



NEOMED **STUDENT RESEARCH** SYMPOSIUM

NOVEMBER 19, 2021

*Presented by NEOMED's Office of Research and Sponsored Programs
and Committee for Student Clinical Research*

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Students and Colleagues:

Welcome to the second annual Northeast Ohio Medical University Student Research Symposium (2021). This symposium is an annual event that showcases the diverse research activities of NEOMED's professional and graduate students. The research symposium is intended to allow students to showcase their research in a formal venue with presentation skills consistent with expectations of professional medical and research societies.

Congratulations to all of the student participants on your achievements and the quality of your research. Success in research and scholarship requires your determination and perseverance and - valuable guidance from supportive faculty mentors. The skills you have learned in conducting your research - including your definition of the research question, your strategy in collecting and organizing information and data relevant to answering that question, plus your abilities to evaluate and apply the new knowledge you gained - will be useful in many facets of your careers and lives. Presenting and defending your research is the culmination of the research process.

Faculty mentors - thank you for your time, talent and support of the students. I also extend a special thanks to the Committee for Student Clinical Research for co-sponsoring this event and for the tireless efforts of the coordinating committee to configure a meaningful symposium. Your time and expertise have been invaluable. I know that students participating in the research symposium will find this to be a valuable experience and will gain important feedback related to their projects.

Again, thanks to all participants and attendees. I hope you enjoy the Student Research Symposium.

Best wishes for your continued success.

Sincerely,

A handwritten signature in blue ink that reads "Steven P. Schmidt". The signature is written in a cursive, flowing style.

Steven P. Schmidt, Ph.D.

Vice President for Research

Dean of the College of Graduate Studies



Northeast Ohio
MEDICAL UNIVERSITY

Student Research Symposium Program

November 19th, 12:30 - 4:30 pm

12:30 - 12:35 PM: WELCOME AND OPENING REMARKS

President John Langell, M.D., PH.D., M.P.H., M.B.A.

12:35 - 12:50 PM: THE VALUE OF RESEARCH

Introductions: Raman Bhambra and Andrew Alejo (M2)
COM: Gordon Hong (M3)
COP: Raquel Fricker and Jamie Fries (P4)
COGS: Ernesto Solorzano Zepeda (PhD Candidate)

12:50 - 12:55 PM: OVERVIEW OF THE PROGRAM

Raman Bhambra and Andrew Alejo

12:55 - 1:00 PM: TRANSITION TO THE BREAKOUT ROOMS VIA ZOOM

Presentations are organized and coded based on the Session number and topic, the Breakout Room number, and order of appearance.

For example:

1-1-1: Session 1, Breakout Room 1, and Presentation 1

2-3-5: Session 2, Breakout Room 3, and Presentation 5

Attendees, please follow the program book and abstract guide to find the presentations you wish to attend. You may enter and leave any of the four Breakout Rooms in a single session.

All presentations are 3 minutes long with a brief transition from one presentation to the next within the same Breakout Room. All presentations in each Breakout Room will be shown first, followed by an 8-minute Q and A (or longer if time permits) so that attendees can ask the presenters questions about their research. Approximately 1-2 brief questions can be asked for each presenter; if time permits additional questions can be posed.

All abstracts accepted have been confirmed to have a proper IRB/IACUC protocol in their study

1:00 - 1:40 PM: SESSION 1: ANATOMY & NEUROBIOLOGY

Presenters must be ready to begin at 1:00 pm in their respective ZOOM Breakout Rooms and leave by 1:40 pm.

Each presentation is 3 minutes with some transition time between presentations.

Once presentations have been delivered, there will be a 7-minute Q and A from attendees, or longer if time permits.

	Breakout Room 1	Breakout Room 2	Breakout Room 3	Breakout Room 4
	Foundational Orthopedics	Anatomical Sciences	Neurodegenerative Disorders	Neurodegenerative Disorders and Brain Injury
	Moderator: Alice Dalo	Moderator: Pratyusha Ghanta	Moderator: Gurkiran Singh	Moderator: Hannah Mann
1	1-1-1: The Anti-inflammatory Properties L-Plastin Mediates in the Pathogenesis of Osteoarthritis (Alejo)	1-2-1: Balance Dysregulation in an Infant Pig Model of Preterm Birth (Fan)	1-3-1: The Effect of Sleep Disordered Breathing on Cognitive Function in Patients with Normal Pressure Hydrocephalus (Bhambra)	1-4-1: Ultrastructural Changes in the Parietal Cortex are Attenuated with Triiodothyronine Nanoparticles in a Porcine Model of Cardiac Arrest (Beaver)
2	1-1-2: Lymphatic Secretome Negatively Regulates Bone Cell Differentiation and Function (Solorzano)	1-2-2: Structure-based Discovery of Potent NDM-1 Metallo Beta-lactamase Inhibitors for the Design of Novel Combinational Antibiotic Therapy (Hillyer)	1-3-2: Gender Differences in Distribution of Lewy Body Pathology in Individuals with Parkinson's Disease (Chanamolu)	1-4-2: Age-related Ultrastructural Changes across the Tonotopic Inferior Colliculus in Fischer Brown Norway Rats (Wawrzyniak)
3	1-1-3: The Effect of the ACTN3 Gene on Hindlimb Muscle Mass and Bone Strength (Andrade)	1-2-3: Oropharyngeal Capsaicin Application Alters the Biomechanics of Swallowing to Improve Swallow Safety in Infants (Edmonds)	1-3-3: Cholinergic Inputs to Ascending, Descending and Commissural Pathways that Terminate in the Inferior Colliculus (Fritz)	1-4-3: The Effect of Exercise on Motor and Non-motor Function in a Rat Model of Parkinson's Disease (Belmona)
4	1-1-4: The Expression of Apoptosis Inducing Factor Protein is Associated with Chondrocyte Apoptosis in Human and Mouse Model of Osteoarthritis (Ashruf)	1-2-4: Impact of Nipple Properties on Pharyngeal Function Term and Preterm Infant Feeding (Delahoz)	1-3-4: Melanopsin Ganglion Cell Morphology in the 3xtg Mouse Model of Alzheimer's Disease (AD) (Fusillo)	1-4-4: Ultrastructural Changes in the Hippocampus are Attenuated with Triiodothyronine Nanoparticles in a Porcine Model of Cardiac Arrest (Slabinski)
5	1-1-5: Osteoactivin as an Orthobiologic Factor for Spinal Fusion in an Osteoporotic Rat Model (Khalil)	1-2-5: Impact of Nipple Properties on Performance and Rates of Term and Preterm Infant Feeding (Bontrager)	1-3-5: Etiology of Sex Differences in Alzheimer's Disease: Migraine as a Risk Factor (Hoyt)	1-4-5: Migraine as a Risk Factor for Alzheimer's Disease: Evaluation of Panx1 Channel Activation (Brooks)
6	1-1-6: In Silico Modeling of Achilles Tendon Function in Running Humans: Effects of Foot Geometry, Speed, and Gait (Dubé)	1-2-6: "Hey, I'm Just Big Boned!": Bone Mechanical Properties in Mice Raised on a High-fat diet (James II)	1-3-6: Identification of Developmental Factors Contributing to Alzheimer's Disease Sex Differences (Marsico)	1-4-6: mRNA for Glutamate Decarboxylase (GAD) Changes with Age in the Low Frequency Auditory Midbrain (Koehler)
7	1-1-7: Sequential Delivery of RNR Inhibitors in Cervical Cancer Treatment (Bell)	1-2-7: Transoral Laryngeal Reconstructive Surgery for Vocal Cord Paralysis in Adduction: A Case Report (Chanamolu)	1-3-7: Association of Blood Brain Barrier Glycosaminoglycan Profile and Amyloid Beta Protein Accumulation in Alzheimer's Disease (Foresi)	1-4-7: Separate Origins of Commissural and Intrinsic Circuits in the Inferior Colliculus (Cox)

1:40 - 1:45 PM: 5 MINUTE BREAK AND TRANSITION TO SESSION 2

1:45 - 2:25 PM: SESSION 2: CLINICAL INVESTIGATIONS, INTERVENTIONS & PATIENT CARE

Presenters must be ready to begin at 1:45 pm in their respective ZOOM Breakout Rooms and leave by 2:25 pm.

Each presentation is 3 minutes with some transition time between presentations.

Once presentations have been delivered, there will be an 8-minute Q and A from attendees, or longer if time permits.

	Breakout Room 1	Breakout Room 2	Breakout Room 3	Breakout Room 4
	Clinical Investigations and Interventions	Clinical Investigations and Innovations	Primary and Mental Health Care I	Primary and Mental Health Care II
	Moderator: Katie Bretland	Moderator: Yusuf Khalil	Moderator: Vincent Pham	Moderator: Raman Bhambra
1	2-1-1: Patient Disposition and Resources Utilized for those Requiring Emergency Department Transfer (Septaric)	2-2-1: An Updated and Versatile Fracture Reduction Clamp Design for Orthopedic Surgeons (Alejo)	2-3-1: Student Wellness at NEOMED - A Survey on Burnout and Stressors (Dadlani)	2-4-1: Benefit versus Risk of Methocarbamol Use in Older Patients (Hensperger)
2	2-1-2: Effectiveness of Breast Recovery after Surgery Protocol Among African American Women (To)	2-2-2: Hand Sanitization Compliance Systems (Basdavanos)	2-3-2: Comparing the Mental Health of Medical School Population to a General Student Population (Adik)	2-4-2: Understanding Obesity Attitudes and Knowledge in Health Sciences Students (Quedding)
3	2-1-3: Impact of CFTR Modulator Therapy on Nutritional Status, Hepatic Steatosis, and Dyslipidemia in Patients with Cystic Fibrosis (Sundaram)	2-2-3: A Homologous Alternative to Reduce Spinal Fusion Revisions: Saccavi (Robinson & Solorzano)	2-3-3: METRIC Hypertension Performance Improvement Project: An AAFP Sponsored Study (Fetterman)	2-4-3: Identification & Assessment of Factors Affecting Patient & Institution Satisfaction with Addiction Services of the South End Community Health Center (Aguilar)
4	2-1-4: Distal Embolization of Hydrophilic Polymer Gel After Tibial Artery Angioplasty: A Case Report and Review of the Literature (Petrinec)	2-2-4: Stress-Induced Mouse Model of the Cardiac Manifestations of Friedreich's Ataxia Corrected by AAV-mediated Gene Therapy (Salami)	2-3-4: Implementation of a Dietitian Screening Protocol in a Student Run Free Clinic (Marsico)	2-4-4: Perceived Value of Pediatric Palliative Care Home Visits by Caregivers (Richner)
5	2-1-5: Impact of Deprescribing Medication on 30-Day Readmission Rates in Older Adults with Traumatic Fall (Christman)	2-2-5: NEOvations Bench to Bedside Program Innovation: A Novel Casting Approach to Assess Open Fracture Wound Healing (Tubo & Foresi)	2-3-5: A Case of Fournier's Gangrene Following a Large-Volume Hydrocelectomy in a Diabetic Patient Managed with SGLT-2 Inhibitor Therapy (Leone & Barat)	2-4-5: Patients Feeling Heard Can Lead to Better Outcomes (Khaira)
6	2-1-6: Intrathecal Morphine Administration in Pediatric Patients Undergoing Selective Dorsal Rhizotomy: A Pilot Study (Goel)	2-2-6: Is HFpEF Caused by Coronary Microvascular Disease? (Sompalle & Domingo)	2-3-6: A Shortage of Urologists in Rural America: An Analysis of the American Urological Association Census (Krasnoschlik)	2-4-6: End of Life Care for the Sikh Patient (Singh)
7	2-1-7: Probability Analysis of Sequential SCFE (PASS score) (Singh)	2-2-7: Minimally Invasive Cable Grip System (Samson & Basdavanos)	2-3-7: Lung Herniation- A 62-Year-Old Male with a Rare Cause of Chest Pain in the Emergency Department (Lesh)	2-4-7: Novel Interventions to Reduce Fall Risk in Geriatric Patients (Arnold)
8	2-1-8: Inappropriate Prescribing Patterns of Loop Diuretics in a Nationally Representative Outpatient Population (Smearman)	2-2-8: Diagnosis of Metaplastic Synovial Cysts in Clinical Dermatology (Vora)	2-3-8: A Case of Successfully Treated Urethral Condyloma Acuminatum in a Woman Utilizing Self-Application of 5-Fu via a Q-Tip (Leone)	2-4-8: COVID-19 and Mental Health in a Rural Population (Jinka)

2:25 - 2:30 PM: 5 MINUTE BREAK AND TRANSITION TO SESSION 3

2:30 - 3:10 PM: SESSION 3: SYSTEMS & TRANSLATIONAL SCIENCES

Presenters must be ready to begin at 2:30 pm in their respective ZOOM Breakout Rooms and leave by 3:10 pm.

Each presentation is 3 minutes with some transition time between presentations.

Once presentations have been delivered, there will be an 8-minute Q and A from attendees, or longer if time permits.

