



SECOND ANNUAL STUDENT RESEARCH DAY

Friday, September 23, 2022



College of Osteopathic Medicine
SAM HOUSTON STATE UNIVERSITY

MEMBER THE TEXAS STATE UNIVERSITY SYSTEM

GUEST SPEAKER

Anil T. Mangla, State Epidemiologist, DC



Dr. Mangla has previously served in numerous public health leadership roles at the state, city, and county levels, including Assistant Director at the San Antonio Metro Health Department, Director of Infectious Diseases and Immunization, and Acting State Epidemiologist at the Georgia Department of Health, lead epidemiologist at the Indiana State Department of Health, a supervisory epidemiologist at the Texas Department of State Health Services and laboratory manager and MedTox laboratories.

Dr. Mangla completed his undergraduate degree at the University of KwaZulu-Natal, a master's at the University of El Paso, and his Ph. D at Texas Tech University. He then completed an infectious disease fellowship and an MPH at the University of Minnesota. After his fellowship, Dr. Mangla served as the chair of infectious diseases for the United Nations Association and traveled to South Africa, Swaziland, and Lesotho, as part of the response to HIV, TB, and Malaria. He interned with congresswoman Betty McCollum and served as a public health advisor for Colette Von Hanna.

He was Board Chair for the Texas Kidney Foundation and one of the 17 gubernatorial appointees by Texas Governor Abbott to the Chronic Kidney Disease Task Force for his expertise in diabetes-related amputations and kidney failure. He served as an Associate Professor and Director of Public Health at UIW School of Medicine and as an adjunct professor at the Mercer School of Medicine and the University of Georgia. He serves as the chief scientific officer TOXYScreen laboratories.

Dr. Mangla has received numerous accolades for his leadership in public health, policy development, Social Determinants of Health, and social justice. A strong patriot of human rights, he is one of the victims that survived the apartheid era and the free Nelson Mandela campaign. His African roots ignite his passion for identifying pathways for immigrants and minorities to overcome health and higher education barriers.

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Advisor: R. Marek



Clinical Medicine/Community Health Research

These projects aim to produce knowledge valuable for understanding human disease, preventing, and treating illness, and promoting health. These projects embrace a continuum of studies involving interactions with patients, diagnostic clinical materials or data, or populations.

An Analysis of Sagittal Suture Variation in Trauma Specimens Using Computed Tomography

Z. Rasheed, S. Baker, P. Martin

Advisor: P. Lewis

Introduction: Cranial sutures are fibrous tissues that unite the different bones of the skull. However, it is currently unknown exactly how different trauma alters these structures and compromises the skull's integrity. Here, we analyze cranial sutural separation in human specimens with known head trauma using mCT scans to understand how cranial trauma alters the anatomy of the sagittal suture.

Methods: To measure variation in the sagittal suture, three crania with patent sagittal sutures were borrowed from the Southeast Texas Applied Forensic Science Facility: Control, Intraoral Gunshot Wound, and Repetitive Antemortem Trauma. Specimens were transported to the University of Texas CT Lab for high-resolution microCT scanning. Avizo 9.7.0 was used to segment the scans of each specimen's sagittal suture and the total open sutural volume was calculated.

Results/Anticipated Results: Preliminary results indicate total sutural volume of the Intraoral Gunshot Wound specimen was 458.99 mm³. It is anticipated for the Repetitive Antemortem Trauma specimen to have a value greater than the control, but less than the intraoral gunshot wound specimen. These anticipated results would provide a quantitative value to the altered integrity of the crania.

Conclusion: From this project's completion, we can gain a better understanding of how repetitive traumas impact the skull's integrity. With future projects, we can expand our knowledge on how contact sports, such as football, impact the protective barrier around the brain and assist with developing better guidelines and protective equipment (such as helmets) for athletes. This health education will help reduce the number of sports medicine cases damaging the cranium, causing conditions such as Chronic Traumatic Encephalopathy and progressive brain damage.

Body Composition Changes in Gestational Diabetes Treated Conservatively or With Insulin: A Pilot Study

G. Magno

Advisors: O. Kelly, P. Taylor

Introduction: Gestational diabetes (GDM) incidence has increased in the past decade. Women who are a minority and/or of lower economic status are at higher risk. Treatment includes insulin and lifestyle/dietary modifications. However, insulin can contribute to increased type II diabetes risk and weight gain. Measuring body composition through bioelectrical impedance (BIA) throughout pregnancy may offer better insight into metabolic changes occurring as fat mass percentage was shown to be a good predictor of GDM later in pregnancy. Comparing the impact of GDM diagnosis and treatment between rural and urban populations is understudied. Only a few BIA studies have been performed on pregnant women. The purpose of this study is to evaluate body composition changes with gestational diabetes between urban and rural populations while comparing treatment with insulin or conservatively.

Methods: Body composition measures (fat versus fat-free mass) will be obtained peri- and postpartum. All interventions (conventional or pharmacotherapy) will be per standard of care at each physician's discretion. Control group will be pregnant women without GDM. Questionnaires (experiences and attitudes before, during, and after pregnancy, demographics, lifestyle, nutrition) and food diaries will be collected.

Anticipated Results: Women with GDM will have higher fat and lower lean mass compared to those without, and insulin therapy will increase fat mass in those with GDM.

Conclusion: This study will provide new evidence on the role of standard interventions in GDM on BIA. Future work will look at BIA from conception to one year postpartum to help predict pregnancy outcomes in hopes of diminishing health disparities.

Characterization of Motor and Speech Phenotypes in Children Under 18 Years of Age Diagnosed with *MBD5*-Associated Neurodevelopmental Disorder (MAND) Associated with 2q23.1 Deletions Inclusive of *MBD5*

L. Zhan, S. Elsea

Advisor: S. Mullegama

Introduction: *MBD5*-associated neurodevelopmental disorder (MAND) is characterized by developmental delay, speech impairment, seizures, and intellectual disability. One cause is haploinsufficiency in *MBD5*, a dosage-sensitive gene involved in gene activity regulation. This study characterizes motor and speech phenotypes in children with 2q23.1 deletions inclusive of *MBD5*.

Methods: A survey was administered to caregivers (n=38) of children under 18 years of age with a heterozygous *MBD5* deletion confirmed through clinical genetic testing. Questions covered demographics, milestone achievement, therapies received, gross and fine motor skills, speech, and other behaviors.

Results: The mean age of diagnosis was 3.17 ± 2.88 years. The mean age at the time of survey was 7.03 ± 4.20 years. The majority did not meet major milestones for gross motor skills on time, with crawling and standing not achieved by 63.6% (20/32) and walking not achieved by 55.5% (19/35). The motor phenotype observed with *MBD5* haploinsufficiency includes gait abnormalities, poor coordination, difficulty with fine motor control, and difficulty swallowing. Speech is markedly impaired, with severely delayed development and inappropriate control of tempo, volume, and pitch when verbal.

Conclusions: Missed milestones are apparent in the first year of life, but most children remained undiagnosed after 3 years of age. These data highlight the need to define the underlying cause of MAND and target critical milestones earlier in the child's life. Earlier genetic evaluation for children who miss key milestones would lead to earlier diagnosis and would offer education and specific interventions to families navigating these complex syndromes, improving outcomes in these populations.

