± 0.11, p<0.001), no prior shunt infection (87% vs 76%, p=0.003), and no prior shunt revisions (68% vs 52%, p<0.001). On multivariable analysis with collinear variables removed, patients with a frontal shunt (OR 1.67 [95% CI: 1.08, 2.70], p=0.037), programmable valve (OR 2.63 [95% CI: 1.32, 5.26], p=0.007), non-siphoning shunt at malfunction (OR 2.76 [95% CI: 1.63, 4.67], p<0.001), larger baseline FOR (OR 3.13 [95% CI: 2.21, 4.43], p<0.001), and no prior shunt infection (OR 2.34 [95% CI: 1.27, 4.30], p=0.007) were more likely to have unchanged ventricles at malfunction.

Conclusion: In a multicenter cohort of children with shunt malfunction, those with a frontal shunt, programmable valve, non-siphoning shunt, baseline large ventricles, and no prior shunt infection were more likely than others to have unchanged ventricles at shunt failure.

Primary Presenter: William Brandon

Project Title: UTILITY OF USING ONLY LEFT-SIDED ADRENAL VEIN SAMPLING DATA IN LATERALIZING PRIMARY ALDOSTERONISM

Primary Mentor: Christopher Raeburn

Secondary Mentor(s):

Thematic Area: Clinical Science

Abstract:

Background: Primary aldosteronism (PA) is present in up to 10% of patients with hypertension, and those with unilateral PA are surgical candidates. Adrenal vein sampling (AVS) is the gold standard for determining laterality; however, it is technically challenging, with success rates varying widely between institutions. Depending on the experience of the interventional radiologist, AVS may fail to achieve bilateral adrenal vein sampling in 50% or more of patients. Inability to cannulate the right adrenal vein (RAV) is the most common reason for AVS failure. In the absence of RAV data, comparison of aldosterone levels from just the left adrenal vein (LAV) and inferior vena cava (IVC) may correctly predict laterality. A previous publication found that LAV/IVC ratios of >5.5 and <0.5 accurately predicted left- and right-sided disease, respectively. The aim of this study was to evaluate the accuracy of these LAV/IVC criteria in predicting unilateral hyperaldosteronism at our institution.

Methods: Retrospective review was performed of all patients undergoing AVS at our institution from 2012-2019 (n=67). AVS was performed with ACTH stimulation, adrenal veins were cannulated sequentially and a selectivity index (AV/IVC cortisol level) > 5 defined successful cannulation. Only patients with complete AVS data were included. A lateralization index (high-side aldosterone/cortisol over low-side aldosterone/cortisol) > 4 defined unilateral disease. Results were then analyzed as if the RAV data was unavailable, utilizing only the LAV/IVC "5.5-0.5" criteria to predict laterality.

Results: AVS was successful on first attempt in 60 patients (89.6%) with 7 patients undergoing successful repeat AVS. Based on assessment of complete AVS data, 48 (71.6%) patients had unilateral and 19 (28.4%) had bilateral disease. If only the LAV/IVC data were utilized (see figure), the upper cutoff (>5.5) was 100% specific (100% PPV) for correctly predicting left lateralization; however, the sensitivity was only 14% (3 of 21 patients met the > 5.5 cutoff). The lower (<0.5) LAV/IVC cutoff was only 90% specific (85% PPV) and would have resulted in 4 out of 19 patients in the bilateral cohort being incorrectly identified as lateralizing to the right. Lowering the LAV/IVC cutoff to <0.1 resulted in 100% specificity/PPV for both high and low cutoffs but would have resulted in 33/48 patients with unilateral disease having inconclusive results. This would still allow for ~22% (15/67) of patients to avoid repeat AVS if these guidelines were followed. ã€€

Conclusion: This study found that the previously published LAV/IVC "5.5-0.5" criteria would have correctly predicted laterality in 26/48 (54%) of our patients with unilateral disease but would have incorrectly predicted unilateral disease, leading to unnecessary surgery, in 4/19 (21%) patients with bilateral disease. Adjusting the LAV/IVC criteria to "5.5-0.1" achieved 100% PPV but limited the utility, as only about 20% of AVS patients would meet the criteria. Thus, the LAV/IVC ratio may be useful in guiding management of PA in select patients with unsuccessful AVS; however, the decision of whether to repeat AVS versus proceed to surgery should be based on careful discussion between surgeon and patient.

Primary Presenter: William Cohen

Project Title: A CASE-BASED UPSTANDER TRAINING FOR CONFRONTINGRACISM, DISCRIMINATION, AND MICROAGGRESSIONS

Primary Mentor: Anna Neumeier

Secondary Mentor(s):

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

Background: American medical students within clinical settings are uniquely faced with role consideration and hierarchies which make acts of racism, discrimination, and microaggressions (RDM) considerably challenging to address and experience. An increased number of experiences of microaggression and mistreatment in the clinical setting are correlated to higher rates of positive depression screening and lower satisfaction with medical training. This course was built by students at the University of Colorado School of Medicine for peri-clinical students to instill critical analysis of RDM and tool utilization in addressing RDM prior to entering the clinical setting.