	Breakout Room 1	Breakout Room 2	Breakout Room 3	Breakout Room 4
	Systems Sciences	Pharmacology	Translational Models I	Translational Models II
	Moderator: Parker Kelly & Christina Koehler	Moderator: Vindya Perera	Moderator: Scott Everett & Andrew Alejo	Moderator: Varun Nagendra
1	3-1-1: Upregulation of Thrombospondin-1 Associates with Accelerated Atherosclerosis and Reduced SMC Differentiation in Metabolic Syndrome (Gupta)	3-2-1: Metabolomic Features Associated with Carboxylesterase 1 Activity: Biomarker Screening for Sacubitril Therapy Optimization (Lungu)	3-3-1: The Lysosomal Trafficking Regulator (LYST) Gene is Regulated Through FGF2 via an FGF-Receptor Signaling Mediated Pathway (Mirhaidari)	3-4-1: Study of Smooth Muscle Function by Localized Intradermal 6-Hydroxydopamine (6-OHDA) Sympathectomy (Sanchez Montejo)
2	3-1-2: Histone Acetylation Turnover is Altered in a Diet-induced NAFLD Mice Liver (Konka)	3-2-2: Evaluating the Role of Pharmacy Technician-Administered Vaccines in Ohio During the COVID-19 Pandemic (Merico)	3-3-2: Identifying the Multifactorial Therapeutic Mechanisms of Irisin Against Emerging Neuropathology in htau and 3xtg Mice (Bretland)	3-4-2: Age-Related Changes to the Bone of Bowhead Whales (Tubo)
3	3-1-3: The Effect of Chemotherapy and Radiation on Spinal Gliomas (Pham)	3-2-3: A Rational Strategy for Characterizing the Beta-Lactam Antibiotic-Induced Multidrug Resistance Patterns (Aguirre)	3-3-3: An Organ-On-Chip Neuronal Model (Galbraith)	3-4-3: Impact of Nipple Properties on Oral Function in Term and Preterm Infant Feeding (Kerkvliet)
4	3-1-4: Doxorubicin-induced Cardiomyopathy: Prevention and Treatment of Doxorubicin-induced Cardiomyopathy (Kim)	3-2-4: Carboplatin Medication Use Evaluation (Daghlasyusuf)	3-3-4: Study of Maternal Behavior and Oxytocin through Mouse Model (Ananth)	3-4-4: Assessment of 3D-Printed PLA Scaffolds as a Platform for Bone Delivery of Gallium Acetylacetonate (GaAcAc) (Ghanta)
5	3-1-5: Mitochondrial Heme Lyase Mediates the Cardiac Resilience to Ischemia and Reperfusion (Wolff)	3-2-5: Macrolide Prescribing Patterns for Preventing Exacerbations of Chronic Obstructive Pulmonary Disease (COPD) in a National Representative Outpatient Population (Ganios)	3-3-5: The Detrimental Effects of Low Aerobic Capacity on Bone Metabolism (Solorzano)	3-4-5: Distraction Vector Along the Posterior Border of the Ramus Corrects the Underlying Mandibular Discrepancy Robin Sequence (Franson)
6	3-1-6: The Vascular Basis of Takotsubo Syndrome (Choban, Godel & Martin)		3-3-6: Using PET/CT Imaging to Monitor Chemotherapy-Induced Vascular Toxicity in Pediatric, Adolescent, and Young Adult Lymphomas (Deep)	3-4-6: Early-Life Stress Disrupts Amplitude Modulation Detection in Gerbils (Srinivasan)
7	3-1-7: The Role of SDF-1/CXCR4 Axis in Diet-Induced Diabetic Cardiomyopathy (Orozco)		3-3-7: Cardiovascular Function in GDF 11 Knockout Mice (Mokkapati)	3-4-7: Circadian Disruption in 3xTg Alzheimer's Disease Mice (Dey)
8			3-3-8: Mechanisms of Prolonged Auditory Maturation in Adolescence (Yerigeri)	3-4-8: Reverse Dynamization Accelerates Distraction Osteogenesis Regenerate Bone Maturation in a Large Animal Model (Singh)

3:10 - 3:15 PM: 5 MINUTE BREAK AND TRANSITION TO SESSION 4

3:15 - 3:55 PM: SESSION 4: EDUCATION & SPECIALTY MEDICINE

Presenters must be ready to begin at 3:15 pm in their respective ZOOM Breakout Rooms and leave by 3:55 pm.

Each presentation is 3 minutes with some transition time between presentations.

Once presentations have been delivered, there will be an 8-minute Q and A from attendees, or longer if time permits.

	Breakout Room 1	Breakout Room 2	Breakout Room 3	Breakout Room 4
	Quality Improvement and Evaluation	Education and Program Evaluation	COVID-19	Specialty Medicine I
	Moderator: Taylor Yamamoto	Moderator: Meghana Chanamolu	Moderator: Ernesto Solorzano Zepeda	Moderator: Nino Kovaljesko
1	4-1-1: Is Pregnancy a Risk Factor to Developing Postoperative Nausea and Vomiting? (Kanaparthy)	4-2-1: Clarifying Code Status via Patient Education (Dryer)	4-3-1: Impact of the COVID-19 Pandemic on Pediatric Emergency Department Utilization for Head Injuries (Satoskar)	4-4-1: Language, Race, Ethnicity, and Insurance-Related Disparities in Blepharoptosis Surgery (Dalo)
2	4-1-2: Examination of Advance Care Planning Policy Using the PZL Model (Cervantes)	4-2-2: Staff Education in Diversity and Implicit Bias at a Federally Qualified Health Center (Schnall)	4-3-2: Improving Risk Prediction for Pulmonary Embolism in COVID-19 Patients using Echocardiography (Satoskar)	4-4-2: Sunscreen Utilization Among Medical Students (Ganios)
3	4-1-3: Economic Challenges to Medication Adherence in Urban Populations and Providers' Efforts to Address Patient Barriers (Kaminski)	4-2-3: Diabetic Group Visits: Methods and Impact on Patients (Winebold)	4-3-3: Assessment of the COVID-19 Pandemic on Skin Cancer Incidence as a Quality Improvement Initiative (Goff & Murali)	4-4-3: A Sarcoma Stem Cell Model for Studying Chemoresistance in Human Osteosarcoma (initial stages) (Gallogly & Wong)
4	4-1-4: Improving Routine Cervical Cancer Screening Rates at My Community Health Center: A Quality Improvement Proposal (Ward)	4-2-4: Health Professions Students' Perceptions of and Experiences with Philanthropy (Perera)	4-3-4: The Effects of Inducible SARS-CoV-2 Spike Protein Expression in Human iPS Cardiomyocytes (Murali)	4-4-4: Geriatric Patients with Periorbital Trauma Have a Higher Probability of Death in Five Year Follow Up (Pham)
5	4-1-5: Qualitative Analysis of Health Equity in Portage County, OH (Chalasan & Cuizon)	4-2-5: Rural Patient Education: The Importance of Newborn Hearing Screenings (Cox)	4-3-5: Covid-19 and Central Line Associated Bloodstream Infection (CLABSI): A Single Tertiary Center Experience (Schweibinz)	4-4-5: Sacral Insufficiency Fracture in Third Trimester of Pregnancy: A Case Report (Seif)
6	4-1-6: Improving Patient Engagement with Online Health Portals (Whetstone)	4-2-6: Health Literacy, Perceptions, and Preferences for Muslims: Mosque-Based Study in Central Ohio (Alhashim)	4-3-6: Risk of Thromboembolic Events in COVID-19 Patients (Fricker & Fries)	4-4-6: Is Undergoing General Anesthesia Safe During Pregnancy? (Kanaparthy)
7	4-1-7: Pilot Program Implementing Exercise and Nutrition Zoom Sessions and Impact on Lifestyle Factors in the Hispanic/Latino Community in Akron, Ohio (Aguilar & Houston)	4-2-7: Demographic, Treatment, Clinical, and Socioeconomic Determinants of Patient Satisfaction post-Breast Surgery (Lowden)	4-3-7: Initial COVID-19 Treatment Project: An AAFP Sponsored Study (Paolucci)	4-4-7: Electrode-to-Modiolus Distance in Round Window versus Cochleostomy Surgical Approaches: A Meta-Analysis (Jinka)
8	4-1-8: Chart Review to Inform Understanding of Ulceration Recurrence Associated with Remote Foot Temperature Monitoring (Grasso)	4-2-8: Anatomy Academy: Assessing the Participant Experience of an Immersive Medical Education Outreach Program (Tang & Tam)	4-3-8: Population-level Analysis of COVID-19 in Ohio (Adik)	4-4-8: Efficacy of Conventional Therapies for Perianal Fistulizing Disease in patients with Ileal Pouch Anal Anastomosis (Pedersen)

3:55-4:00 PM: 5 MINUTE BREAK AND TRANSITION TO SESSION 5

4:00 - 4:20 PM: SESSION 5: CAREERS & SPECIALTY MEDICINE

Presenters must be ready to begin at 4:00 pm in their respective ZOOM Breakout Rooms and leave by 4:20 pm.

Each presentation is 3 minutes with some transition time between presentations.

Once presentations have been delivered, there will be a 4-minute Q and A from attendees, or longer if time permits.

	Breakout Room 1	Breakout Room 2
	Career Pathways	Specialty Medicine II
	Moderator: Adam Awad	Moderator: Zachary McCalla
1	5-1-1: Transparency in the Ophthalmology Residency Match: Study and Medical Student Perspective (Markle)	5-3-1: Skincare from the Inside Out: A Pilot Project Addressing Social Determinants of Health through Dermatology (Kimball)
2	5-1-2: Evaluating the Health Humanities as Essential Curriculum (Colvis, Schnall & Saleh)	5-3-2: Hearing Preservation in Round Window versus Cochleostomy Surgical Approaches: A Meta-Analysis (Avasarala)
3	5-1-3: A Descriptive Analysis of Neurosurgery Residency Programs' Website Data (Palmer)	5-3-3: Pediatric Odontogenic Tumors: A Perspective on Management (Lele)
4		5-3-4: Impact of Obesity in Reduction Mammoplasty (Petrinec)

4:20 - 4:30 PM: CLOSING REMARKS

Steve Schmidt, Ph.D., Vice President, Research and Sponsored Program, Dean College of Graduate Studies

Foundational Orthopedics

1-1-1

The Anti-inflammatory Properties L-Plastin Mediates in the Pathogenesis of Osteoarthritis

Andrew Alejo MMAS, Nazar Hussein PhD, Hope Ball PhD, Fayez Safadi PhD*

Osteoarthritis is by far the most prevalent arthritic joint disorder that is considered chronic and strongly associated with aging. Chondrocytes are the cells responsible for maintaining the homeostasis of the extracellular matrix of joints by producing its major components, collagen and proteoglycans. During osteoarthritis, matrix metalloproteinases and interleukins are largely upregulated and lead to the breakdown of this cartilage extracellular matrix. L-Plastin (LPL) is an actin-bundling protein essential for actin regulation in eukaryotes. We explored the role LPL plays in osteoarthritic inflammation. Chondrocyte cell and mice femoral head cultures were examined by inducing inflammation. Inflammatory marker levels were assessed in cases of inhibition and knock-out LPL. Arthritis was surgically induced using the destabilization of the medial meniscus (DMM) surgical model. This was followed by euthanization, tissue collection, histological assessment, and grading of cartilage degradation. LPL knock-out and LPL inhibitor groups in the mice femoral head explant culture had less inflammatory marker expression post inflammation-induced treatment. The LPL knock-out mice also displayed less cartilage damage in the DMM-induced osteoarthritis model compared to the wild-type via significantly lower grading scores. LPL's role in osteoarthritis has not been reported previously. When LPL was knocked-out or inhibited, proinflammatory marker expression and cartilage degradation was significantly decreased. Taken together, these data indicate that LPL may act as an anti-inflammatory by reducing proteoglycan loss in articular cartilage, similar to the pathogenesis of osteoarthritis.

1-1-2

Lymphatic Secretome Negatively Regulates Bone Cell Differentiation and Function

Ernesto Solorzano Z. BS, Takhar Kasumov PhD, Michael Kelly PhD, Fayez Safadi PhD*

Complex lymphatic anomalies (CLA) are rare conditions characterized by abnormal lymphatic

invasion in bone. Under normal conditions, lymphatic vessels and bone do not come in contact with each other. Gorham-Stout Disease (GSD) is an aggressive type of CLA characterized by its regional and aggressive invasion of cortical bone, thus making it "disappear". Lymphatic endothelial cells (LECs) and their secretome content are likely both crucial to lymphatic migration into the bone and the cortical destruction seen in GSD. For this study, we treated bone cells with LEC-conditioned medium (L-CM) and Semaphorin-3F (SEMA3F) and assessed their differentiation and function. Osteoblast MC3T3 cells were differentiated while treated with L-CM. Osteoblast differentiation was assessed at days 7, 14, and 21. Murine hematopoietic stem cells (IACUC approved) were differentiated into mature osteoclasts while treated with L-CM over a 10-day period. Osteoclasts were assessed for differentiation, activity, and function. For RNA isolation, LEC gene expression was assessed via RT-qPCR analysis. L-CM treatment was found to inhibit osteoblast viability, proliferation, and differentiation while stimulating osteoclast differentiation and function. SEMA3F gene expression was upregulated, while VEGF-C was downregulated in rapamycin treatment diminished LEC viability in a dose-dependent manner. Our study revealed the lymphatic secretome leads to a decrease in osteoblast differentiation and function, while accelerating osteoclast maturation and function. We provide evidence that direct interaction between lymphatics and bone leads to bone loss in vitro and how SEMA3F might be a possible treatment/biomarker for patients with CLA.