***De novo* missense Variants in *SEPHS1* Cause a Neurodevelopmental Disorder with Developmental Delay, Hypotonia, Muscle Weakness, Speech Delay, and Growth Delay**

N. Tilton, K. Kiernan, E. Torti, E. Pavlovsky, A. Sekula, H. Gao, J. Alaimo, K. Blocker, K. Dipple, V. Fettig, R. Hickey, H. Hare, I. Glass, D. Grange, M. Griffin, C. Phornphutkul, L. Massingham, L. Mehta, D. Miller, E. Muller, M. Osmond, S. Sawyer, R. Slauch, B. Wolf, M. Simonović, T. Palcuict, A. Telegrafi, D. Carere, I. Wentzensen, M. Morrow, K. Monaghan, J. Juusola

Advisor: S. Mullegama

Selenophosphate synthetase (SEPHS) is an ATPase enzyme that synthesizes selenophosphate from ATP and selenide, which serves as the primary selenium donor in the selenocysteine biosynthetic pathway. Two SEPHS paralogues, SEPHS1 and SEPHS2, have yet to be implicated in human disease. Here, we report nine individuals with heterozygous missense variants in the SEPHS1 gene, sharing overlapping developmental delay, hypotonia, speech delay, and growth delay phenotypes. Seven missense variants were found to be classified as pathogenic based on the American College of Medical Genomics variant guidelines. The remaining two were classified as likely pathogenic. The effects of these variants were investigated using biochemical assays, structural modeling, and knockdown of SEPHS1 mRNA in fly, mouse, and human cell models. Structural modeling revealed these variants occur in p.W352 or p.R371 residues, both of which are situated within a six-stranded β -sheet in the C-terminal domain. p.W352 variants significantly decreased the inflection temperature and markedly altered the Chymotrypsin-catalyzed cleavage pattern compared to WT Sephs1, while p.R371 variants did not. Thus, p.R371 does not contribute to protein stability or proteolytic cleavage but may instead participate in protein-protein interactions involving Sephs1 in the cell. Knockout and knockdown studies of SEPHS1 mRNA showed that SEPHS1 is critical in the survival of embryonic stem cells. In conclusion, we end the diagnostic odyssey of nine patients with a novel disorder caused by pathogenic variants in SEPHS1. We were able to provide preliminary insight into a novel neurodevelopmental disorder, which may aid physicians in diagnosing and caring for patients with SEPHS1 variants.

Developing a Counseling Psychology Course Elective at an Osteopathic Medical School

A. Arauzo, L. Banuelos, R. Bhattacharjee, W. Williams

Advisors: R. Marek, Y. Zhao

Introduction: Counseling psychology is a field of primary healthcare that uses culturally informed practices to assist individuals with their mental well-being and crisis management. Though mental illness is similarly prevalent in both metropolitan and rural areas, this service is largely inaccessible to individuals in rural and medically underserved areas. Consequently, primary care physicians in these areas serve as first-line mental healthcare providers. Unfortunately, current undergraduate medical education lacks a strong foundation in counseling and psychotherapy education. Our study aims to create a counseling psychology elective and determine whether this course will better prepare students to address the mental healthcare shortage in rural and medically underserved areas.

Methods: Four osteopathic medical students conducted a literature evaluation on the state of counseling psychology education in American medical schools. Next, SHSU-COM curriculum was mapped and evaluated for the existence of counseling psychology themes and concepts. A student and preceptor survey was then created to assess student perceptions on counseling skills and gauge interest in the proposed program. Expected

Results: Literature evaluation demonstrated a lack of structured counseling psychology education within American medical institutions. SHSU COM-specific curriculum mapping reflected this trend, with a lack of curriculum on mental health treatment modalities. Survey results are expected to demonstrate a student demand for this course offering.

Conclusion: Our study provides a novel framework for expanding medical mental healthcare education at the undergraduate medical level and better preparing students of the SHSU-COM and other medical institutions to serve the mental healthcare needs of rural and medically underserved areas

Effect of Nutritional Choices on Mental Well-Being

E. Deya Edelen, X. Valencia, R. Buch, J. Thomas

Advisor: O. Kelly

Introduction: New medical students must navigate a different set of expectations, contributing to student anxiety, which results in worse performance and grades. A healthy diet may assist in the prevention and treatment of anxiety, especially foods high in magnesium and zinc. However, there is no information, to our knowledge, on medical student diets and how diet changes in the first two years of medical school. This study will determine if diet is associated with an increased perception of anxiety in medical students during their first semester.

Methods: Participants record their food intake over three days (3-day food diary) and complete the Generalized Anxiety Disorder Questionnaire (GAD-7) twice over the course of a semester. Food diaries will be analyzed using Food Processor® (ESHA Research). The GAD-7 score will be calculated and assigned scores of minimal anxiety, mild anxiety, moderate anxiety, and severe anxiety. Both study tools (3-day food diary and GAD-7) have been extensively validated. Dietary components and GAD-7 scores will be analyzed for correlations.

Anticipated Results: It is expected that students with poorer dietary components (e.g., low zinc and magnesium intake) will have greater anxiety. However, the main limitation in this pilot study is sample size may be too small to find correlations.

Conclusion: This study will help inform medical students on the importance of good dietary habits throughout medical school to mitigate anxiety and maintain performance. Future work will involve a cohort study of dietary habits and anxiety over the first two years of medical school.

Etiology of Diffuse Idiopathic Skeletal Hyperostosis: The Influence of Smoking, Diabetes, and Obesity

I. Esparza, J. Ross
 Advisor: K. Lesciotto

Diffuse idiopathic skeletal hyperostosis (DISH) is a condition that results in ligamentous ossification, primarily affecting the spine. Although the pathogenesis of DISH is not fully understood, studies suggest that inflammatory conditions contribute to its development. This study aimed to examine the relationships between tobacco smoking, diabetes mellitus (DM), and obesity (BMI > 30), as inflammatory factors, and the presence of DISH, using data collected from the Southeast Texas Applied Forensic Science Facility Skeletal Collection. Eighty-five individuals in this collection were identified as having skeletal indications of DISH, following the diagnostic criteria set forth by Resnick et al. (1978). Height/weight data, history of smoking, and DM were gathered from associated donor files. Data were analyzed to examine whether the observed frequency of smoking, DM, and obesity within this study's DISH sample significantly differed from expected values, based on age-matched data on the general population of the United States, taken from the Centers for Disease Control. While the observed frequencies of smoking ($\chi^2 = 156.6$, $p < 0.00001$), DM ($\chi^2 = 5.71$, $p = 0.017$), and obesity ($\chi^2 = 4.79$, $p = 0.029$) were all significantly higher than expected for this study's sample, only smoking significantly affected the effect size of comorbidity with DISH (odds ratio = 10.21, $p < 0.0001$). These findings support the hypothesis that inflammatory conditions contribute to the etiology of DISH, while also highlighting the variability in effect sizes.

Evaluating the Acute: Chronic Workload Ratio Across a Season in Collegiate Female Lacrosse Athletes

M. Wojciechowski, C. Schumann
 Advisor: J. Bunn

The purpose of this study was to analyze the in-season variations of external workload variables and the acute: chronic workload ratio (ACWR) by player positions on a Division I collegiate women's lacrosse team. Data were collected via wearable microtechnology across 17 games and 64 training sessions on 15 participants (attackers $n=5$, midfielders $n=5$, defenders $n=5$). Weekly totals for distance, high-intensity distance (HID), sprints, accelerations, and decelerations were tabulated, and ACWRs were calculated by dividing the workload from the past seven days by the workload from the past 28 days for each metric. Two repeated measures analyses of variance (RM-ANOVA) were used to compare positional differences and weekly changes in all five metrics for 1) ACWR and 2) weekly totals. There were several differences in weekly totals and ACWRs across all five metrics evaluated ($p < .05$), but no positional differences were noted. With the exception of the early training weeks, ACWR primarily stayed within the optimal window of 0.8-1.3 to maximize performance and reduce injury risk. These data indicate that there was significant variation in weekly totals for the main five metrics studied that cause "spikes" and "valleys" in workload, but the athletes had built enough of a base in their chronic workload that it did not affect their ACWR to move outside of the optimal window. Using this information, coaches and team physicians can more effectively program training not only to optimize performance, but also to limit injuries, fatigue, and lack of fitness.