Methods: Senior medical students identified curricular gaps in students' preparation for dealing with instances of RDM in rotations. Cases were submitted anonymously, then revised by the team to be delivered in small group sessions for rising clerkship year students. Response strategies were adapted and presented to students who were then able to practice their role-played responses to prepared cases.

Results: Pre and post session survey cohort comparison for two cohorts of learners data (n=23;77) demonstrated a significant (p<0.05;<0.05) increase in students' awareness of what instances RDM looked like, the feeling that they had communication strategies to deal with RDM in a clinical setting, and their comfort addressing RDM in the clinical environment aimed toward others, themselves, and those aimed at patients. Students also reported that their comfort level in addressing RDM had markedly improved.

Conclusion: Students gain valuable communicative skills from interactive sessions that address RDM. This session empowers students to feel prepared to enter professional teams and ready to effectively mitigate harmful discourse.

Primary Presenter: William Kim

Project Title: Skin of Color Representation on Wikipedia

Primary Mentor: Robert Dellavalle

Secondary Mentor(s):

Thematic Area: Public Health and Epidemiology

Abstract:

Background: Wikipedia is one of the most popular websites and may be a go-to source of health and dermatology education for the general population. Prior research indicates poor skin of color (SOC) photo representation in printed dermatology textbooks and online medical websites, but there has been no such assessment performed to determine whether this discrepancy also exists for Wikipedia.

Objective: The aim of this study was to investigate the number and quality of SOC photos included in Wikipedia's skin disease pages and to explore the possible ramifications of these findings.

Methods: Photos of skin diseases from Wikipedia's €œList of Skin Conditions€⬚ were assigned by three independent raters as SOC or non-SOC according to the Fitzpatrick system, and were given a quality rating (1-3) based on sharpness, size/resolution, and lighting/exposure.

Results: We identified 421 skin disease Wikipedia pages and 949 images that met our inclusion criteria. Within these pages, 20.7% of images of skin diseases (196 of 949 images) were SOC and 79.3% (753 of 949 images) were non-SOC (P<.001). There was no difference in the average quality for SOC (2.05) and non-SOC (2.03) images (P=.81). However, the photo quality criteria utilized (sharpness, size/resolution, and lighting/exposure) did not capture all aspects of photo quality. Another limitation of this analysis is that the Fitzpatrick skin typing system is prone to subjectivity and was not originally intended to be utilized as a non-self SOC metric.

Conclusions: There is SOC underrepresentation in the gross number of SOC images for dermatologic conditions on Wikipedia. Wikipedia pages should be updated to include more SOC photos to mend this divide to ameliorate access to accurate dermatology information for the general public and improve health equity within dermatology.

Primary Presenter: William Mundo

Project Title: Hypoxia-induced inhibition of mTORC1 activity in the developing lung: a possible mechanism for the developmental programming of pulmonary hypertension

Primary Mentor: Colleen Julian

Secondary Mentor(s):

Thematic Area: Clinical Science

Abstract:

Perinatal hypoxia induces permanent structural and functional changes in the lung and its pulmonary circulation that are associated with the development of pulmonary hypertension (PH) in later life. The mechanistic target of the rapamycin (mTOR) pathway is vital for fetal lung development and is implicated in hypoxia-associated PH, yet its involvement in the developmental programming of PH remains unclear. Pregnant C57/BL6 dams were placed in hyperbaric (760 mmHg) or hypobaric chambers during gestation (505 mmHg, day 15 through postnatal day 4) or from weaning through adulthood (420 mmHg, postnatal day 21 through 8 wk). Pulmonary hemodynamics and right ventricular systolic pressure (RVSP) were measured at 8 wk. mTOR pathway proteins were assessed in fetal (day 18.5) and adult lungs (8 wk). Perinatal hypoxia-induced PH during adulthood, even in the absence of a sustained secondary hypoxic exposure, as indicated by reduced pulmonary artery acceleration time (PAAT) and peak flow velocity through the pulmonary valve, as well as greater RVSP, right ventricular (RV) wall thickness, and RV/left ventricular (LV) weight. Such effects were independent of increased blood viscosity. In fetal lung homogenates, hypoxia reduced the expression of critical downstream mTOR targets, most prominently total and phosphorylated translation repressor protein (4EBP1), as well as a vascular endothelial growth factor, a central regulator of angiogenesis in the fetal lung. In contrast, adult offspring of hypoxic dams tended to have elevated p4EBP1 compared with controls. Our data suggest that inhibition of mTORC1 activity in the fetal lung as a result of gestational hypoxia may interrupt pulmonary vascular development and thereby contribute to the developmental programming of PH.