1-1-3

The Effect of the ACTN3 Gene on Hindlimb Muscle Mass and Bone Strength

Verushqa Andrade MMAS, Peter Houweling PhD, Jesse Young PhD, Chris Vinyard PhD*

We evaluated the relationships among the ACTN3 gene, hindlimb muscle mass, and tibial and femoral mechanical properties in a house mouse model. ACTN3 encodes for the α -actinin-3 protein, a major structural component of skeletal muscle. Though the effects of ACTN3 gene on muscle composition and athleticism have been extensively studied, previous studies have not evaluated the influence of ACTN3 on bone material properties and performance. Here, we

compare hindlimb muscle mass, femoral and tibial cross-sectional area and strength in cadaveric α -actinin-3 deficient mice relative to wild-type controls with similar C57BL/6 backgrounds. We dissected triceps surae muscles and femora and tibia from ACTN3 knockout (n=16) and control mice (n=30 from two sources). We weighed triceps surae muscles. We scanned the femora and tibia via μ CT and conducted three-point bending tests to assess bone mechanical properties. Based on our current understanding of the ACTN3 gene, we hypothesized α -actinin-3 deficient mice will have reduced muscle mass and bone load-resistance abilities compared to controls. As predicted, triceps surae mass and bone material properties were reduced in the ACTN3 knockout mice compared to controls, but only in female mice (P<0.05). Overall, these findings partially support the hypothesis that there is an association between ACTN3 and reduced muscle mass and bone resistance abilities. The sex-specific link of ACTN3 to femoral performance in female mice requires further study.

1-1-4

The Expression of Apoptosis Inducing Factor Protein is Associated with Chondrocyte Apoptosis in Human and Mouse Model of Osteoarthritis

Omer Ashruf BS, Mohammad Yunus Ansari PhD, Tariq M Haqqi PhD*

Osteoarthritis (OA) is the most common type of degenerative joint disease, affecting over 30 million people in the United States. Increased chondrocyte apoptosis has long been linked to OA pathogenesis, but the precise mechanism remains unknown. We investigated the role of the apoptosis inducing factor (AIF) protein in the regulation of chondrocyte apoptosis. The expression of AIF in human and mouse cartilage was determined by immunohistochemistry (IHC) for protein levels and RT-qPCR for mRNA levels. Chondrocytes were prepared from the knee joint of 4-5 week old C57BL6 mice and maintained in DMEM/F12 supplemented with 10% serum and treated with H₂O₂ for 24 hours. The supernatant was collected to determine cell death by estimating the Lactate Dehydrogenase (LDH) release. The localization of AIF was determined by

immunofluorescent staining and confocal microscopy. The expression of AIF in chondrocytes was confirmed by immunoblotting. Immunofluorescent staining showed mitochondrial localization of the AIF protein in chondrocytes. AIF protein expression was high in the damaged areas of human OA cartilage and in the knee joint of mice with surgically-induced OA as determined by IHC and RT-qPCR. H₂O₂ (50 μ M) treatment increased mitochondrial network fragmentation, nuclear translocation of AIF and apoptosis in HT94 cells and primary mouse chondrocytes. Our findings indicate that AIF protein expression is significantly higher in damaged areas of human OA cartilage and mouse destabilization of the medial meniscus (DMM) joints, implying that AIF may be involved in the regulation of chondrocyte apoptosis during OA progression.

1-1-5

Osteoactivin as an Orthobiologic Factor for Spinal Fusion in an Osteoporotic Rat Model

Yusuf Khalil BS, Hope Ball PhD, Andrew Alejo MMAS, Trinity Samson BS, Thomas Mbimba PhD, Fayeze Safadi PhD*

Complications have led surgeons to consider the use of orthobiologic agents to stimulate bone regeneration. Here, we investigated the potential use of Osteoactivin (OA), a protein known to have osteoinductive properties in vitro and in vivo, for spinal fusion in a postmenopausal osteoporotic rat model. Sprague-Dawley rats (n=160) were ovariectomized to surgically-induce post-menopausal osteoporosis, confirmed by estrogen levels and micro-computed topography (μ CT) analyses. Animals were randomized into 5 groups: PBS (control), autologous bone graft, recombinant OA (rOA), OA peptide (OAp) and recombinant BMP-2 (rBMP-2). Groups received posterolateral interlaminar fusion at the L5-L6 segment. Animals were sacrificed 10-weeks post-surgery and spines assessed using μ -CT analyses. Three-dimensional spinal visualization showed successful spinal fusion and enhanced bone growth in rOA, OAp, rBMP-2 and autologous graft groups compared to control animals. Furthermore, in comparison to PBS-treated animals, those treated with rOA, OAp, rBMP-2 and autologous graft showed higher bone volumes, with the pOA group having the largest increase in trabecular segmentation. Interestingly, while the rOA and OAp groups demonstrated increased bone growth at the target

surgical sites, rBMP-2 treatment resulted in heterotopic ossification (HO) in areas close to the fusion site. OAp shows potential to increase bone formation and minimize deleterious side effects, making this an osteoinductive agent of interest for further investigation for potential clinical use.

1-1-6

***In silico* Modeling of Achilles Tendon Function in Running Humans: Effects of Foot Geometry, Speed, and Gait**

Michael Dubé BS, Adam Foster PhD, Jesse Young PhD*

Previous research suggests that Achilles tendon (AT) moment arm length is positively correlated with energy costs of locomotion at running speed. Foster et al. tested this hypothesis and found significant negative correlations between AT moment arm length, stress on the AT, and elastic energy storage. In this study, we use an *in silico* musculoskeletal model in OpenSim to explore the relationship between moment arm length and AT strain during running. Morphometrics and kinematic/force data were collected from n=7 human subjects and an *in vivo* AT strain was modeled using the inverse kinematics and computed muscle control toolkits of OpenSim. We calculated mean and peak strain values over stance phase and mean values during heel strike. The Campbell University IRB approved all study methods/procedures and informed consent was obtained prior to subject participation. *In silico* simulation demonstrated that mean and peak tendon strain is moderated by speed, with values increasing from walking at the lowest, and jogging at the highest. Unlike in Foster et al., results from this study show significant correlation between AT moment arm length and mean strain at heel strike in jogging gaits (Pearson's $r = -0.480$, $p = 0.036$). Overall, these data suggest a functional relationship between AT moment arm length and tendon strain. Differences in results between *in vivo* and *in silico* studies may be attributed to a smaller sample size for the modeling dataset, differences in how joint work was calculated, or the inability of the model to represent morphometric variation.

1-1-7

Sequential Delivery of RNR Inhibitors in Cervical Cancer Treatment

Paris Bell BS, Timothy Winschel BS, Moses O. Oyewumi BPharm, PhD*

Cervical cancer is the leading cause of premature morbidity and mortality in women worldwide. The efficacy of existing platinum chemotherapy with/without radiotherapy, linked to DNA damage, can be mitigated by DNA repair processes modulated by the ribonucleotide reductase (RNR) enzyme. The purpose of this study is to investigate effects of two RNR inhibitors (Hydroxyurea and Triapine) on cervical cancer cell viability and proliferation. Human cervical cancer lines (C33A and CASKI) were cultured and treated in the following groups: RNR inhibitors or radiation alone (2-6 Gy), RNR inhibitors applied at 1, 2 and 3 hours before radiation (4 Gy) (pre-treatment), and RNR inhibitors applied at 1, 2 and 3 hours after radiation (4 Gy) (post-treatment). The optimal sequence of RNR inhibition combined with radiation is evaluated using cell viability and colony formation assays. The feasibility of delivering RNR inhibitors via polymersome delivery systems is also investigated. Cell viability assays showed effective concentrations for different treatments: Triapine (11-15 μM), Hydroxyurea (15 μM) and radiation (4 Gy). Stable polymersome formulations with triapine or hydroxyurea were developed at concentrations ranging from 25 $\mu\text{g/mL}$ to 100 $\mu\text{g/mL}$. Data from viability assay indicated that 1 hour-pre-treatment caused the most cell death. However, all treatments resulted in a marked reduction in number of colonies for C33A and CASKI cells. Initial assessment of optimal sequence of RNR inhibition in cervical cancer treatment was conducted. Further studies are warranted to evaluate efficacy and application of RNR inhibitors.

Anatomical Sciences

1-2-1

Balance Dysregulation in an Infant Pig Model of Preterm Birth

T Fan BS, CJ Mayerl Ph.D., RZ German Ph.D., JW Young Ph.D.*

Preterm infants typically experience significant delays in motor development. The cause of such motor delays is currently unclear. Because human preterm infants

are fragile, we cannot collect the integrative physiological data needed resolve this issue. The goal of this study is to gather preliminary data on the biomechanics of postural development in an infant pig model of preterm human infants. Instantaneous center of pressure (COP) movement was measured on 14 preterm and 6 term pigs during feeding on two force platforms. We used MATLAB to measure the velocity, acceleration, path length, and total area of the COP during standing and analyzed these data in R using Principal Component Analysis (PCA) and Multivariate Analyses of Variance (MANOVA). The first and second PCA axes together accounted for 69% of COP variance. Loadings on these axes indicated orthogonal variation between COP size (i.e., areas and path length; axis 1) versus COP movement (i.e., velocities and accelerations; axis 2). MANOVA indicated that COP variation significantly differentiated term and preterm pigs ($P < 0.01$), principally driven by greater COP velocity and acceleration in term pigs (all $P < 0.01$). Results suggest that term pigs are able to correct disturbances in their balance more quickly, suggesting that preterm birth impacts motor development in infant pigs in a similar manner to human infants. Ongoing research with this model will continue to explore motor delays associated with preterm birth.

1-2-2

Structure-based Discovery of Potent NDM-1 Metallo Beta-lactamase Inhibitors for the Design of Novel Combinational Antibiotic Therapy

Trae Hillyer BS, Woo Shik Shin PhD*

Since the discovery of penicillin more than five decades ago, β -lactam antibiotics have been used in primary therapeutics to combat common bacterial infections. However, resistance to beta-lactam antibiotics via the expression of beta-lactamases has created numerous global public health problems. Metallo-beta-lactamases (MBLs) are zinc-containing carbapenemases that catalyze the hydrolysis of β -lactam antibiotics, rendering them ineffective against their target, penicillin-binding protein (PBP). Due to the lack of beta-lactamase inhibitors available for restoring existing beta-lactam antibiotic arsenals, there is an urgent need to develop alternative therapeutics against multidrug-resistant pathogens. Our fragment-based screening of a non-specific metal chelator library demonstrates our compound as a broad-spectrum, nanomolar inhibitor against MBLs.

Evaluation of lead compounds was continued with cell-based inhibition assays in combination with meropenem to determine minimum inhibitory concentrations and optimal antibiotic: inhibitor ratios. Five of the fourteen lead candidates repeatedly showed more than 70% inhibition at the enzyme level against NDM-1 MBL. The top two compounds, 1 and 4, reduced cell efficacy of NDM-1 (+) transformed *E. coli* by 80% and had respective EC_{50} values of 2.2 μ M and 1.1 μ M. These compounds also showed low toxicity in human kidney cell lines with CC_{50} values comparable to current antibiotics. In conclusion, our compounds retained high affinity for NDM-1 MBL in cell-based assays with low toxicity and remain promising lead candidates as a combinational therapy for multi-drug resistant pathogens. In addition, we will further investigate their specific mechanism of action and clinical efficacy through x-ray crystallography and *in vivo* approaches.

1-2-3

Oropharyngeal Capsaicin Application Alters the Biomechanics of Swallowing to Improve Swallow Safety in Infants

Chloe Edmonds BS, Rebecca German PhD, Laura Bond BS, Francois Gould PhD, Khaled Adjerid PhD, Kendall Steer, and Christopher Mayerl PhD*

Airway protection is an important aspect of infant swallow performance, as aspirated liquid may cause serious health problems including aspiration pneumonia. Therefore, it is important that infants are able to acquire and transport milk in such a way that a manageable liquid bolus is formed prior to swallowing. This could involve increasing the excitability of the internal branch of the superior laryngeal nerve (iSLN), which triggers the pharyngeal swallow and therefore has the capacity to limit boluses to sizes that can be safely swallowed. One possible method for upregulating iSLN activity is the application of capsaicin, which has been shown to alter oropharyngeal kinematics and improve swallow performance in adults. This method remains unexplored in infant populations, despite their predisposition towards dysphagia. Furthermore, the neurophysiological basis for improved swallow safety after capsaicin application is elusive and warrants additional research. To evaluate the effects of capsaicin in infants and further examine the iSLN's role in the neural control of the swallow, we recorded infant pigs with unilateral iSLN lesions via

videofluoroscopy. Each infant pig was recorded prior to and immediately following the application of a capsaicin solution to the valleculae and soft palate. We found that capsaicin changed the timing of the movements of oropharyngeal structures, decreased bolus size, and subsequently improved swallow safety. Our results suggest that enhancing the function of the iSLN with capsaicin may be a promising method for reducing bolus size and improving swallow performance in infants.

1-2-4

Impact of Nipple Properties on Pharyngeal Function Term and Preterm Infant Feeding

Christina Delahoz MAS, Rebecca Z. German, Christopher Mayerl*

Preterm infants are a vulnerable population who commonly experience problems with feeding. Because feeding is a sensorimotor process, varying sensory input has the potential to change feeding motor behavior. We varied sensory input by changing the material properties and hole size of nipples to determine their impact on the biomechanics of infant feeding in both term and preterm infants. We used high-speed, biplanar video fluoroscopy to examine the movements of radio-opaque markers that implanted in the hyoid and thyroid of three preterm infant pigs and six term infant pigs. We designed and built four nipples: two values of stiffness (material) and two-hole sizes. This allowed us to measure movement during the swallow at seven days old, comparing differences from varying nipple hole size and stiffness. There was no significant change observed in the hyoid kinematics of preterm pigs when using different nipple types. However, there was greater hyoid excursion in the terms when they were feeding on the nipples with larger holes compared to the nipples with smaller holes. Nipple stiffness did not impact terms feeding. Increasing nipple hole size only significantly impacted the term pigs, who showed greater hyoid and thyroid excursion during the pharyngeal swallow likely from a larger bolus size. Overall changing nipple material properties had limited impact on the pharyngeal function of both preterm and term infant pigs. More testing should be done to assess if adjusting other nipple properties can impact the pharyngeal function of preterm infants.