Evaluation of Copy Number Losses in the MBD5 5'-Untranslated Region: Expression Matters

K. Kashyap, S. Milosavljevic, M. Zschappel, R. Mendoza-Londono, W. Han Tan, J. Innis, T. Ezashi, S. Elsea

Advisor: S. Mullegama

Genomic tools, such as chromosomal microarray analysis and exome sequencing, allow for detection of copy number variants (CNVs) or single nucleotide variants (SNVs) in patients with suspected genetic conditions. However, these tools do not detect an important component of gene transcription which is the 5' untranslated region (5'UTR). We hypothesize that when there is alteration of mRNA gene expression in the 5'UTR of a dosage-sensitive gene, this defect could lead to a clinical phenotype. Therefore, to confirm the importance of the 5' UTR, we investigated CNV losses in *MBD5* which is associated with 2q23.1 deletion syndrome. 2q23.1 deletion syndrome is one of the many disorders that are grouped under *MBD5*-associated neurodevelopmental disorder (MAND). These disorders affect the function of *MBD5* and share developmental disabilities, neurological disturbances, language impairments, and hyperactive behavior. Patients were recruited with deletions in the 5' UTR region of *MBD5* to evaluate whether these deletions may be responsible for haploinsufficiency of *MBD5* which is present in all 2q23.1 deletion patients. The patients were grouped based on their 5'UTR *MBD5* deletions into six categories of deletions. Genotype-phenotype studies of these deletions revealed that Category 1 5'UTR deletion phenotypes resembled a traditional MAND phenotype. We conducted qPCR studies to evaluate the mRNA expression of the various 5'UTR deletions. We saw decreased *MBD5* mRNA expression in Category 1 and Category 3. This study confirms the importance of careful assessment of the 5' UTR in clinical genetics testing, particularly for dosage-sensitive genes for we could be missing genetic diagnoses.

Further Elucidation of Mullegama-Klein-Martinez Syndrome

K. Liang

Advisor: S. Mullegama

Deriving its name from its central role in sister chromatids cohesion, the cohesin multi-protein complex is involved in many cellular mechanisms. The cohesin complex includes four subunits and interacts with several regulatory proteins to carry out roles in DNA replication, repair, and transcription. Consequently, variants in any part of the cohesin complex, or of its regulators, result in a spectrum of syndromes called cohesinopathies. Recently, a novel X-linked cohesinopathy was identified, Mullegama-Klein-Martinez syndrome (MKMS), which shares overlapping phenotype to other cohesinopathies such as developmental delay, speech delay, microcephaly, skeletal abnormality, and brain anomalies. MKMS results from pathogenic single nucleotide variants in the *STAG2* gene which encodes for stromal antigen 2 protein, a core subunit of the cohesin complex. In this study, we further characterize the genotype and phenotype of MKMS. Eighteen female and nine male cases were collected that were genetically diagnosed with MKMS. Genotype-phenotype studies were conducted on this cohort and compared this cohort to our systematic literature review of all reported MKMS patients which allowed us to further expound on the range of phenotypes manifested in MKMS. We found that most of the symptomatic female cases demonstrated loss of function variants. Meanwhile, male, and familial cases were mainly missense mutations, notably occurring around residues related to *RAD21* docking. We propose that these findings can enhance the understanding of *STAG2* variants and improve accuracy in clinical diagnosis and prognosis. This study supports the need for further research on *STAG2*'s role in development.

Impact of COVID-19 on the Self-Report Assessment of Obsessive-Compulsive Disorder

E. Meza, G. Hapenciuc, S. Bistricky

Advisor: R. Marek

Introduction: The COVID-19 pandemic and subsequent guidelines put in place (e.g., social distancing, handwashing, and wearing face masks) have had a substantial effect on social norms. This likely affected self-report assessment of psychopathology, namely those that assess obsessive-compulsive tendencies routinely used to screen for obsessive compulsive disorder (OCD). It was hypothesized that self-report assessment of OCD likely produces inflated, nondiscriminating scale scores.

Method: Data collection occurred prior to the COVID-19 pandemic with the aim of validating a new psychological test; however, data collection was abruptly halted in March 2020. Data collection was allowed to resume in the latter half of the year. The pre-COVID sample consisted of 75 participants and the pandemic sample consisted of 64 participants, with both groups being racio-ethnically and gender diverse.

Results: Measures of OCD yielded inflated scores. For instance, the total Obsessive Compulsive Inventory – Revised (OCI-R) average score of all participants went from normative levels prior to COVID-19 ($M=13.69$, $SD=10.32$) to an average score that was above the clinical cut-off on the OCI-R ($M=32.89$; $SD=12.95$) during the pandemic ($t(135)=9.66$, $p < .001$, Cohen's $d=1.66$). Two by two factorial ANOVAs were also conducted to examine if there were any method by gender interaction effects. Interaction effects were non-significant across all criteria.

Conclusions: The larger OCD-related scale scores assessed are likely false positives due to COVID-19 health guidelines put in place to protect against infection that may otherwise be considered contamination fears on OCD measures.

Pre-Surgical Psychological Functioning Predicts One-Year Postoperative Spine Surgery Outcomes

J. Le, G. Hapenciuc, M. Philip, A. Block, Y. Ben-Porath

Advisor: R. Marek

Introduction: Over 80% of the population in the United States have reported experiencing chronic low back pain at least once in their lives. Although a variety of treatment options exist, reparative spine surgery is being increasingly sought after. To minimize postoperative detriments, pre-surgical psychological evaluations are becoming more routine to assess for psychosocial risks. This investigation hypothesized that objective psychological markers assessed prior to spine procedures predict pain, functional disability, and negative emotions up to one-year post-operation.

Method: The sample included 910 participants – 50.4% men and 49.5% women. The sample was 89% White, 4.1% Black, and 3.9% Hispanic. Prior to surgery, participants took the Minnesota Multiphasic Personality Inventory – 3 – the most widely used objective measure of psychopathology. They were also administered self-report measures of pain, functional disability, and negative affect prior to surgery and one-year postoperative.

Results: Patients largely reported decreases in pain and negative affect, though standard deviations were quite large. Hierarchical linear regression analyses suggested that the presurgical MMPI-3 scale scores that assessed somatization and emotional dysfunction accounted for up to 5.4% additional variability in these outcomes after controlling for baseline measures.

Conclusions: Pre-surgical scale scores on the MMPI-3 were notably associated with pre-surgical and post-surgical negative affect and functional disability scores. Emotional dysfunction scales, such as Demoralization, Dysfunctional Negative Emotions, and Negative Emotionality/Neuroticism tended to be the strongest predictors of post-surgical negative affect. Use of reliable, validated tests of psychopathology during a pre-surgical evaluation can predict diminished outcomes in spine surgery and spinal cord stimulator settings.