Primary Presenter: Zachary Horwitz

Project Title: Sacral Level Spina Bifida Plantar Pressure Analysis

Primary Mentor: Aaron Powell

Secondary Mentor(s):

Thematic Area: Clinical Science

Abstract:

This study seeks to investigate if patients with Sacral level Spina Bifida (SSB) with myelomeningocele have equivalent foot mechanics when compared quantitatively and qualitatively using pedobarography to healthy controls (HC). Quantitative measures included foot progression angle, foot start location, foot end location, lateral pressure ratio, and arch pressure ratio, and center of pressure. Qualitative measures compared peak pressures and shape. The data was collected retrospectively from Children's Hospital Colorado's Gait Analysis Laboratory using a pedobarography mat. The quantitative data was analyzed using a Covariant T-Test comparing the 17 SSB patients to the 18 HC patients across multiple variables looking for covariation with age and BMI. The data strongly supports that the SSB patients have statistically significant increases in the variability of their center of pressure through the gait cycle show by the higher minimum ($p < 0.01$) and a lower maximum ($p < 0.01$), and a higher amount of skew ($p < 0.05$). Comparative analysis reveals fundamental differences in the feet of children with sacral level spina bifida. While it is uncertain if plantar pressure will yield information that can aid in clinical risk stratification and decision making for this population, it does show promise for future prospective research.

Primary Presenter: Zaid Al Bahrani

Project Title: Student perspectives on the diversity climate at a U.S. medical school: a 13-year follow-up

Primary Mentor: Steven Lowenstein

Secondary Mentor(s):

Thematic Area: Bioethics, Humanities, Arts, and Education

Abstract:

Background: Diversity, equity, and inclusiveness (DEI) play important roles in medical education, as they help build a respectful, inclusive, and supportive learning environment, increase students' awareness of healthcare disparities, and prepare students to serve diverse patient populations. In 2008, a Student Climate Survey was sent to students at one medical school to assess their perspectives on the climate of the school with respect to DEI and cross-cultural understanding. The authors conducted an updated version of this survey in 2021 to assess changes in campus climate from the prior baseline, efficacy of diversity efforts in the intervening years, and level of support felt by various groups on campus.

Methods: All students in the doctor of medicine (MD), physical therapy (PT), and physician assistant (PA) programs at a public medical school were asked to complete a Student Climate Survey consisting of 33 Likert-scale, short-answer, and open-ended questions, some of which were new and some of which were drawn from the 2008 survey. The questions were designed to measure student experiences and attitudes regarding general diversity culture, witnessed negative speech or behaviors, diversity in the learning environment, and effectiveness of current diversity efforts. Participation in the survey was entirely voluntary. Survey responses were summarized using proportions and 95 percent confidence intervals (95% CI). To test for associations between participants' characteristics (for example, demographic attributes or program) and key survey responses, odds ratios and 95% CIs were calculated. To test for statistical significance, chi square values and p values were calculated.

Results: Of 1,004 eligible students across the MD, PA, and PT programs, 178 (18%) participated in the survey. Most participants agreed that the school of medicine (SOM) campus is friendly (89%, 95% CI 84 to 94) and welcoming to people from minority groups (78%, 95% CI 72 to 85). Sixty-one percent of students (95% CI 53 to 68) agreed that the campus is diverse, an increase from 37% in 2008. Almost all students (99%, 95% CI 97 to 100) of students agreed that their learning is enhanced by having a diverse student body and faculty, versus 90% who agreed in 2008. Nearly all participants (98%, 95% CI 96 to 100) believed the SOM is welcoming to those with liberal views, while only 49% (95% CI 47 to 51) believed it to be welcoming to those with conservative views. Many students reported witnessing other students, residents, or faculty make disparaging remarks or exhibit offensive behaviors toward minority groups, most often targeting people with conservative political views or ideologies, those with strong religious beliefs, those

of low socioeconomic status, women, or racial or ethnic minority groups. Fewer students reported other students or residents making disparaging remarks or exhibiting offensive behaviors targeting non-English speakers and gay/lesbian, bisexual, or transgender (LGBT) individuals than in 2008 (12% [95% CI 7 to 18] in 2021 versus 34% in 2008 and 12% [95% CI 6 to 18] versus 25%, respectively). Students who identified as underrepresented minorities were 5- to 25-times more likely to feel isolated on campus because of their race/ethnicity than non-minority white students. When asked about potential efforts to enhance the DEI climate on campus, most survey participants endorsed recruitment of more diverse faculty (80%), students (76%), residents and fellows (61%), and SOM leadership (61%) as well as increased efforts to ensure that the curriculum reflects and respects diversity (70%).

Conclusions: Students increasingly value a climate that promotes DEI in supporting their own learning as well as the school's educational and clinical care missions. A higher percentage of students believed the campus to be diverse in 2021 compared to 2008. Based on these results, the SOM should continue to embrace a broad definition of diversity that encompasses race, ethnicity, gender, age, socioeconomic status, sexuality, political views, religious beliefs, and other background characteristics and life experiences. Importantly, the SOM should identify new ways to respond when students experience or witness comments that are disrespectful or marginalizing.