1-2-5

Impact of Nipple Properties on Performance and Rates of Term and Preterm Infant Feeding

Tyler Bontrager BS, Christopher Mayerl PhD, Rebecca German PhD*

Preterm birth significantly impacts postnatal infant development. Preterm infants often rely on feeding bottles to deliver their primary source of nutrition, as opposed to the maternal breast. This study used an infant pig model to determine how varying the physical properties and design of feeding bottle nipples impacts feeding in term and preterm infants. We designed four nipples, with two levels of stiffness and two hole sizes, as well as an intermediate “training nipple” for usual feeds. Term and preterm infant pigs, equivalent to a 2-month-old human infant, were fed milk replacer formula with added barium and biplanar, high speed videofluoroscopy was used to record the feeding process and XMA software was used to identify sucks and swallows. Both term and preterm infant pigs experienced a change in feeding rates with the different nipples. The suck rate in both terms and preterms was lower for stiffer nipples and nipples with larger holes. The swallow rate was lower for both on the stiffer nipples. The preterms did not change swallow rate with hole size, but term infants swallowed faster on the large hole size. We found that the physical characteristics of infant feeding bottle nipples impacted infant feeding rates, with some differences between term and preterm infants. Given the prevalence of infant feeding disorders, further exploration of nipple properties may improve outcomes in these fragile patients with difficulty feeding.

1-2-6

“Hey, I’m just big boned!”: Bone Mechanical Properties in Mice Raised on a High-fat diet.

*Roy T. James II*MMAS, Maria A. Serrat, Christopher J. Vinyard PhD*

Rapid bone elongation is common with childhood obesity. These children suffer increased risk of slipped epiphyses and fractures. Using a mouse model of excess dietary fat intake, we examined the cross-sectional properties, mechanical performance and density of femora in high-fat mice predicting they will have reduced mechanical performance. We examined 24 mice at 5 weeks of age, 12 fed a high fat diet while the remaining 12 were raised on standard mouse chow

as controls. Groups were divided evenly into males and females. Mouse femora were microCT scanned (Scanco:VivaCT75) to measure cross-sectional area, bending moments of inertia, polar moment of inertia, section modulus and density using ImageJ software. We assessed elastic modulus and peak stress in three-point bending using a universal testing machine (Instron:Electropuls3000). Two-way ANOVA indicated a significant increase in cross-sectional area, bending moment of inertia, polar moment of inertia, and section modulus for high fat mice compared to the control group ($P<0.05$) and for males over females ($P<0.05$), with gender showing the greatest difference. Peak stress and elastic modulus were significantly higher for males compared to females ($P<0.05$). While high fat and controls did not differ in elastic modulus, controls approached significantly larger peak stresses ($P=0.052$) suggesting controls may be stronger despite their smaller cross-sectional areas. Average density did not differ with diet or sex. Our findings suggest that despite having larger cross-sectional dimensions, a high-fat diet may still impact bone performance through other changes in bone quality during growth.

1-2-7

Transoral Laryngeal Reconstructive Surgery for Vocal Cord Paralysis in Adduction: A Case Report *Meghana Chanamolu* BS, Paul Castellanos MD*

Vocal cord paralysis induces severe dyspnea, dysphonia, and aspiration. Cord paralysis is a common postoperative complication of thyroidectomies, but can be caused by neoplasms, neurodegenerative diseases, traumatic or idiopathic causes. Multiple surgical interventions are present that mobilize the paralyzed vocal cord, but transoral laryngeal reconstructive (TLR) surgery is a new innovative approach that has better promising outcomes. TLR is performed endoscopically with laser ablation and removal of the central arytenoid and its deeper structures, followed by lateralization, thus widening the airway. We present two patients, a 61 and 81-year-old, with hoarseness, voice pitch changes, and dyspnea due to vocal cord paralysis in adduction. Post-thyroidectomy induced recurrent laryngeal nerve damage resulted in paralyzed vocal cords. One of the vocal cords crosses the midline narrowing the airway aperture obstructing the laminar flow of air. Transoral laryngeal reconstructive (TLR) surgery was performed to lateralize the paralyzed vocal cord and

establish a patent airway, bypassing the need for an open procedure or tracheostomy. Previous lateralization techniques preferred open procedures with a tracheostomy, but TLR provides more effective results with fewer postoperative complications. Lack of incisional scar, adequate visualization of vocal cords, and preservation of laryngeal architecture, especially the mucosa, aid in rapid healing with optimal voice preservation. TLR preserves the anatomy of the larynx and significantly enlarges the glottic aperture, allowing it to be first-line surgical treatment in those experiencing respiratory symptoms and voice issues from vocal cord paralysis in adduction.

Neurodegenerative Disorders

1-3-1

The Effect of Sleep Disordered Breathing on Cognitive Function in Patients with Normal Pressure Hydrocephalus

Raman Bhambra BS, Aruna S Rao MD*

Both normal pressure hydrocephalus (NPH) and sleep apnea (SA) are associated with cognitive deficits. The former specifically affects executive function, memory and attention domains. We sought to explore the specific cognitive domains affected in NPH patients with and without SA. Patients with both NPH and SA have lower scores in attention, memory and recall domains of the Montreal Cognitive Assessment (MoCA) test. We conducted a retrospective chart review of patients with presumed NPH who were admitted to The Johns Hopkins Hospital between the years 2016 and 2018 for extended lumbar drainage (ELD). All patients were administered the MoCA and 33 obtained polysomnograms. Analysis was performed using STATA 15.1. Independent variable was SA and dependent variable was individual MoCA domain scores. Covariates included demographic and anthropometric measurements. In our sample 52.7 % were male, 83.3% white. 26 (73.3 %) had polysomnograms. 69.2 % had SA (apnea hypopnea index of more than 5 per hour). We used unpaired t-tests to analyze differences in MoCA scores in patients with and without SA. Visual spatial $p=0.22$, Naming $p=0.35$, Attention $p=0.41$, Language $p=0.49$, Abstraction $p=0.28$, Recall $p=0.88$, Orientation $p=0.79$. In patients with NPH, there was no statistically significant difference in MoCA scores in

those with sleep apnea. Our results suggest that sleep apnea does not affect cognition in patients with NPH.

1-3-2

Gender Differences in Distribution of Lewy Body Pathology in Individuals with Parkinson's Disease

Meghana Chanamolu BS, Katherine Iannuzzelli, Catherine Bakker MD, Jumana Alshaikh MD, Jee Bang MD, Ankur Butala MD, Cherie Marvel MD, Emile Moukheiber MD, Maitreyi Murthy MD, Alexander Pantelyat MD, Olga Pletnikova MD, Gregory Pontone MD, Gerson Suarez-Cedeno MD, Juan Troncoso MD, Kelly Mills MD, Ted Dawson MD, Liana Rosenthal MD*

Alpha-synucleinopathies (AS) are pathologies with accumulations of altered alpha-synuclein proteins in different neuroanatomic locations. Differences in clinical presentations of AS are caused by many factors, including gender. Anatomical variations, including environmental and cognitive differences, contribute to gender differences in onset, duration, and presentation of AS. This research investigates whether clinical differences in AS between genders are due to neuroanatomical differences in location of alpha-synuclein accumulations (Lewy Bodies, LB) or other factors. Autopsied brain samples of 187 individuals with Parkinson Disease (PD) or Dementia with Lewy Bodies (DLB) were analyzed for levels of LB accumulation and distributions of LB within 10 regions of the brain such as the brainstem, limbic, and cortical areas. Binomial logistic regression compared age at death, LB inclusion location, education, disease duration, and cognitive diagnosis between genders. Shapiro-Wilk normality determined the normal distribution of LB severity scores for 10 brain regions. Mann-Whitney U test determined LB severity score between genders. LB levels were not associated with gender, but having dementia was associated with being male ($p < 0.05$). Severity scores for the Frontal, Temporal, Parietal Lobes, and Amygdala were significantly different ($p < 0.05$) with females having higher scores. Severity scores for other areas were not significantly different. Higher incidence of AS and dementia is prevalent in men, but women have a higher pathological burden in the frontal, temporal, and parietal lobes, and amygdala. Women have significantly greater LB accumulation in the Amygdala which explains the higher rate of depression.

1-3-3

Cholinergic Inputs to Ascending, Descending and Commissural Pathways that Terminate in the Inferior Colliculus

Megan M. Fritz BS, Nichole L. Beebe PhD, Brett R. Schofield PhD*

Acetylcholine (ACh) modulates neuronal responses from the cochlea to the auditory cortex. In the thalamus, ACh differentially modulates ascending and descending pathways to extract important auditory information from noise (Richardson, Sottile, Caspary 2020 doi.org/10.1016/j.heares.2020.108003). Little is known about which brainstem auditory pathways are directly targeted by cholinergic axons. We ask whether cholinergic axons make direct contact with cells that project to the inferior colliculus (IC), a midbrain hub that integrates ascending and descending auditory pathways. All experiments were approved by NEOMED IACUC. We injected a retrograde tracer into one IC in six adult mice, then identified cholinergic axons with an immunostain against vesicular acetylcholine transporter (VACHT). We then examined retrogradely labeled cells for close apposition with VACHT+ (i.e., cholinergic) boutons. We observed retrogradely labeled cells in seven auditory nuclei. VACHT+ axons appeared in close contact with retrogradely labeled cells in the 1) cochlear nucleus and nuclei of the superior olivary complex (ascending pathways); 2) contralateral IC (commissural pathway); and 3) nucleus of the brachium of the IC and the auditory thalamus (descending pathways). We conclude that cholinergic axons directly modulate ascending, commissural and descending inputs to the IC. Combined with previous studies showing cholinergic deficits in aging, we conclude that age-related hearing loss is likely to involve brainstem auditory pathways.

1-3-4

Melanopsin Ganglion Cell Morphology in the 3xTg Mouse Model of Alzheimer's Disease (AD)

Mark Fusillo BS, MBA, S.Dewan, C.M. Dengler-Crish PhD, J.M. Ferrell PhD *M.A. Smith PhD*

Circadian rhythm abnormalities are reported in AD patients very early in the course of the disease. These include abnormal timing and duration of the sleep cycle, reduction of melatonin levels during the night, and alternating expression of clock genes. These deficits could be caused by dysregulation within

several brain sites; however, the retina has been postulated as one of the earliest neural structures affected in AD and melanopsin expressing retinal ganglion cells (mRGCs) are responsible for maintaining circadian rhythms, thus making the retina an attractive target for investigating pathological mechanisms. Loss of mRGCs has been reported in other neurodegenerations such as Parkinson's disease and glaucoma⁷. While there is amyloid- β accumulation, mRGC loss, and gliosis in the retinas of mouse models of AD, little is known about the progression of pathology in mRGC axons. Using a combination of immunohistochemistry⁷ and high-resolution fluorescent microscopy, we examined mRGC morphology in 4-7 month old 3xTg mice, a commonly used murine model of AD. We found significant decreases in dendritic field complexity, dendritic area, and soma size in the retina. Importantly, these changes occurred independent of a reduction in total RGC and mRGC somatic density in the corresponding retinas, a finding that mimics the progression of other age-related neurodegenerations. In conclusion, the 3xTg mouse exhibits early changes in mRGC morphology in the absence of cell body loss. The accessibility, isolation, and simplicity of the anterior visual system may provide a useful framework for studying the mechanisms of axonopathy in AD.

1-3-5

Etiology of Sex Differences in Alzheimer's Disease: Migraine as a Risk Factor

Savanna D. Hoyt BS, Alexandra K. Brooks PhD, Christine M. Dengler-Crish PhD*

Alzheimer's disease (AD) is a neurodegenerative disease that causes progressive memory loss and cognitive decline. It is the most common cause of dementia worldwide, disproportionately affecting postmenopausal women. However, conclusive data explaining why women are at increased risk for AD is lacking. We hypothesized that migraine history could mediate future AD risk in women. We performed extensive literature searches for evidence supporting associations between migraine history and AD risk in women. We also searched for indirect associations between migraine and the known, major modifiable risk factors for AD. We found 14 studies that studied direct associations between migraine and AD risk and, collectively, results were inconclusive as to whether a meaningful relationship exists between

these conditions. In our expanded review of literature that included studies of shared risk factors between migraine and AD, we found more discernable associations. These studies indicated that acquired risk factors of AD such as high cholesterol, hypertension, obesity, type 2 diabetes, ischemic stroke, sleep disturbances, cardiovascular disease, metabolic syndrome, and/or mood disorders were associated with increased migraine incidence. In conclusion, these findings support the possibility of shared etiological factors between migraine and AD, thus justifying more direct research in this area.