Sacral Asymmetry: Relationships Between Morphological and Metric Analyses

R. Mota

Advisor: K. Lesciotto,

Variability in the gross morphology of the sacrum can be attributed to directional asymmetries associated with mechanical loading forces. Directional asymmetry can contribute to unbalanced bone hypertrophy of the sacrum and affect somatic function. Previous studies have used osteological landmarks on the superior aspect of the sacrum to attempt to quantify sacral asymmetry. However, asymmetry between sacral promontory height and bilateral alar height has not previously been defined or correlated with linear sacral measurements, leaving a gap between current knowledge of sacral asymmetry and potential clinical implications. The goals of this projects were to (1) develop an ordinal scoring system for sacral height asymmetry and (2) investigate potential correlations between 3D morphological asymmetry and 2D linear measurements. Data were collected on 92 non-pathological sacra from the Southeast Texas Applied Forensic Science Facility Skeletal Collection. Sacral asymmetry was recorded through nine 2D linear measurements using standard osteological landmarks, as well as a novel scoring method that graded sacral height asymmetry on an ordinal scale of 1-3. Non-parametric testing revealed no significant correlations between ordinal scoring of alar height asymmetry and any linear measurement (all $p > 0.05$). These results demonstrate that the commonly used osteological linear measurements fail to fully capture the range of sacral asymmetry. Further study of the ordinal asymmetry scoring method developed through this research will help provide a foundational frame of reference for sacral asymmetry, pathologies, musculoskeletal biomechanics, and somatic dysfunction

The Effects of Osteopathic Manipulative Treatment (OMT) in Post-Concussive Collegiate-Aged Athletes

L. Milunovich

Advisor: L. Tucker

Introduction: Athletes in many sports are an increased risk to sustaining concussion compared to other populations. One or multiple concussions can lead to serious long-term effects such as chronic traumatic encephalopathy (CTE) and post-concussion syndrome (PCS). Current care after concussion is continuously changing. This study seeks to evaluate osteopathic manipulative treatment (OMT) as a potential option to reduce acute and chronic outcomes. Current research shows that in post-concussive patients there is improved recovery, quicker symptom relief, faster return to play, and reduced post-concussive symptoms when OMT is used as an adjunct treatment.

Objective: To examine the effects of OMT in reduction of symptoms and overall healing in participants with concussion who receive OMT or current standard of care.

Methods: A randomized control trial conducted by the Sam Houston State University College of Osteopathic Medicine. Collegiate-aged athletes will present to the clinic after sustaining a witnessed concussion during a sport-related event. Patients will be randomized into 2 intervention groups, receiving either 2 OMT treatments with current return to play guidelines or no OMT treatments with current return to play guidelines. Patients will be assessed before and after each intervention with SCAT5 reporting, C3Logix balance and reaction time, EEG reading and heart rate variability.

Anticipated Results: 50 participants are expected to participate in the study with the expectation of the OMT experimental group having improvement in symptomology when compared to the control group.



Medical Education Research:

These projects aim to advance the knowledge, skills, and professionalism of medical students by understanding and evaluating educational ecosystems. These ecosystems include policies related to admissions and curriculum, people who serve as teachers and mentors, instructional technology and other resources, the attitudes that pervade a given institution or educational experience, and even the medical students themselves.

Accessibility to Sexual Health Education

A. Nair, H. Jeong, C. Schumann

Advisor: P. Taylor

Background: Texas has one of the highest rates of teen pregnancy in the country and the STI rates continue to increase each year. Currently, there is no data available for most of Texas that attempt to examine the quality of sex education provided by Texas Independent School Districts. The purpose of this study is to investigate the quality and occurrence of sex education in Texas and fill the current literature gap that exists in regards to sex education in Texas school systems. With this data, researchers hope to encourage more accessible and quality comprehensive sex education in the Texas education system.

Methods: A survey was created in order to assess students' past sex education exposure and was dispersed to all SHSU students. This survey aimed to assess the quality, type, and subtopics of sex education taught during 5th-8th grade in adults, primarily from the Texas Education System. The survey assessed both qualitative and quantitative measures allowing for a complete picture of Texas' sex education programs. The data will be collected and analyzed using Qualtrics.

Results: Researchers anticipate significant gaps in the education of both male and female urogenital tracts and comprehensive sex education during 5th-8th grade for the Texas population, regardless of, with most survey participants from East Texas receiving little to no comprehensive sex education.

Conclusion: Researchers anticipate creating a complete and standardized picture of Texas' sex education programs and help identify areas of concern, ultimately encouraging a more comprehensive sex education.

Addressing Vaccine Hesitancy in the Homeless Population

R. Patel, K. Morris-Ibarra, V. Mousa, E. Ladine, M. Wojciechowski, K. Liang, K. Hu, L. Knittig

Advisor: M. Manis

Background: In persons currently experiencing homelessness, chronic lower vaccination rates contribute to an increase in disease vulnerability and burden. In addition to the accessibility concerns evident in this population, vaccine hesitancy plays a role in lower levels of vaccination rates. This study aims to address both the gap in literature around vaccine hesitancy in the homelessness population in non-urban areas and to further develop insight into the behavioral intentions of this population by measuring levels of vaccine hesitancy before and after targeted educational programming.

Methods: Participants receiving services at homeless shelters in Montgomery and Harris Counties will be assessed for vaccine hesitancy through the use of a dual audio and written administered Adult Vaccine Hesitancy Scale survey prior to and following targeted educational programming. The intervention was compiled using population adjusted materials based on the Centers for Disease Control and Prevention (CDC) webpage and will be delivered by second-year osteopathic medical students. Following collection, paired data will be analyzed via t-test to determine if the educational programming affects vaccine hesitancy.

Anticipated Results: The expected outcome is decreased vaccine hesitancy and a desire to stay up-to-date on vaccinations following our educational programming. Due to the inaccessibility and vulnerability of the study population, data collection has been delayed, although materials have been favorably reviewed by a focus group and feedback is being incorporated into the programming.

Projected Impact: Once collected, the data will be some of the first of its kind and can serve to tailor future interventions for people experiencing homelessness in East and Southeast Texas.

An Evaluation Approach of Current Medical Students in the Context of an Implicit Bias Framework – A Mixed Methods Study

D. Dozier

Advisor: C. Collins

Introduction: The purpose of this study is to evaluate medical students within an implicit bias training (IBT) framework, and determine if group differences exist between gender, class, and race. Implicit bias (IB) in healthcare adversely affects marginalized patients, and strains patient-physician interactions. Implementing implicit bias trainings (IBT) in medical education is challenging due to a lack of priority, perceived relevance, and effective curricular integration. Evaluating medical students' adequacies and deficiencies in IB-related topics can guide programs in tailoring IBTs, increasing relevance, and improving integration.

Method: Students completed a survey measuring IBT Framework-guided topics: knowledge, awareness, responsibility/empathy, skills/efficacy, and attitude. A mixed methods approach was used to qualitatively analyze students' open-ended responses through content analysis and quantify scored data through independent samples t-tests and ANOVA models.

Results: Of 186 surveys, 146 (78.49%) participated. Students scored high in responsibility/empathy ($\bar{x}=17.19/24$) and attitude ($\bar{x}=62.69/72$). More students entered keywords related to "implicit bias" (96/139, 69%) and "microaggression" (95/135, 71%) definitions, than "ally" (72/136, 53%). Women outscored men in awareness ($p=.032$), responsibility/empathy ($p=.02$), skills/efficacy ($p=.007$) and attitude ($p<.001$). First-years outscored second years in responsibility/empathy ($p=0.03$) and attitude ($p=.009$). And minorities outscored White students in attitude ($p=.044$) and responsibility/empathy ($p<.001$).

Conclusion: The results of this study show that an IBT framework-guided evaluation can be effectively utilized to identify program-specific deficiencies and establish a baseline for curriculum development. Study results also guided the development of proposed recommendations for IBTs. Limitations of this study include restricted content analysis and small group sizes. Future studies will assess effectiveness of tailored trainings and proposed recommendations.

Developing a Peer Mentorship Program Integrated with Osteopathic Principles for Medical Students at SHSU-COM

W. Zhuo, L. Banuelos, L. Zhan, R. Nagaraj, L. Knittig

Advisor: Y. Zhao

Introduction: While peer mentorship has been implemented in many U.S. medical schools, few programs incorporate osteopathic principles to achieve the goal of providing mental health support for first year students. The osteopathic approach to health promotion and consideration of the entire person can guide incoming osteopathic medical students to avoid burnout and manage anticipated stress. This study aims to design and evaluate the effectiveness of a new peer mentorship program that incorporates the osteopathic principles of mind, body, and spirit on student adaptation to medical school and associated mental health challenges.

Methods: 137 incoming first years were matched with 93 incoming second year students. A curriculum outlining the osteopathic principles of mind, body, and spirit is being developed for discussion at monthly events. The curriculum includes a one-page leaflet for the mentors detailing a theme, including social connectedness, time and stress management, which will be paired with an activity, such as guided meditation, for mentors and mentees. Pre-surveys evaluating mental health and burnout rates of first-year students will be administered just before the first event and post-surveys will be administered at the end of the school year.

Expected Results: Expected outcomes include improved mental health and decreased burnout rates in those who participated compared to those who did not.

Conclusion: Our study provides a novel framework for a mentorship program that improves the mental health of incoming medical students. Future research can target the efficacy of osteopathic principles in establishing effective mentorship programs.

Developing a Student-Led Scholarship of Teaching and Learning Research Interest Group at an Osteopathic Medical School

R. Bhattacharjee, A. Reynolds, L. Knittig, R. Nagaraj, L. Zhan

Advisor: Y. Zhao

Introduction: Counseling psychology is a field of primary healthcare that uses culturally informed practices to assist individuals with their mental well-being and crisis management. Though mental illness is similarly prevalent in both metropolitan and rural areas, this service is largely inaccessible to individuals in rural and medically underserved areas. Consequently, primary care physicians in these areas serve as first-line mental healthcare providers. Unfortunately, current undergraduate medical education lacks a strong foundation in counseling and psychotherapy education. Our study aims to create a counseling psychology elective and determine whether this course will better prepare students to address the mental healthcare shortage in rural and medically underserved areas.

Methods: Four osteopathic medical students conducted a literature evaluation on the state of counseling psychology education in American medical schools. Next, SHSU-COM curriculum was mapped and evaluated for the existence of counseling psychology themes and concepts. A student and preceptor survey was then created to assess student perceptions on counseling skills and gauge interest in the proposed program.

Expected Results: Literature evaluation demonstrated a lack of structured counseling psychology education within American medical institutions. SHSU COM-specific curriculum mapping reflected this trend, with a lack of curriculum on mental health treatment modalities. Survey results are expected to demonstrate a student demand for this course offering.

Conclusion: Our study provides a novel framework for expanding medical mental healthcare education at the undergraduate medical level and better preparing students of the SHSU-COM and other medical institutions to serve the mental healthcare needs of rural and medically underserved areas.

Evaluating Medical Student Perceptions of Team-based Learning (TBL) at SHSU-COM

R. Nagaraj, L. Zhan, L. Knittig

Advisors: R. Andrews-Dickert, Y. Zhao

Introduction: TBL has been associated with positive learning outcomes in medical education, including improved knowledge acquisition and teamwork appreciation. However, challenges exist with successfully implementing TBL, such as student engagement and session planning. As TBL is one teaching method used at SHSU-COM, we aimed to evaluate student perceptions of TBL experience at COM to improve the quality of TBL and learning outcomes.

Methods: OMS2 students were invited to participate in a voluntary survey assessing perceptions of current practice of TBL at SHSU-COM. The survey contained three parts: demographic information, perception questions which were measured on a 5-point Likert scale, and open-ended questions which targeted the perceived advantages and disadvantages of TBL. Descriptive and thematic analyses were performed to analyze data.

Results: Fifty-three out of 108 students (49.1%) participated in the survey. Among all perception questions, peer collaboration in TBL being critical to ensuring future success as a physician received the highest rating (4.68±0.51), which aligned with qualitative analyses. Interestingly, student preference for TBL over traditional lecture was rated lowest (2.51±1.13). The perceived reasons for this included limited time for adequate session preparation and lack of facilitation and feedback from faculty.

Conclusion: Students understand that TBL is advantageous in professional development and concept application; however, students prefer traditional lectures over team-based sessions. A study limitation includes variation in TBL delivery between and within courses, so students may have had difficulties generalizing their views to report in the survey. Future direction includes developing pedagogical strategies to improve TBL delivery at SHSU-COM.

ME7

Facilitating the Integration Embryology, Histology, and Radiology with Clinical Anatomy Education

M. Tran, R. Buch

Advisor: M. Loomis

Introduction: Near-peer teaching has been shown to help students master the type of complex material taught in clinical anatomy. The purpose of this study is to determine if directing teaching assistants to reinforce the generally difficult subjects of histology, embryology, and medical imaging during their time with first-year students in the gross anatomy lab can improve exam performance in those subjects.

Methods: Each week, anatomy TAs are briefed with prepared review sheets highlighting key histology, embryology, and imaging points that were taught in the previous week's lectures. The TAs then reinforce this material by integrating it into the assistance they provide to students in the lab.

Anticipated Results: By comparing student performance between prior SHSU COM Osteopathic medical students in anatomy with the current first years, we will see if the focused guidance of the TAs leads to improved exam performance in the areas of histology, embryology, and imaging.

Conclusions: It is hoped that the integration of histology, embryology, and imaging highlights into the teaching assistants' guidance of students in the gross anatomy lab will lead to improved performance in these subject areas on first-year students' anatomy examinations.

ME8

Facilitating the Integration of Embryology, Histology, and Radiology within Clinical Anatomy Education

R. Buch, M. Tran, M. Loomis, J. Hinojosa, D. Moeller

Advisor: D. Wooten

There is no doubt that the diverse disciplines within a medical school clinical anatomy class can be difficult to tackle. The goal of this project is to identify the extent to which intentional integrative teaching, via formatted deliverables and focused coordination of teaching assistants, can impact the understanding of anatomical sciences in first year medical students. We built a focused and consistent deliverable that can be distributed to teaching assistants as a guide to integrate histology and embryology into the gross anatomy laboratory. The teaching assistants will use that deliverable to correlate embryology and histology with the structures being dissected. These deliverables have started being distributed on a weekly basis to the laboratory teaching assistants for the Fall 2022 anatomy course. For outcome assessment, we will compare the average performance on certain exam items by the current first year medical students to those same results from students in the previous two classes. With the integration of histology and embryology within the gross anatomy lab, we seek to cultivate critical thinking skills needed for examinations, and thus, we anticipate an increase in performance on the histology and embryology items in the lecture and lab examinations. We hope that this study will quantify the anticipated benefits of coordinated near peer teaching as a means of reinforcing histology and embryology throughout the clinical anatomy course.

ME9

Patient-Perceived Implicit Bias in East Texas Clinics

T. Moore, B. Birks

Advisor: M. Manis

Introduction: Various research suggests that implicit bias in clinical settings is adversely affecting the health of minority patients. While there is research on physician bias and how that contributes to poorer health outcomes for patients of mainly minority demographics, there is not as much research on doctor-patient interactions from the patient's perspective. Thus, research from the patient's perspective may also reveal inequities in health outcomes.

Methods: Data collection will be done through incentivized student-administered surveys, where we will assess patients' perceived racial/ethnic implicit bias after physician and/or student doctor interactions in SHSU-COM East Texas clinics. 1-2 SHSU-COM medical students at each of the 3-4 clinics will offer surveys, via tablets, to all patients encountered at the clinics. Patients will create a unique password to avoid analysis of any duplicate response.