1-3-6

Identification of Developmental Factors Contributing to Alzheimer's Disease Sex Differences

Emily Marsico BS, Brad Casali PhD, Erin Reed-Geaghan PhD*

Alzheimer's Disease (AD) is the primary cause of dementia, affecting more than 5 million Americans. While sex differences in AD onset and progression have been well established, the underlying biology is unknown. The purpose of this investigation was to determine whether the sex chromosomes establish sex-specific inflammatory responses in AD, contributing to the divergent disease processes. Two genetic mouse models were used in this project: the Four Core Genotype (FCG) model, to separate chromosomal and gonadal sex, and the 5xFAD Alzheimer's mouse model. These strains were crossed, and the sex and AD status of the resulting progeny (n=42) were determined by PCR and gel electrophoresis. The cerebellum and midbrain were harvested and homogenized for inflammatory gene expression. RNA extractions were performed, and RNA was converted to cDNA for qPCR to identify gene expression in each sample. The genes that were analyzed included, *Apoe*, *Gfap*, *Il1 β* , *Tnf- α* , *Iba1*, and *Trem2*. At 8-months of age, the cerebellum and midbrain showed distinct patterns of gene expression that depended upon chromosomal and gonadal complement. Within the cerebellum, 5xFAD; XXF mice had the overall highest gene expression in all genes, except *Il1 β* . In contrast, the midbrains of 5xFAD; XXM had the overall highest gene expression in all genes, except *Il1 β* . From these results, we concluded the complement of sex chromosomes and gonads drive different gene expression patterns in the cerebellum and midbrains of the 5xFAD mouse

model. This establishes a role for each of these components in AD-related neuroinflammatory processes.

1-3-7

Association of Blood Brain Barrier Glycosaminoglycan Profile and Amyloid Beta Protein Accumulation in Alzheimer's Disease

Brian Foresi MBA, Kimberly M. Alonge PhD, William A. Banks MD/PhD, Aric F. Logsdon PhD*

Alzheimer's disease (AD) is prevalent in our aging society, affecting approximately 5.8 million people in the US. The purpose of this study was to consider a biochemical mechanism initiating amyloid beta (A β) accumulation in the brain, a hallmark of AD. Recent evidence suggests that the extracellular matrix (ECM) composition associated with the blood brain barrier (BBB) may be important to its function and possibly contribute to AD-related dysfunction. Chondroitin sulfate glycosaminoglycans (CS-GAGs) are a major constituent of brain ECM and can be differentially sulfated during golgi apparatus processing. Current technical restraints have hindered the analysis of CS-GAG composition. This study implemented an innovative technique using liquid chromatography tandem mass spectrophotometry (LC-MSMS) to specifically measure five CS isomers (CSA, CSC, CSO, CSD, CSE) and dermatan sulfate (CSB). CS-GAG composition can regulate A β transport across the BBB and so we hypothesized decreased clearance is due, in part, to age-related CS-GAG sulfation changes on brain endothelial cells. In this study, we isolated microvessels from human brains to characterize CS-GAG composition using LC-MSMS after incubating them with a CS-specific enzyme, ChondroitinaseABC (ChABC). To determine whether CS-GAGs were required for A β binding at the BBB, we isolated microvessels from human (n=4) and mouse brains (n=3), performed ChABC incubation, LC-MSMS analysis, then applied fluorescently-labeled A β . We discovered that microvessels had a unique CS composition compared to the whole human brain and they bound significantly less A β compared to untreated microvessels. Moreover, we discovered significant differences in CS sulfation between microvessels in AD and non-demented samples.

Neurodegenerative Disorders and Brain Injury

1-4-1

Ultrastructural Changes in the Parietal Cortex are Attenuated with Triiodothyronine Nanoparticles in a Porcine Model of Cardiac Arrest

Abigail M. Beaver BS, Elizabeth A. Slabinski BS, Mitchell J. O'Hara BS, Nick J. Tokar BS, Shaker A. Mousa PhD, Brian R. Weil PhD, Jeffrey G. Mellott PhD*

Cardiopulmonary resuscitation (CPR) with triiodothyronine nanoparticles (T3np) achieves return of spontaneous circulation at a comparable rate to epinephrine (EPI) while reducing post-resuscitation cardiac injury. We sought to determine whether these protective effects of T3np extend to the parietal cortex ultrastructure. Swine were subjected to cardiac arrest (CA) followed by CPR with defibrillation and intravenous EPI (n=3), T3np (n=3), or T3np+Pcr (n=3; phosphocreatine loaded inside the nanoparticle). The brain was removed and fixed in glutaraldehyde. Parietal tissue was sectioned at 70 nm and assessed with transmission electron microscopy. In brief, we assessed each 1) mitochondria's integrity score (1-5; 5 being the highest), 2) synapse's active zone length and 3) axon as having normal or abnormal myelination. Data collection was blinded and compared to sham controls (n=3). The control group's mitochondria score was 4.17. T3np+Pcr-treated groups had a score of 3.8, while EPI was 3.7. After T3np and T3np+Pcr-treatments, synaptic lengths (254.6 nm and 248.5 nm, respectively) increased compared to control (243 nm) and EPI (233.8) groups. Lastly, the number of axons with abnormal myelination was significantly less in the T3np+Pcr-treated group (24%) than in EPI-treated group (50%). Our data indicate that parietal ultrastructure may be better preserved after resuscitation with T3np+Pcr than with EPI as 1) metabolic integrity was slightly improved, 2) synaptic plasticity may be facilitated by longer synaptic lengths, and 3) communication between neurons is likely more efficient. These results suggest that treatment with T3np+Pcr may lead to more favorable neurological outcomes after CA.

1-4-2

Age-related Ultrastructural Changes Across the Tonotopic Inferior Colliculus in Fischer Brown Norway Rats

Alexa Wawrzyniak MS, Nick J. Tokar BS, Mitchell J. O'Hara BS, Whitney C. Stolnicki BS, Oren Barat BS, Alice Dalo BS, Amir M. Mafi BS, Jeffrey G. Mellott PhD*

It has been demonstrated that GABAergic and excitatory synapses in the tonotopic central inferior colliculus (ICc) decline with age. We sought to determine whether synaptic declines occur in specific ICc frequencies. We assessed young (3 month) and old (28 month) Fischer Brown Norway rats. We used immunogold transmission electron microscopy to characterize synapses in the high, middle and low frequency regions in the ICc. GABAergic synapses were identified as having symmetric synaptic junctions, pleomorphic vesicles, and GABA-positive immunoreactions. Excitatory synapses were identified by their large postsynaptic profiles and larger/rounder vesicles. We additionally measured bouton size and active zone length. A total of 2,443 synapses were characterized. We found that the density of both GABAergic and excitatory synapses decreases with age in each frequency region. The synaptic loss was greater in the high (~34%) and middle (~36%) frequencies than the lower frequencies (~10%). Additionally, we found that GABAergic bouton areas increased with age while excitatory bouton areas slightly decreased. Lastly, active zone lengths in each region increased with the greatest changes occurring with excitatory synapses. As this species of rat is known to undergo age-related hearing loss at lower frequencies, it was surprising to find that the lower frequencies of the ICc lost the fewest number of synapses. This finding may support that 1) reported age-related changes occur more prominently in high and middle frequencies in lower brainstem nuclei and 2) age-related hearing loss is not due to a synaptic loss in the ICc.

1-4-3

The Effect of Exercise on Motor and Non-Motor Function in a Rat Model of Parkinson's Disease

Danny Belmona BA, BS, Ashley Davis PhD, Edward Hamad, Josephine Lepp MS, Emily Simons PhD, Christopher Kemp PhD, Joseph Patterson PhD, Caryl Sortwell PhD, Sheila Fleming PhD*

Parkinson's disease (PD) is a progressive neurodegenerative disorder characterized by the development of motor symptoms that include bradykinesia, resting tremor, rigidity, and postural instability. Non-motor symptoms such as cognitive, neuropsychiatric, and olfactory dysfunction are also common. Pathologically, PD is defined by the loss of dopaminergic neurons in the substantia nigra and the development of alpha-synuclein (aSyn) positive Lewy bodies and Lewy neurites in the brain and the periphery. Clinical and animal model studies show that exercise can improve some aspects of motor function but whether it can slow the progression of PD is unclear. In the present study that was approved by the institutional animal care and use committee, the effect of long-term treadmill exercise was tested in an aSyn rat model of PD. Rats received a unilateral injection of alpha-synuclein preformed fibrils (PFF, n=20) or vehicle (n=19) in the striatum. One month following injection, half of the rats (Veh=10, PFF=10) received treadmill training working up to 10 meters per minute for 20 minutes. The other half (Veh=9, PFF=10) were placed in the treadmill apparatus but did not run. Treadmill training was performed for five days a week for five months. At the end of the five months, all rats were assessed on a battery of behavioral tests to determine the effect of exercise on sensorimotor function, olfaction, cognition, and neuropsychiatric function. Early results show that PFF rats receiving treadmill exercise initiate a step faster than PFF rats without exercise.

1-4-4

Ultrastructural Changes in the Hippocampus are Attenuated with Triiodothyronine Nanoparticles in a Porcine Model of Cardiac Arrest

Elizabeth A. Slabinski BS, Abigail M. Beaver BS, Mitchell J. O'Hara BS, Nick J. Tokar BS, Shaker A. Mousa PhD, Brian R. Weil PhD, Jeffrey G. Mellott PhD*

CPR with triiodothyronine nanoparticles (T3np) achieves return of spontaneous circulation at a comparable rate to epinephrine (EPI) while reducing post-resuscitation cardiac injury. We sought to determine whether these protective effects of T3np extend to the hippocampus ultrastructure. Swine were subjected to cardiac arrest (CA) followed by CPR with defibrillation and intravenous EPI (n=3), T3np (n=3), or T3np+Pcr (n=3; phosphocreatine loaded inside the nanoparticle). The brain was removed and fixed in

glutaraldehyde. Hippocampal tissue was sectioned at 70 nm and assessed with transmission electron microscopy. In brief, we assessed each 1) mitochondria's integrity score (1-5; 5 being the highest), 2) synapse's active zone length and 3) axon as having normal or abnormal myelination. All data collection occurred in a blinded fashion and compared to sham controls (n=3). The control group's mitochondria score was 4.04. T3np and T3np+Pcr-treated groups had scores of 3.87 and 3.7, respectively. The score for EPI-treated tissue was lower at 3.55. Each non-control group had shorter active zone lengths than the control group (272.8 nm). The T3np and T3np+Pcr-treated groups had lengths of 233.7 and 251.5, respectively; the EPI-treated group had the smallest length at 225.3 nm. Lastly, there was a 10-17% increase of axons with abnormal myelination in the EPI-treated group as compared to the T3np treated groups. Our data indicates that the integrity of the hippocampus is better preserved after resuscitation with T3np/T3np+Pcr than with EPI. These results suggest that treatment with T3np/T3np+Pcr may lead to more favorable neurological outcomes after CA.

1-4-5

Migraine as a Risk Factor for Alzheimer's Disease: Evaluation of Panx1 Channel Activation

Alexandra K. Brooks PhD, Savanna D. Hoyt BS, Christine M. Dengler-Crish PhD*

Alzheimer's disease (AD) is an incurable neurodegenerative disorder that affects over 44 million people worldwide. The pathogenesis of AD involves the accumulation of amyloid beta and tau protein in the brain, leading to neuronal dysfunction and cell death; however, the etiology of AD is still unclear. Aside from aging, female sex is the largest unmodifiable risk factor for developing AD, but this relationship is not well understood. We sought to determine whether any previous research supported a relationship between migraine history and AD risk in women. Literature reviews were conducted to find evidence of overlapping molecular mechanisms between migraine and AD. Beyond non-specific inflammation, which was a shared factor between the conditions, one novel and specific overlapping mechanism was related to the hemi-membrane channel pannexin-1 (Panx1). Migraine induction (stimulated by either cortical spreading depression or calcitonin-gene related protein upregulation) was

shown to open Panx1 channels, leading to an inflammatory response, prolonged trigeminal nerve stimulation, and activation of the inflammasome. Blocking a similar hemi-membrane channel (connexin-43) was also shown to prevent additional migraine attacks. Recent studies suggest that activation of Panx1 may be associated with AD, as blocking Panx1 improved memory deficits and reversed abnormal hippocampal dendrite arborization in AD mouse models. Additional research will be needed to further define linkages between Panx1-related mechanisms in migraine and AD. Overall, these studies support the possibility of shared etiological factors between migraine and AD and identify Panx1 channels as specific molecular candidates.

1-4-6

mRNA for Glutamate Decarboxylase (GAD) Changes with Age in the Low Frequency Auditory Midbrain.

Christina C. Koehler BS, Mitchell J. O'Hara BS, Nick J. Tokar BS, Amir M. Mafi BS, Jesse W. Young PhD, Jeffrey G. Mellott PhD*

GABAergic downregulation is well documented in the aging inferior colliculus (IC) and hypothesized to underlie elements of age-related hearing loss. We sought to determine whether GAD mRNA is downregulated in the IC at specific frequencies, cell sizes and lifespan. We used an aging rat model from the National Institute on Aging that is known to lose low frequency hearing with age. All protocols received IACUC approval. Briefly, brains were extracted from three age groups (young, middle and old), and flash frozen in liquid nitrogen. IC sections (12 μ m) were processed for GAD1 using single molecule fluorescent *in situ* hybridization. Images were randomly taken across the IC's tonotopic nucleus, somas were contoured, and individual GAD1 mRNA were quantified using Neurolucida 360. The first finding was the number of GAD1 mRNA was greatest in the young at low frequency (LF). By middle age there was a significant loss of mRNA in the LF. When cell size was accounted for, we found 1) the smallest cells in the LF downregulated GAD1 mRNA with age while 2) the largest cells upregulated GAD1 throughout aging. Our data illustrate that GAD1 mRNA regulation may be significantly tied to age-related hearing loss in our model as major changes of expression occurred primarily at the LF.

Cell size data may reflect compensatory aging mechanisms employed by distinct IC circuits. The largest GABAergic cells are providing inhibition to the auditory thalamus while the smallest cells may be providing inhibition to more local targets within the auditory midbrain.