Anticipated Results: We expect that patients that have perceived implicit bias will have poorer health outcomes, indicated by medical records of increased disease prevalence or severity, less medical visits, and/or less medication adherence from previous research.

Conclusion: Research would allow us to evaluate how the patients of SHSU physicians, clinical sites, and medical students perceive their interaction to be and why. The main takeaway is that if we have a better understanding of patient accounts, then we can have a better understanding of how we can provide equitable care that could be established through targeting the curriculum and discussing the issue during the training of medical students. This allows conversations and actions towards the progression of increased healthy doctor-patient relationships.

ME10

Skin of Color in Medical School Dermatology Curricula

L. Knittig, B. Birks, L. Zhan, R. Nagaraj

Advisor: J. Hinojosa

Introduction: Previous studies suggest that dermatology curriculum in U.S. medical schools inadequately represents the diversity of skin tones in patients. Since medical schools are tasked with training competent physicians, students should be familiar with how skin manifestations present on various skin tones. Thus, this project aims to increase representation in dermatology curriculum at Texas medical schools and student preparedness in treating a diverse population.

Methods: We will distribute surveys to all Texas medical schools and gather quantitative and qualitative data to assess student confidence and accuracy in identifying dermatological conditions on various skin pigmentations. Students will then be invited to use a dermatologist-reviewed supplemental resource highlighting common skin disorders in an inclusive range of skin pigmentations. A post-survey will be administered which includes a 5-point Likert scale with a competency assessment with open-ended questions used to assess the perspectives on skin diversity in the curriculum.

Results: The expected outcome is that students introduced to diversity in skin manifestations through educational resources will have increased confidence and accuracy in identifying conditions on darker pigmented skin. A mixed approach will be utilized to analyze student perception and competency as well as identify patterns between different demographics.

Conclusion: The results will be used to evaluate current approaches towards dermatology curriculum at SHSU-COM and other Texas medical schools. The data will be utilized to suggest improvements to dermatology curriculum that can enhance student learning outcomes. Future directions include expansion of increased diversity in case presentations, standardized patients, and other aspects of medical curricula.

What's in a tû? Scheduling Disparities Among Non-English Speakers

K. Dang, K. Ibarra, E. Deya Edelen

Advisor: P. Taylor

Introduction: Translation in healthcare systems is a multifaceted issue with value-based considerations often anecdotally leading to reinterpretation of existing standards or use of more convenient measures, such as the use of a family member, to deliver care. This study seeks to provide evidence relating to the perceived disparities of care-delivery in non-English speakers, through the use of “cold-calls” and clinic surveys.

Methods: This study focuses on how language can be a barrier in non-English speakers. Obgyn clinics within the SHSU-COM clinical rotation will be “cold-called” on a rotating order: English, Spanish, and Vietnamese by Osteopathic Medical Students seeking to set up an appointment for the “soonest availability”. In addition, clinics will receive a survey regarding their use of in-house translation systems, perceived barriers to implementation, and current knowledge of translation best practices and standards.

Results: No data has been gathered at this present time; however, this study hopes to identify any significant difference in scheduling dates based on date-of-call to date-of-appointment. In addition, survey results will gauge how well guidelines are currently implemented and how that correlate to patient scheduling.

Conclusions: This study is to determine disparities in scheduling dates based on date-of-call to date-of-appointment for non-English speakers. Limitations include the inclusion of only two language groups besides English; this has been done to account for the other two dominant languages in the area but does not consider disparities found in other minority groups. Future studies could focus on identifying in person barriers and health outcomes.

You Can D.O. Medicine; Mini-Medical School Camp and Self-efficacy in High School Students

P. Jesudasen, D. Dozier

Advisor: R. Marek

Introduction: Mini-medical school programs introduce pre-medical students to medicine through hands-on learning, information sessions, and interactions with medical students. Previous mini-medical school studies reported increased student interest in, and knowledge of, medicine. However, effects on perceived self-efficacy to be a medical student have yet to be explored. We developed a 4-day mini-medical school camp and studied its effect on perceived self-efficacy.

Hypothesis: Participation in the program will increase perceived self-efficacy to be a medical student.

Methods: To measure self-efficacy, we collated validated surveys measuring self-efficacy in academics, grit/perseverance, learning clinical skills, self-care, and social support. We received IRB approval. Participants were (n=23) rising high school sophomores who completed the pre-test, then at the conclusion of the camp, completed the post-test. Responses were analyzed using a paired sample t-test.

Results: A total 18 of 23 surveys were analyzed. Six removed due to inability to match pre- and posttests. There were significant increases with large effect sizes in grit/perseverance ($t=2.46$; $p=.026$; Hedges' $g=.583$), clinical skills ($t= 3.221$; $p=.005$; Hedges' $g= .742$), and self-care ($t=-2.365$; $p=.030$; Hedges' $g = .545$) (CI=95%). Social support slightly increased ($t=1.123$; $p=0.324$), with a moderate effect size (Hedges' $g = 0.454$). There was no significant difference in Academic self-efficacy scores ($t=0.426$; $p=0.678$, Hedges' $g = .118$).

Conclusions: Our study improved several components of self-efficacy; an important factor in propelling students towards medicine to address the current physician shortage. Limitations include small sample size, survey misprint, and lack of diversity. Future direction will address these limitations.



Pre-Clinical/Laboratory (PL):

These projects involve the application of the natural sciences, are performed in the laboratory setting, and will often require additional training (provided by the program) for working with animal tissue, human tissues, cultures, or biosafety protocols.

PL1

Airyscan Technology Fills the Gap Between Traditional Confocal Methods and New Super-Resolution Microscopy for Sensitive Immunohistochemistry Protein Studies

M. Kakakhe, L. Tebbe, M. Makia, M. Al-Ubaidi,

Advisor: M. Naas

Introduction: Protein abnormalities, errors in processing, transport, and breakdown may be implicated in several retinal and neurological diseases. Maintaining a good balance between spatial and temporal resolution without sacrificing fluorescence signal intensity and image contrast remains a challenge when studying these disease-causing proteins.

Methods: Classic confocal microscopes use point illumination to scan the sample (Figure 1A, Left [1]). A pinhole spatially limits this disk to block out light that is out of focus from reaching the detector. Closing the pinhole gives a higher resolution but detects fewer photons. Airyscan is an area detector with 32 concentrically arranged detection components (Figure 1A, right [1]) that allow you to obtain more of the disk while the pinhole remains open and prevents blockage of light. This produces greater light effectiveness while imaging and further enhanced deconvolution methods (Figure 1B [2]).

Results: Airyscan imaging was utilized in a study analyzing mutated Ush2a protein in retinal diseases. Figure 1C presents confocal imaging which displays an overview of protein localization, while airyscan shows direct membrane integration of the protein. Figure 1D presents another useful component of airyscan, which is enhancing the mutated flag labeled Ush2a. This feature enables the ability to see the difference between mutated protein (flag labeled) and non-mutated protein (no flag label) which is useful for tracking and localization studies.

Conclusion: Airyscan is a combination of super-resolution imaging and high sensitivity image quality. This is crucial to distinguish sub-cellular features. This technology will open new possibilities for advanced studies that focus on protein labeling, which can allow for the faster development of gene therapy targets for retinal diseases.