1-4-7

Rural Patient Education: The Importance of Newborn Hearing Screenings

Madison Cox BS*

The state of Ohio requires newborn screenings to be performed on all babies born in the state. However, parents may deny these screenings due to religious beliefs or may refuse to follow up with practitioners. The refusal of these screenings may be particularly high in rural areas or areas with a large Amish population. To educate new parents among these demographics on the importance of newborn hearing screenings, an informational pamphlet was created. The pamphlet defined newborn hearing screenings and described how they are performed, why they are important, and next steps for parents. It also listed other educational resources including the Center for Disease Control and the American Speech Language Hearing Association. Information for this pamphlet was gathered from scholarly sources such as Auditory and language outcomes in children with unilateral hearing loss¹ and Communication and behavioural disorders among children with hearing loss increases risk of mental health disorders². The objective of this pamphlet was to decrease the number of refused newborn screenings by raising awareness of the effects of hearing loss in children and the value of early intervention.

Clinical Investigations and Interventions

2-1-1

Patient Disposition and Resources Utilized for those Requiring Emergency Department Transfer

Kristen Septaric MPH, Jessica Krizo PhD, Baruch Fertel MD, Courtney Smalley MD, Caroline Mangira MPH RN, Erin Simon DO, FACEP*

When emergency department (ED) patients require a higher level of care, transferring patients may be needed. Since specialty consultation or hospital admission generally indicate that a higher level of care was required that could not otherwise be provided at the initial ED, our objective was to analyze if transferred patients required these services. This study was a retrospective cohort of all patients aged 18 to 65 years of age who presented to an ED within a large integrated health system between January 1, 2018, and December 31, 2020, and were transferred to another ED within the hospital system. Categorical variables are presented as frequencies and percentages. Multiple logistic regression was utilized to determine if age, acuity level, means of arrival, reason for transfer and specialty consult were predictive of admission to the hospital. A total of 4,733 encounters were included. At the transfer ED, 23.2% (n=1,098) received only a specialty consult, 17.4% (n=825) were admitted to inpatient services within the facility without a consult, 35.2% (n=1664) received a consult and were admitted, and 24.1% (n=1141) were neither admitted nor received a consultation. We found that age 1.02 [95% CI 1.02-1.03], acuity high vs. low 2.94 [95% CI 2.22-3.89], middle vs low 1.78 [1.42-2.23], means of arrival to transfer ED 4.31 [95% CI 3.69-5.03], reason for visit (illness) 1.78 [95% CI 1.29-2.46], (injury) 1.68 [95% CI 1.20-2.36] and reason for transfer were all statistically significant predictors of admission. Approximately three-fourths of ED-to-ED transfers required a specialty consultation or admission to the hospital.

2-1-2

Effectiveness of Breast Recovery After Surgery Protocol Among African American Women

Thomas To MA, Joseph Gabra, Amanda Mendiola*

The importance of equality in the effectiveness of clinical interventions has become more relevant than ever as the racial demographics of the US population continues to become increasingly diverse. This is

especially true regarding post-surgical protocols in breast surgery. Among breast cancer patients, African American women have the highest mortality rate. While the incidence of breast cancer rates is similar between White and Black women, there is still more to be done regarding racial equality in post-surgical care. The Breast Recovery After Surgery (BRAS) Protocol is a postoperative surgical protocol designed to decrease opioids and reduce length of stay in breast surgery patient encounters. A retrospective chart analysis was implemented to determine the efficacy of the BRAS protocol. Data was used from the Cleveland Clinic Akron General Breast Health Center and includes patients undergoing breast surgery from January 1, 2016 to June 30, 2019. Patients excluded are chronic pain patients and those who had breast surgery in February 2017 which was the first month the protocol was initiated. The research showed that the BRAS protocol has significantly reduced opioid use ($p < 0.00001$ both) and reported pain scores ($p = 0.0034$, Blacks vs. $p = 0.028$, Whites) among both Black and White patients. Interestingly, it was observed that Black patients trended towards having a larger distribution in length of stay after their breast surgery ($p = 0.4207$, Blacks vs. $p = 0.0734$, Whites). Future research can explore if length of stay is associated with race in order to further improve postoperative surgical protocols to ensure equal effectiveness in all races.

2-1-3

Impact of CFTR Modulator Therapy on Nutritional Status, Hepatic Steatosis, and Dyslipidemia in Patients with Cystic Fibrosis

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Cystic fibrosis (CF) occurs from a mutation in cystic fibrosis transmembrane conductance regulator (CFTR). Symdeko and Orkambi are CFTR modulators that help improve CFTR function. Trikafta, a newer modulator, is effective at restoring CFTR function. Impact of CFTR modulators on lipid levels is not well characterized and is the aim of this study. Retrospective chart review was performed on sixteen adults with CF who were treated with modulator therapy and had protein density fat fraction, BMI, ppFEV1, and serum lipids assessed before and after treatment with different modulators. A Wilcoxon Signed Rank test was used for analysis. Eight patients were initially on Symdeko or Orkambi and switched to Trikafta. There were significant increases in

median ppFEV1 from 68% to 78% (p=0.0156), median BMI from 22.7 to 24.7 kg/m² (p=0.0078), median LDL-C from 73 to 90 (p=0.0078) and median HDL-C (p=0.0391) from 48 to 52 after switching to Trikafta. No significant difference in PUFF. Eight patients were not on any modulator therapy initially and then started on Symdeko (n=5) or Trikafta (n=3). There was a statistically significant increase in median BMI from 21.8 to 24.7 (p=0.031). Median HDL-C increased from 46 to 52 (p=0.0625). No significant difference in PUFF. This study shows addition of Trikafta is associated with increased levels of HDL-C, LDL-C, and BMI. Limitations include sample size. Further research should investigate mechanisms of elevated lipid levels in CF after modulator treatment, and whether this incurs risk for cardiovascular disease.

2-1-4

Distal Embolization of Hydrophilic Polymer Gel After Tibial Artery Angioplasty: A Case Report and Review of the Literature

Emily G. Petrinc BS, Joseph McShannic MD, John Moawad MD, Drazen Petrinc MD, Eric Turney MD*

Hydrophilic polymer gel is used as coating for many intravascular devices. Polymer gel embolization was first described 20 years ago as a cause of microvascular inflammation, ischemia, and potential morbidity. There are few reports of embolization complicating peripheral vascular interventions. We report a case of hydrophilic polymer gel embolization following lower extremity arterial angioplasty. The patient was an 81-year-old with past medical history of type 2 diabetes, coronary artery disease, hypertension, and hyperlipidemia presenting with a non-healing ulcer of the right great toe. Non-invasive vascular testing revealed critical limb ischemia with severe arterial insufficiency. The patient underwent right leg arteriography with balloon angioplasty of the posterior tibial artery. The patient returned after two weeks with complaints of increased pain and dry gangrene of the distal half of the right great toe. He underwent right great toe amputation with resolution of pain and complete healing of amputation site. Final pathology report described hydrophilic polymer gel emboli with giant cell and chronic inflammatory reaction. Estimated prevalence of distal embolization following lower extremity endovascular procedures is 1-5%. Authors have advocated elevated inflammatory markers as suggestive of polymer embolization, but

tissue biopsy is definitive diagnosis. Antiplatelet therapy, steroids, and immunosuppressive therapy are reported to improve inflammatory symptoms. A high index of suspicion is necessary to consider the diagnosis and further research is necessary to investigate strategies to prevent and treat hydrophilic gel polymer embolization.

2-1-5

Impact of Deprescribing Medication on 30-Day Readmission Rates in Older Adults with Traumatic Fall

Kailey Christman BS, BA, Emily Kanis PharmD, Patrick Gallegos PharmD, BCPS, Chanda Mullen PhD, Michaelia Cucci PharmD, BCPS, BCCCP*

Fall can lead to serious injury in older adults and is associated with polypharmacy. The primary objective of this study was to evaluate whether deprescribing medication in older adults admitted for traumatic fall affected 30-day hospital readmission rates. This retrospective cohort study included data from three regional trauma centers within Cleveland Clinic health system. Baseline demographics, clinical variables, admission and discharge medications, and readmission data were collected. Patient's age 65 and older hospitalized for a fall between January 1, 2018 and December 31, 2020 were included and were categorized to no-deprescribing and deprescribing groups. Deprescribing was defined as removing or reducing at least one medication at discharge. Individuals were in the no-deprescribing group if their medications were continued, increased, or new medications were prescribed. The primary outcome was 30-day hospital readmission to a Cleveland Clinic hospital determined by the electronic medical record system. Secondary outcomes included 30-day emergency department readmission, 30-day readmission for fall, and 30-day mortality. Chi-square test was performed to compare readmission and mortality rates. Of 775 patients included, the median age was 82 [74-89] and 60% (n=466) were female. Results showed 15% (n=113) were deprescribed medication and 85% (n=662) were not. For the primary outcome, 19% (n=21) of patients deprescribed medication and 19% (n=123) of patients not deprescribed medication were readmitted ($\chi^2(1) = 0.000$, p=1.000). There was no difference between the two groups for secondary outcomes. Preliminary results showed medication deprescribing in elderly

patients with traumatic fall did not impact hospital readmissions.

2-1-6

Intrathecal Morphine Administration in Pediatric Patients Undergoing Selective Dorsal Rhizotomy: A Pilot Study

Nupur Goel BS, Jared Pennington PhD, Tsulee Chen MD*

The purpose of this study was to evaluate the effectiveness of intrathecal morphine in Cerebral Palsy patients following a selective dorsal rhizotomy procedure. This was a retrospective, cohort analysis over 4 years. The analysis consisted of a treatment group which received intrathecal morphine (5 mcg/kg) injection and a control group that did not receive the injection prior to closure. All patients underwent multilevel laminectomies at the same institution. The effectiveness of the treatment was measured by total dose of hydromorphone administered on patient-controlled analgesics, number of days on oral narcotics, and cumulative dose of oral narcotics (oxycodone). Of the 15 pediatric patients, 7 patients received intrathecal morphine injection while the other 8 did not receive the treatment. There was no statistically significant difference between the two groups ($P > 0.05$). The treatment group had a lower PCA dose (3243 mcg) than the control group (4378 mcg). The total PCA dose based on weight was lower in the treatment group (163 mcg/kg) than in the control group (171 mcg/kg). The mean total days on oral narcotics was greater in the treatment group (2.6) than the control group (1.8). The total oral narcotic dose was lower in the treatment group (14.1 mg) compared to the control group (17.9 mg). The administration of intrathecal morphine clinically reduces the opiate need in the first 96 hours post-operatively. The use of intrathecal morphine allows CP patients to regain their functional status more quickly, for which the SDR procedure was originally performed.

2-1-7

Probability Analysis of Sequential SCFE (PASS score)

Baruch Danino MD, Satbir Singh BS, Junxin Shi PhD, Jingzhen Yang PhD, Walter P Samora MD, Christopher A Iobst MD, Kevin E Klingele MD*

This study aimed to develop a scoring system based on clinical and radiological findings to predict the risk of a sequential slipped capital femoral epiphysis (SCFE). Paediatric patients with unilateral SCFE and at least two years of radiographic follow-up were screened for inclusion. Medical records were reviewed for multiple variables including age, gender, body mass index (BMI), stability of SCFE, and time to sequential presentation. Radiographic analysis included triradiate physeal status, Risser staging, superior epiphyseal extension ratio (EER), posterior epiphyseal angle (PEA), posterior sloping angle (PSA), and slip severity. 163 patients (88 male, 54%) were included. Of those, 65 (40%) with a mean age of 11.9 ± 1.3 years developed sequential SCFE at 9.8 ± 6.4 months after the initial slip. Eight independent variables were statistically different ($p < 0.05$) between unilateral and sequential groups. Following multivariate analysis, Risser stage and triradiate status were no longer significant predictors and were excluded from the final model (overall area under the curve (AUC) = 0.954). We developed the PASS score using three radiographic parameters using chosen cut-off values that were near their maximized value and weighted the point value assigned to each parameter based on the strength of predictor. A PASS score of three or higher predicts a high probability of sequential SCFE with 95% confidence and may warrant prophylactic screw fixation. PASS score calculation can be used to predict a sequential SCFE and provide an objective method to determine the utility prophylactic screw fixation.

2-1-8

Inappropriate Prescribing Patterns of Loop Diuretics in a Nationally Representative Outpatient Population

Jacob Smearman BA, Steven Fosnight PharmD, Emily Graves, Melvin Vazquez, Mate Soric PharmD, BCPS, FCCP*

The purpose of this study was to determine the prescribing patterns of ambulatory providers for loop diuretics in patients without a prior diagnosis of heart failure, chronic kidney disease, or liver cirrhosis in the United States. This was a national, retrospective, cross-sectional investigation conducted using the National Ambulatory Care Survey (NAMCS) from 2013 to 2016. Outpatient visits for patients 18 years and older who were prescribed loop diuretics were included. Patients prescribed a loop

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diuretic with an appropriate indication for therapy were excluded. The primary endpoint was the frequency of inappropriate loop diuretic prescribing. A multivariate regression model identified potential predictors of inappropriate loop diuretic utilization. This analysis identified 5,261 outpatient visits conducted during the study period in which loop diuretics were prescribed. Of these, 3,648 visits (65.8%) were determined to be inappropriately prescribed. Positive predictors of inappropriate treatment with loop diuretics included age greater than 65 (OR 1.71; 95% CI 1.38-2.13), concomitant calcium channel blocker (OR 1.42; 95% CI 1.09-1.84), sodium-containing medication use (OR 2.78; 95% CI 1.23-6.25), and prescription by a cardiologist (OR 2.84; 95% CI 2.31-3.50). This analysis identified that loop diuretics are frequently prescribed inappropriately. Several variables were defined as predictors for these inappropriate prescribing patterns. The frequency of loop diuretic prescribing was impacted by concomitant medication use as well as patient and provider trends. These patterns create a unique opportunity for pharmacists to help decrease the misuse of these medications, reinforcing the need for further investigation into this topic.

Clinical Investigations and Innovations

2-2-1

An Updated and Versatile Fracture Reduction Clamp Design for Orthopedic Surgeons

Andrew Alejo MMAS, Sumaiya Ahmed BS, Kareem Mukkassa, Eric Miller MD*

The clinical need our clamp will address is the lack of a clamp specifically designed to enable an orthopedic surgeon stability when dealing with transverse fractures of long bones. Orthopedic surgeons go about fixing a transverse fracture by plating with screws the proximal end of the broken long bone, then using a curved lobster clamp, they reduce the distal end of the broken bone to the proximal end while inserting screws into the plate. Right now, there are no good designs of current clamps out there that are straight and sliding to allow the bone to be reduced in a stable way. Orthopedic surgeons often have to modify or bend existing curved tined clamps to get them to stay parallel in the holes they drill in order to properly reduce the bone. Our solution to this unmet clinical need is simply designing a new clamp that will have

straight and parallel tines that exert equal pressure through the pilot holes. We interviewed 10 orthopedic attendings and residents in the Northeast Ohio area. All 10 agreed that there is a need for a newly designed clamp and that they have experienced this bending issue. If there were a better designed clamp, all would purchase them to use in their operating room. This helped us validate the value proposition for our new clamp design. Currently we have filed a provisional patent on this technology with Summa Health System's IP department.

2-2-2

Hand Sanitization Compliance Systems

Alyssa Basdavanos BS, Muhammad Islam, Phaedra Norrell, Dr. Fayez Safadi PhD*

Within healthcare, restaurants, cruise ships, and other large communal gathering areas, hand sanitization compliance presents a significant risk of infection to patients, customers, and other subjects. Hospital-acquired infections are a detriment to health care facilities because they can potentially extend a patient's length of stay, lead to unnecessary deaths, reduce a hospital's standing with the joint commission, and cost the institution. Currently, hospitals use an auditing system where a third party records and observes the incidence of hospital workers' correct hand hygiene compliance. This process is error-prone due to the sporadic observational nature and the Hawthorne effect. The CDC states that hand washing is the number one way to reduce the spread of infections; therefore, all parties would benefit from a centralized monitoring system. Our technology addresses the need to increase hand hygiene compliance through providing biofeedback via vibration, soft blinking light, or both, in the form of a wearable device or through using the app that tracks each user's compliance. Existing hand sanitization dispensers are retrofit to our sensors. We conducted 20 interviews for customer discovery and market validation. Market analysis of the global infection control market, which includes health care facilities, restaurants, research facilities, cruise ships, and others, was valued at 32.6 million dollars in 2020. We currently have an invention disclosure filed with NEOMED. Additionally, we are working towards partnering with NEOMED's clinical partners (such as Akron General, University Hospitals, Akron Children's Hospital, or Summa Health) to begin pilot studies.

2-2-3

A Homologous Alternative to Reduce Spinal Fusion Revisions: Saccavi

Gabrielle T. Robinson BS, Ernesto Solorzano-Zepeda* BS, Timothy Nagy BS, Muhammed Islam BS, Fayez F. Safadi, Ph.D.*

In the United States, 1.62 million spinal fusions are performed annually. Current spinal fusion procedures lead to 20% of revisions. A potential consequence of such revisions may involve the vertebrae failing to heal/fuse, requiring additional surgical intervention. To prevent revisions associated with spinal fusions, we have developed Saccavi. Saccavi supplements the current spinal fusion procedure by improving fusion efficiency and the healing period. Our technology isolates osteoactivin (OA) from patients and implements it within spinal fusion cages. OA is an orthobiologic proved to be safe and efficacious in comparison to other bone stimulants. With the help of NEOvations bench to bedside, our team was able to complete 77 customer discovery interviews with neurosurgeons, orthopedic surgeons, physical therapists, surgical technicians, regulatory experts and various health care providers. From these interviews, we established the clinical need, our customer segment, and regulatory requirements needed to move forward with our technology. Additionally, our interviews revealed our product applicability in other orthopedic procedures that use the iliac crest as a bone graft harvest site. An initial prototype for our technology was designed and 3D printed. Upon completion of the program our team successfully filed a provisional patent for our technology. We are currently moving forward with pursuing further assistance for regulatory guidance from The University of Utah as we are exploring all possible options for both our technology.

2-2-4

Stress-Induced Mouse Model of the Cardiac Manifestations of Friedreich's Ataxia Corrected by AAV-mediated Gene Therapy

Christiana O. Salami MS, Katie Jackson, BS, Clarisse Jose, BS, Laith Alyass, BS, Georges-Ibrahim Cisse, BS, Bishnu P. De, PHD, Katie M. Stiles, PHD, Maria J. Chiuchiolo, PHD, Dolan Sondhi, PHD, Ronald G. Crystal, MD, * and Stephen M. Kaminsky, PHD*

Friedreich's ataxia (FA), an autosomal recessive disorder caused by a deficiency in frataxin (FXN), is characterized by neurodegeneration and hypertrophic cardiomyopathy. Cardiac dysfunction is the most common cause of mortality in FA, but in most patients, the cardiac disease is often subclinical. All available mouse models to study the cardiac manifestations of FA involve organs in addition to the heart and/or have a severe cardiac phenotype. To generate a cardiac-specific mouse model of FA analogous to the typical FA patient, we created a Cre-Lox recombination cardiac-specific excision of FXN exon 4 to generate a heart-specific FA (HSFA) model that mirrors the mild clinical cardiomyopathy of FA, providing a relevant mouse model to evaluate gene therapy for the cardiomyopathy associated with FA. Compared to wild-type controls, HSFA mice had lower levels of FXN mRNA expression in the heart and lower stress response ($p < 10^{-5}$). A one-time intravenous administration of 10^{11} genome copies of adeno-associated virus (AAV) rh.10 serotype gene transfer vector expressing human FXN corrected the HSFA stress-induced phenotypes. HSFA mice treated with AAVrh.10FXN exhibited an increase in ejection fraction indistinguishable from controls. Similarly, the stress-induced fractional shortening in treated HSFA mice was 53%, an increase in stress response indistinguishable from littermates (46%, $p > 0.07$). In summary, the HSFA mice provide an ideal model to study long-term cardiac complications due to FA and the ability of AAV-mediated gene therapy to correct the stress induced cardiac phenotype observed in many FA patients.

2-2-5

NEOvations Bench to Bedside Program Innovation: A Novel Casting Approach to Assess Open Fracture Wound Healing

Gina Tubo BS, Brian Foresi* MBA, Czarina Legitimas, Fayez Safadi PhD*

Open fractures require surgical intervention, prompting wound closure and casting. Sutures beneath casting material have the potential to burst and/or harbor infectious microorganisms. Casting prevents visualization of the incision, impairing a clinician's ability to diagnose and create a treatment plan in the event of these complications. The current practice for disease assessment beneath casts includes haphazard windowing with cast saws and the potential for saw-induced burns of the limb. Our team has

developed a device to implement during casting, mitigating the need for the use of cast saws. The device is 3-dimensionally printed with parameters that mimic the current windowing procedure outcome. Our device serves as a placeholder for cast technicians to utilize during casting to facilitate a molded port to underlying skin. The device was used in several cast placements by a cast technician to determine if appropriate windowing could be achieved without the use of a saw. Casting experiments have proved the efficacy of our device to provide a window equivalent in function to one made by a saw. Cast technicians were in favor of the device, highlighting this product's usability in the current marketplace. Our device provides evidence that prophylactic cast windowing can be performed without a saw, eliminating the risk of saw burns from current windowing procedures. Future directions will include a cast structural integrity experiment and a risk assessment study for allergic reactions and infection. Finally, our device will be used to conduct human trials in post-operative casting of open, long bone fractures.

2-2-6

Is HFpEF Caused by Coronary Microvascular Disease?

SaiAravind Sompalle BS, Catherine Domingo* MMAS, William Chilian PhD, Thomas Pucci MS, Karlina Kegecik BA, Vahagn Ohanyan MD, PhD*

Heart failure with preserved ejection fraction (HFpEF) is a conundrum as there is no effective treatment. We posit that one of the reasons for this deficiency relates to an incomplete understanding of the mechanisms underlying HFpEF, which may be related to inadequate preclinical models. Most preclinical models show modest levels of ventricular diastolic dysfunction, but do not consider one of the hallmarks of HFpEF – ventricular stiffness. Accordingly, we posed two questions. First, can we assess ventricular stiffness in a murine model, and second, does impaired perfusion of the ventricle, such as induced by coronary microvascular dysfunction, produce HFpEF? To answer the questions, we made measurements of left ventricular pressure-volume loops in anesthetized mice while varying end-diastolic volumes. The slope of the diastolic pressure-volume (P-V) line equates to stiffness. We completed the measurements in wild type, normal mice (WT) and mice null for Kv1.5 channels (Kv1.5^{-/-}); a model of

coronary microvascular dysfunction and inadequate myocardial blood flow. Our results show that Kv1.5^{-/-} mice have a steeper slope of the diastolic P-V relationship than WT indicating a stiffer heart (P<0.05). We postulate that the increased stiffness reflects HFpEF because Kv1.5^{-/-} mice (compared to WT) exhibit poorer exercise tolerance, lower peak exercise capacity, and shortened lifespan. Moreover, the ventricles of aged Kv1.5^{-/-} mice show extensive collagen deposition. In conclusion, our results are consistent with the concept that impaired myocardial perfusion induces microscopic areas of ischemia leading to cell death and fibrosis. The fibrotic injury accumulates over time and eventually leads to HFpEF.

2-2-7

Minimally Invasive Cable Grip System

Trinity Samson* BS, Alyssa Basdavanos* BS, Muhammad Islam, Eric Miller MD

Orthopedic cable systems may be used for long-bone fixation when securing a bone during fracture stabilization or joint implants. The current technology requires a large incision to visualize the bone, circumnavigate the cable, and receive the cable on the other side. The nature of the open procedure causes extensive soft tissue dissection and extends recovery time. The current tools are difficult to use and passing the cable around the bone can be problematic because of the room for error and time-consuming nature. With the patient under anesthesia longer, the surgeon working on the case longer, and the hospital losing valuable operating room time, all parties would benefit from a shorter procedure time and smaller incision site. Our technology is a minimally invasive bone securement system that acts as the final fixation step for bone securement or joint replacements and includes a system for inserting, tightening, and locking the wire around the bone. We completed 20 interviews for customer discovery and market validation. Market analysis demonstrated a growing \$39,585,000 orthopedic surgical device industry and growing cerclage cable procedure volume due to the increasing elderly population, trauma-related accidents, and FDA classification. Currently, no minimally invasive options for cable passing and securement are available on the market. A provisional patent application has been submitted for our technology. Further testing for a minimal viable product will need to be developed before pursuing a licensing agreement with a medical device company.

2-2-8

Diagnosis of Metaplastic Synovial Cysts in Clinical Dermatology

Paayal Vora BS, Sonam Rama, DO, Stephen Olsen MD*

Metaplastic synovial cysts are a rare clinical finding, with less than seventy cases diagnosed to date. These cysts are painful and can greatly impact patients' quality of life. The goal of this case report is to describe the manifestations of these cysts to aid in clinical diagnosis and management. We herein report a case of a 58-year-old male who presented with a bump on the lateral left knee. He experienced pain upon walking. Notably, he had a past medical history of left knee replacement fifteen years prior to presentation. Upon physical exam, the bump resembled a firm subcutaneous nodule. It was subsequently biopsied via eight-millimeter punch excision, revealing a metal portion of the patient's knee replacement; biopsy resulted in the removal of the entire bump. Biopsy results showed a cystic space in the deep dermis containing papillary villous projections consisting of fibrous cores, partially surfaced by a synovial-like lining. Based on these results, a metaplastic synovial cyst was diagnosed. The patient was referred to orthopedic surgery for replacement to prevent recurrence, as the metal in the knee replacement was presumed the source of the cyst. The patient was then reassessed three months later, and he described resolution of his knee pain. Physical exam showed a well-healed linear scar. This patient's history and exam findings, along with the dermatopathology results, reflect the characteristic pattern in patients suffering from metaplastic synovial cysts. Prompt identification and subsequent removal can significantly improve patient's pain and ability to carry out daily activities.

Primary and Mental Health Care I

2-3-1

Student Wellness at NEOMED - A Survey on Burnout and Stressors

Amy Adik BS, Arjun Pandey, Akanksha Dadlani MPH, Alexander Isla, Dr. Randon Welton, MD*

Burnout is a syndrome of professional distress defined by emotional exhaustion, depersonalization, and a sense of reduced personal accomplishment. Research

shows that over 50% of medical professionals in the US experience burnout. At NEOMED, wellness is a subject that has been of greater emphasis in recent years. Despite initiatives put forth by the College of Medicine, NEOMED has demonstrated low scores on the ACGME Wellness Surveys. We sought to investigate the degree of medical student burnout at NEOMED, and if this correlated to student wellness. An anonymous 8-question survey was sent out to all NEOMED College of Medicine students over a 3-week span in January 2021. The survey was done on Qualtrics SM Survey software and was statistically analyzed using Microsoft Excel. Data was broken down by year. The survey was completed by 166 students (28% response rate). Results showed that as students progress to their clinical years, they were more likely to self-report greater quality of relationships, ability to take time for self, and sense of purpose. Results also showed that about 50 percent of students, irrespective of year, claimed that medical school was worse mentally than they expected it to be. It is clear that students in their preclinical years feel more detached, drained, and defeated. It is also clear that while all four years of medical students had similar ratings for medical school difficulty, M3s/M4s were significantly more satisfied. Recommendations have been made to increase student wellness based on survey results.