PL2

Assessing if Tumor Secreted IL-6 Type Ligands Regulate Peripheral Tissue in a Drosophila Tumor Model

B. Birks, C. Everson, I. Perez

Advisor: M. Atkins

In *Drosophila melanogaster*, the fat bodies have functional analogy to both human adipose and liver tissues as they function to store both fats and glycogen. Previous studies suggest that tumors may induce cachexia-like wasting in the fat body and activation of the STAT transcription factor. In *Drosophila* the JAK-STAT pathway is activated by the Unpaired ligands (Upd1-3). Unpaired ligand 2 (Upd 2), analogous to Interleukin 6, has been linked to tumorigenesis, but further characterization of Upds(1, 2, and 3) is needed. This study assesses the role of tumor derived Upds(1-3) on inducing fat-body wasting by assessing Upds(1-3) knockdowns in the tumor. In this experiment, wild-type larvae, and day 10 Upd (1-3) knockdowns were dissected and stained with periodic acid-Schiff to label glycogen, mounted, and imaged. Fat bodies were blind-scored for glycogen storage defects and rated according to severity. We observed an increase in score (severity) in Upd (1-2) knockdowns compared to Upd 3 knockdowns. Additionally, wild-type larvae and day 10 Upd (1-3) knockdowns were dissected, stained with Dapi, mounted, and imaged. Fat body nuclei were counted using Fiji Cell Counter. Based on preliminary data, we observe a statistically significant difference in the number of fat cells in Upd1 and Upd2 knockdowns compared to the wild-type. We conclude that Upd 3 knockdowns exhibit milder phenotypes than Upd1 or Upd2 knockdowns as evidenced by more glycogen storage and higher fat body cell numbers. These results suggest that Upd3 produced by the tumor has a stronger contribution to the cachexic phenotypes than Upd 1 or Upd2.

Does Tumor-Produced TEP3 and PGRP-SA activate a host innate immune response in *Drosophila melanogaster* tumor-bearing larvae?

I. Perez

Advisor: M. Atkins

This study uses a *Drosophila melanogaster* *Ras*^{V12}; *scrib*^{RNAi} tumor model to investigate candidate genes responsible for remote Toll pathway activation, as part of continued research into tumor-host interactions. It is known that Toll receptors recognize pathogen-associated molecular patterns. Two proteins established to be upstream regulators of the Toll pathway are PGRP-SA and TEP3- their role is previously established as direct recognition of non-self pathogens. A previous study demonstrated, in the absence of non-self-pathogens, the Toll Pathway is remotely activated in the fat body of *Drosophila* larvae with tumors (Parisi et al. 2014). Based on prior data gathered in the Atkins lab, it is established that the potential Toll activating molecules TEP3 and PGRP-SA are upregulated in the *Ras*^{V12}; *scrib*^{RNAi} tumor. These findings are the basis for this study's hypothesis that tumor-produced TEP3 and PGRP-SA trigger Toll pathway activation in the fat body and that this activation influences tumor progression.

RNAi knockdowns of TEP3 and PGRP-SA investigated each gene's relative effects on Toll pathway activation in the fat body. GFP reporter of Toll activation was used, Drs-GFP. The effects of the RNAi knockdown on tumor survival, proliferation and invasiveness were assessed using DCP-1, PH3, and MMP-1, antibody staining, respectively.

We observed decreased cell death, increased proliferation, and increased invasiveness. These results suggest that TEP3 and PGRP-SA produced by the tumor may stimulate an anti-tumoral response from the host. Despite observed change in tumor morphology, no significant way to quantify the tumor size difference has been established. Future work will determine if that response relies on Toll activation in the fat body.

Ebf1 GST Fusion Proteins Protocol & Pull Down's

K. Ibarra, A. Gutierrez, Z. Bailey, H. Jenkins, Y. Martinez

Advisor: M. Griffin

Introduction: In the well-established association between obesity and chronic inflammation in adipose tissue, although the end product (Obesity) and its continued progression is known, the initial "trigger" of inflammation remains unclear. In prior work, Early B-Cell Factor (Ebf1) protein has been shown to be a potent factor in regulating the metabolic complications of obesity, with Ebf1 knockdown leading to impaired expression of several major components of the insulin signaling pathway. In order to further elucidate effects of Ebf1 on the inflammatory cascade, this research sought to produce viable GST fusion proteins in bacteria.

Methods: Using E.Coli BL21 cells with recombinant plasmids encoding GST-fusion proteins various GST-Ebf1 deletion constructs were transformed into bacteria. Subsequent pull-down assays were performed using glutathione beads to purify several recombinant Ebf1 constructs. To determine the presence of GST-Ebf1 in transformed populations and to establish protocol, eluates were analyzed by SDS-PAGE to determine the presence and correct size of the fusion proteins.

Results: The protein gels showed successful generation of several Ebf1 fusion proteins for GST pull down assays.

Conclusions: The generation of viable Ebf1 GST fusion proteins in bacteria will allow further exploration into Ebf1 interaction domains which may be needed to develop novel anti-inflammatory agents. The next phase of the project will involve incubating our verified GST-Ebf1 deletion proteins with a recombinant Myc-Ebf1 "prey" protein to validate the use of this technique for protein-protein interaction studies. Further studies with suspected Ebf1 protein partners will continue to elucidate the role of Ebf1 in adipose inflammation.

Effect of Neuropsychiatric Medications on Gut Microbiome

I.Ali

Advisor: O. Kelly

Introduction: A *bidirectional* connection between the GI tract and CNS exists, termed the “gut-brain axis.” Mechanisms of this relationship include modulation of neurotransmitter secretion by bacterial metabolic byproducts that affect pain perception and cognition. Gut dysbiosis has been identified in Parkinson’s, depression, autism, chronic pain, post-op delirium, addiction, and sleep disorders. According to previous studies, medications that act primarily on GABA and NMDA receptors have changed the intestinal microbiota diversity. However, there is limited data on the particular bacterial phyla most affected. The effects of CNS-targeting medications (isoflurane, midazolam, propofol, morphine, methadone, succinylcholine, rocuronium, ketamine, psilocybin, MDMA, LSD, and GHB) on intestinal microbiota is also poorly understood.

Methods: To investigate the acute effect, and repeated effect, of CNS mediations, mice will be randomly assigned to four intervention groups: the first will receive one dose, the second group will receive a placebo, the third will receive daily doses and the fourth group will receive a daily placebo. Fecal samples will be assessed pre- and post-administration at 1-day, 2-days, 1-week, and 2-weeks via 16s rRNA gene sequencing.

Anticipated results: A shift in intestinal microbiota diversity will result from medications that target the CNS, the effect will be more pronounced in mice given repeated doses.

Conclusion: By identifying changes in the intestinal microbiota diversity, earlier diagnosis of dysbiosis and its negative consequences may occur. Future work will include the development of psychobiotics (a class of probiotics with mental health benefits) which could be used in conjunction with administration of CNS medications.

In-vitro Characterization of the Release Profile Models of Novel Cannabidiol Formulations Using Cryopreserved Cadaveric Skin Mounted in Franz Diffusion Cells

L. Zhan

Advisor: H. Abdelhady

Introduction: Transdermal cannabidiol (CBD) is gaining traction as an analgesic. Transdermal delivery has advantages over other systemic administration routes: rapid onset, reduced first-pass metabolism, reduced toxicity risks, and uniform pharmacokinetic drug profiles. This study aims to characterize diffusion profiles of novel transdermal CBD formulations using Franz diffusion cells to elucidate the effect of a long-chain fatty acid emulsion on CBD molecular kinetics.

Methods: 250µm-thick cryopreserved, cadaveric arm skin samples from a certified skin bank will be thawed at ambient temperature. Prior to use, skin integrity will be confirmed through impedance measurements and permeation studies. A 2x2cm² skin sample will be clamped between the donor and receptor portions of a Franz diffusion cell and maintained at human body temperature and pH. A one-time, 48-hour dose of one novel formulation will be applied to the stratum corneum. Samples will be collected from the receptor chamber at set time points under sink conditions; a stir bar in the receptor chamber ensures media homogeneity. Diffusion studies will be performed six times per novel formulation.

Anticipated Results: Samples of each formulation will be analyzed with HPLC-MS to detect the amount of CBD released over time. A permeation profile will be generated per diffusion study and compared to the control.

Conclusions: The anticipated results of this study have implications on the design and use of transdermal CBD to treat pain. Future directions include further comparisons between formulations at different temperatures, skin types, and skin locations to better characterize the release profiles of these novel formulations.

Quantifying Ultrasound and Micro-CT Imaging of Cranial Suture Anatomy and Related Trauma

P. Martin, S. Baker, Z. Rasheed

Advisor: P. Lewis

Introduction: The anatomy of human cranial sutures is sparsely documented in the literature, as are the effects of trauma on sutures. Recent work on sutures using micro-CT suggests suture anatomy may alter when subject to trauma. Ultrasound (US) may offer advantages to micro CT for understanding the impacts of trauma on sutures regarding cost, portability, and radiation exposure. Our goal is to determine if US data are comparable to micro CT data for the analysis of cranial suture anatomy and the impact of trauma on that anatomy.

Methods: Our sample consisted of six skulls from the Southeast Texas Applied Forensic Science Facility; two with blunt force trauma, two with gunshot wounds, and two were controls with no known trauma. A GE Versana Active Ultrasound System with a GE L6-12-RS linear probe was used to image the coronal, sagittal, and lambdoid sutures. Qualitative data were evaluated for the presence or absence of sutures on US images. Presence was defined as an irregular anechoic gap through the periosteum, cortical bone, and medullary bone. Sutures were determined absent if no anechoic gap was observed.

Results/Anticipated Results: We expect a greater prevalence of cranial suture diastasis in specimens with known trauma when compared to controls.

Conclusion: This study builds upon works identifying suture diastasis in specimens with cranial trauma. Ultimately, we aim to determine if US offers a clinical diagnostic imaging modality comparable to micro CT data for the analysis of cranial suture anatomy and trauma. Future studies will quantitatively compare US to micro CT imaging.

Oral

O1

Application of Osteomyelitis Classification Systems in Skeletal Samples

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Adult cases of osteomyelitis, or an infection in bone, are most frequently observed in the tibia, although other long bones and vertebrae are also commonly affected. Expedient evaluation of the infection is critical to prevent bacteremia and possible amputation of an affected limb; however, a lack of universal agreement on diagnostic criteria has led to the creation of 13 classification systems. These systems are intended to aid in the description, management, and/or prognosis of osteomyelitis patients, primarily relying upon clinical symptoms and medical imaging. This research tested the application of the most common osteomyelitis classification systems to dry bone, using the Southeast Texas Applied Forensic Science Facility Skeletal Collection. Eleven individuals were identified as having at least one bone that exhibited characteristics of osteomyelitis (6 tibiae, 3 femora, 1 fibula, and 1 clavicle). Each was scored according to the Cierny-Mader, Weiland, Waldvogel, Kelly, and Romano systems, as these are widely known classification systems that provide a descriptive or etiologic explanation. Classification systems that focused on pediatric populations or soft tissue examination were excluded from this study. The Romano system uses the largest number of criteria to grade osteomyelitis, providing more criteria that could be applied to skeletal samples and therefore providing the highest level of description. Three case studies are included to highlight the benefits and limitations of each classification system, as well as demonstrate characteristics observable on dry bone that may affect the treatment and progression of osteomyelitis which may not be fully appreciated through traditional imaging.

O2

Comparing Two Methods of Calculating Acute: Chronic Workload Ratio on Girls, Youth Volleyball

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Monitoring training load using acute: chronic workload ratio (ACWR) enables coaches to maximize fitness potential while mitigating injury risks. There are two methods of determining ACWR: rolling average (RA) and exponentially weighted (EWMA). Female high school volleyball athletes play year-round, participating in a high school season (HSVB) and a club season (CVB) This study aimed to 1) compare changes in kinetic energy (KE) output in youth female athletes ($n = 24$) during the HSVB and CVB seasons, and 2) evaluate the agreement in RA and EWMA ACWR calculation methods during the high school and club seasons. Weekly load was measured using a wearable device and both the RA and EWMA ACWR were calculated using KE as the primary metric. A repeated-measures ANOVA assessed both the HSVB and CVB datasets for weekly differences and a repeated measures correlation was used to evaluate the agreement between the two ACWR methods. The HSVB data showed spikes in ACWR at the onset of the season and during one week at mid-season ($p = .001-.015$), whereas the CVB data had greater training load variations throughout the season ($p < .05$). Both datasets showed moderate correlations between the two ACWR methods (HSVB: $r = .756, p < .001$; CVB: $r = .646, p < .001$). This suggests that both methods can be used as a monitoring tool, but more research is needed to investigate which method is more appropriate for training and competition that does not follow a consistent schedule like that of CVB.

Novel Partial MBD5 Duplication in a Patient Expands and Refines the Phenotypic Spectrum of 2q23.1 Duplication Syndrome

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MBD5-associated neurodevelopmental disorder (MAND) includes duplications, deletions, and single nucleotide variations involving the *MBD5* gene located at chromosome 2q23.1. This group of disorders are clinically characterized by intellectual disability, motor delay, developmental delay, seizures, speech impairment, and autistic-like features. In this study, we describe a 6-year-old patient with one of the smallest reported 2q23.1 duplications that presented with developmental delay, language delay, and mild cerebellar features. The patient's clinical features and duplication location were compared to other reported patients in PubMed, ClinVar, and Decipher with *MBD5* duplications. Additionally, the patient's *MBD5* mRNA levels were also compared to three controls through quantitative-PCR. The patient's expression of *MBD5* mRNA was increased while the three controls had normal levels. Our findings support *MBD5*'s classification as a dosage dependent gene while expanding the clinical phenotype of 2q23.1 duplications to include motor delay, seizures, language impairment, infantile hypotonia, behavioral problems, craniofacial anomalies, and autistic-like features. Our contribution towards the characterization of 2q23.1 duplication will assist clinicians in identifying and diagnosing patients with this syndrome.

Re-Evaluating the Binge Eating Scale Cut-Off Using DSM-5 Criteria: Analysis and Replication in Presurgical Bariatric Surgery Samples

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Background: Binge eating disorder (BED) is associated with poorer outcomes in bariatric surgery. A measure used to screen for BED is the Binge Eating Scale (BES). A BES cut-off score of >17 is suggested for screening patients who have a high likelihood of meeting BED. The DSM-5 lowered the threshold for meeting criteria for BED, and classification accuracies of the BES need to be re-evaluated.

Methods: 1,133 patients seeking bariatric surgery were randomly split into two samples for validation and replication. The validation sample yielded 561 patients (30.1% men, 35% non-White). The replication sample yielded 572 patients that were demographically similar to the first random split sample (e.g., 25.3% men, 34.4% non-white). Patients were evaluated by psychologists for BED using a semi-structured clinical interview. Afterwards, patients completed the BES. Classification accuracies were calculated in both samples to evaluate the optimal cut-off score for the BES.

Results: 13.5% of patients met DSM-5 criteria for BED in the validation sample and 13.8% met criteria for BED in the replication sample. Lowering the interpretative cut-off to >15 on the BES yielded sensitivity values of >.72, specificity values of >.67, and accurate classification of BED in >.70 of cases across both samples – which were better than classification statistics at the traditional cut-off.

Conclusions: When using DSM-5 criteria for BED, BES cut-off scores need to be lowered to 15 for interpretation. Modifying the BES cut-off score will allow for a more accurate and sensitive screening in patients seeking bariatric surgery who also present with BED.

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