2-3-2

Comparing the Mental Health of Medical School Population to a General Student Population

Amy Adik BS, Sanjay Jinka BS, Christian Seif BS, Ted Weber BS, Anika Jinka, Randon Welton MD*

There is limited data on how students in medical school compare to the general student population in universities. Our study compares the students at NEOMED (n=150) with the total student population (n=550,000) participating in the Healthy Minds Study (undergraduate and graduate students of similar age to NEOMED students) in spring of 2021. The results of the Healthy Minds Study at NEOMED were compared to the college population. Categories included emotional distress, previous diagnoses of mental illness, stress regarding mental health/social support, and psychiatric medications. There were no statistical differences in the response of NEOMED medical students and general university students when it came to needing help for emotional or mental health problems or taking psychiatric drugs. The NEOMED

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medical students were significantly more likely to have no days in the last month when emotional or mental difficulties hurt their academic performance ($p=.005$) or deny the need for help with emotional or mental health problems ($p=.047$). The NEOMED medical students were significantly less likely to have a previous diagnosis of depression ($p=.044$) or anxiety ($p=.028$); be willing to talk with a professional clinician ($p=0.017$), friend ($p=.001$), significant other ($p=.009$), or family member ($p=.001$) about serious distress; or take anti-anxiety medications ($p=.018$). Students at NEOMED seem to be functioning at or above the level of a general student population in terms of mental health functioning and utilization of resources. Next steps would be to examine potential reasons for these outcomes.

2-3-3
METRIC Hypertension Performance
Improvement Project: An AAFP Sponsored Study
Mary Klein MD, Bryce Fetterman BS*

Hypertension is a global health issue, accounting for 6.6 million deaths per year. Effective education and patient-specific anti-hypertensive pharmacotherapy has the potential to reduce morbidity and mortality associated with hypertension. An AAFP sponsored performance improvement project was completed to assess the effectiveness of the clinician's treatment of hypertension. Ten patients diagnosed with stage two hypertension were educated on the mechanism of hypertension and associated complications. ACE inhibitors (ACEi) were prescribed in patients without known adverse reactions and contraindications. Patients that were unable to tolerate the ACEi were treated with an Angiotensin II receptor blocker, calcium channel blocker, or diuretic. Patients were encouraged to take their medications daily, and to change to a low sodium diet. Motivational interviewing was used for smoking cessation. Patients were advised to follow up with a nurse in a week to recheck blood pressure and asked about medication adherence. Those with poor adherence weren't included in the project. The mean blood pressure among subjects was 146/90 at the initial visit. After a week of taking medications, the mean blood pressure was 129/80. 9 patients self-reported medication adherence. One patient refused medication and was advised to diet and exercise. This project allowed the physician to assess their performance when treating hypertension leading to better quality of care.

Medications along with patient education can lead to successful treatment of hypertension.

2-3-4
Implementation of a Dietitian Screening Protocol in a Student Run Free Clinic
Emily Marsico BS, Anna Cherian RD, LD, Alicia Bond, MD*

The Student Run Free Clinic (SRFC) provides health care to the medically underserved residents of Northeast Ohio. Many patients of the SRFC are affected by nutrition related chronic diseases such as diabetes, hypertension, and hyperlipidemia. Nutrition counseling provided by a registered dietitian (RD) can be one of the first approaches in managing these diseases. To help address these issues, a dietitian screening protocol at the clinic was implemented. The purpose of implementing this screening protocol, is to connect patients with hypertension, diabetes, and hyperlipidemia to a RD and help patients manage their chronic diseases through diet. Evaluate and collect patient demographics from EHR and identify which chronic disease categories a certain patient falls under. Ask these identified patients if they want to see a RD. Connect patient with RD to receive nutritional counseling. During the implementation process, there were 8 patients who were identified as meeting the screening criteria. Out of these 8 patients, 6 agreed to meeting with the RD. The RD still provides nutritional counseling to these 6 patients. The RD is responsible for evaluating patient goals, outcomes, and compliancy throughout the counseling process. Nutrition counseling can be one of the first approaches in managing chronic disease such as diabetes, hypertension, and hyperlipidemia. Utilization of a dietitian can help patients learn to prepare healthy meals, eat healthier, and create goals to develop sustainable changes. To connect our patients with a RD, we incorporated a dietitian into our clinic flow.

2-3-5
A Case of Fournier's Gangrene Following a Large-Volume Hydrocelectomy in a Diabetic Patient Managed with SGLT-2 Inhibitor Therapy
Giovanna Leone BS, Oren Barat* BS, Ethan Vargo MD, Aaron Yunker MD, Neel Parekh MD*

Patient is a 64-year-old male with type 2 diabetes mellitus (DM), mechanical aortic valve, on chronic

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anticoagulation with warfarin who initially presented with an enlarging left hydrocele after failed conservative management. He elected to undergo left hydrocelectomy and 2 liters of hydrocele fluid was drained. The patient's post-operative course was complicated by the development of Fournier's gangrene. It is believed that the patient may have been predisposed to Fournier's gangrene due to the concurrent use of dapagliflozin (Farxiga), a common treatment for type 2 DM. The patient subsequently underwent debridement and successful scrotal reconstruction. Fournier gangrene (FG) is a rare complication of SGLT2 inhibitors. FG is a necrotic infection of the scrotum, perineum, or penis that can be life threatening if not identified and treated early. There are no published cases of FG postoperatively. In one case, however, FG resulted after trauma to the perianal region. A 71-year-old female on dapagliflozin developed FG after falling in her bathroom. While physical trauma is different from surgical stress, both could be considered triggers for the development of FG by similar mechanisms. Currently, there are no clinical recommendations regarding the perioperative use of SGLT2 inhibitors and scrotal surgery. This is the first case in the literature of FG after scrotal surgery in a patient on a SGLT2 inhibitor. Overall, clinicians should maintain a high index of suspicion in the post-operative period in these cases and proceed with timely surgical interventions if FG were to develop.

2-3-6

A Shortage of Urologists in Rural America: An Analysis of the American Urological Association Census

Nicholas Krasnoschlik BA*

Physician shortages in rural areas contribute to the substantial health disparities experienced by this population and may be related to increased mortality when compared to other demographical categories. There is a stark difference in the number of specialists in rural versus urban areas with the National Rural Health Association reporting that there are only 30 specialists per 100,000 people in rural communities, compared to 263 specialists per 100,000 urban residents. Urology is a surgical subspecialty with many aging providers who struggle to meet the genitourinary needs of an aging population, many of whom experience urinary incontinence or need oncological treatment. This research aims to explore

the shortage of rural urologists and future trends in an aging provider population. Through the use of the American Urological Association Census data from 2014 to 2020 and Rural-Urban Commuting Zip Codes (RUCA) from the United States Department of Agriculture, trends in urologist age and their primary practice location were studied and visualized. Additionally, urologist to population rates were calculated for metropolitan, micropolitan, small town, and rural areas with rural areas having a significantly lower urologist to population ratio compared to all other areas studied. This ongoing research may provide insight into how to address rural urology provider shortages and future directions for rural urology research, a scarcely represented field in the literature.

2-3-7

Lung Herniation- A 62-Year-Old Male with a Rare Cause of Chest Pain in the Emergency Department

Nicholas Lesh BS, Alison Southern MD, MS, FACEP*

Lung herniation is an uncommon condition that may be congenital or acquired. Due to its rarity, lung herniation may be overlooked as part of the differential diagnosis in patients who present with chest pain to the emergency department (ED). This case report serves as an opportunity to educate on this rare topic. A 62-year-old man with a past medical history significant for coronary artery disease, hyperlipidemia, hypertension, and chronic obstructive pulmonary disease presented to the ED with sharp intermittent chest pain that occurred in ten-minute intervals for the past 2-3 days. The patient denied any syncope, orthopnea, paroxysmal nocturnal dyspnea, and peripheral edema. He stated he had a productive cough with clear mucus and occasional wheezing. Upon further inspection, the patient had a left anterior chest lump that he states has been present since a MIDCAB procedure in 2013. After a cardiac etiology was ruled out through EKG and serial enzymes, a computed tomographic angiography revealed herniation of lung parenchyma through the third left intercostal space. He was subsequently transferred to a tertiary care facility for definitive treatment. This case demonstrates the importance of maintaining broad differential diagnoses and avoiding anchoring bias. With chest pain being a common complaint in the ED, it is important for physicians to consider all etiologies of cardiac and non-cardiac chest pain.

2-3-8

A Case of Successfully Treated Urethral Condyloma Acuminatum in a Woman Utilizing Self-Application of 5-FU via a Q-Tip

Giovanna R. Leone BS, Howard B. Goldman MD, Jacqueline M. Zillioux MD*

Condyloma acuminatum (CoA) is a benign genital lesion caused by low-risk human papillomavirus (HPV) subtypes 6 and 11. Approximately 20% of HPV-associated genital warts occur in the urethra. [1] Treatment options include topical 5-fluorouracil (5-FU) or interferon, thermal or laser ablation, and excision. Procedural therapies may be complicated by urethral strictures or fistulae. [2] Topical treatment of urethral condyloma in women can be challenging to treat as it is difficult to apply the medication such that it maintains contact with the urethra long enough to be effective. We present a case of a successfully cleared urethral CoA treated via self-application using a Q-tip allowing adequate contact time with medication. A 63-year-old female with chronic idiopathic urinary retention on clean intermittent catheterization presented with a urethral meatal mass. Cystoscopy demonstrated frondular lesions throughout the urethra. Biopsy revealed CoA. A novel intraurethral 5-FU protocol was initiated: 5% 5-FU cream was applied to a Q-tip and placed intra-urethrally 4cm to approximate the bladder neck for 10 minutes. This was repeated with the tip placed more distally. Additional cream was then applied to the meatus. She was taught this technique over 3 weekly office treatments then transitioned to twice weekly home application. She tolerated treatment without adverse side effects. Interval cystoscopies showed progressive improvement. At 1-year follow-up, the urethra was clear of lesions. To our knowledge, this technique is novel. Our technique offers a non-surgical option for women with urethral condyloma who wish to avoid risks associated with traditional surgical therapy.

Primary and Mental Health II

2-4-1

Benefit versus Risk of Methocarbamol Use in Older Patients

Vincent Hensperger BS, Sue Fosnight RPh, BCGP, BCPS*

We aimed to gather information about the use of methocarbamol in older patients. Methocarbamol is a muscle relaxant that is recommended to be avoided in older patients by the 2019 Beers Criteria for Potentially Inappropriate Medication Use in Older Adults. However, literature indicates it may have opioid-sparing effects and some use in older patients has been noted. This review was approved as a quality improvement project by Summa's IRB. Data was retrospectively collected in reverse chronological order for inpatient adults age 65 and older who received methocarbamol between June 2020 and May 2021. The primary outcome was change in opioid use in oral morphine equivalents 24 hours before and after methocarbamol administration. Secondary outcomes included changes in pain, delirium, and falls. Data was collected for 57 patients. The mean opioid intake in oral morphine equivalents prior to methocarbamol administration was 29.6 mg (SD 22.22). This is compared to the mean opioid intake post-methocarbamol administration of 34.4 mg (SD 39.57); P-value= 0.349. Pain scores (0-10 scale) were measured as 6.98 (SD 2.68) pre-methocarbamol and 5.06 (SD 2.88) post-methocarbamol, P-value <0.001). No significant changes in delirium scores or falls were noted. Methocarbamol showed no significant effect on opioid use, falls, or delirium. Pain scores were significantly decreased post methocarbamol use, but this may be due to the non-significant increase in opioid use. Further, larger, controlled trials are needed.

2-4-2

Understanding Obesity Attitudes and Knowledge in Health Sciences Students

Erika Marie C. Quedding B.Sc, MFT, Kristen A. Knepp, PhD, Mary Himmelstein, PhD*

Our team utilized surveys to measure body weight biases among current NEOMED health sciences students. The research team hypothesized that NEOMED students will display anti-obesity biases that have been demonstrated in prior research studies.

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Participants were surveyed on: demographics (e.g., height, weight, race, gender identity); beliefs about the causes of obesity; attitudes about treating obese patients; counseling confidence with obese patients; and knowledge about weight stigma. 45 respondents reported mean BMI of 25.68 kg/m² with a response rate of 19.2%. Regression analysis showed significant relationship between participants' own BMI and Personal Experiences in Healthcare score. The most rated common causes of obesity were: 1) food prices; 2) poor nutritional knowledge; 3) food addiction; and 4) genetic factors. Participants indicated, on average, they were somewhat familiar with the term "weight stigma," and believed it had at least a moderately strong effect on all health outcomes listed (e.g., depression, self-esteem, unhealthy eating, healthcare avoidance). Participants reported low scores on the Antifat Attitudes Questionnaire, except on items that assessed their own fears of gaining weight. Evidence suggests this sample was already familiar with weight stigma and its negative effects on health. Higher BMI participants were more likely to report experiencing weight stigma themselves. On average, students reported feeling somewhat confident about counseling obese patients. The current study measured explicit weight bias but social desirability may have impacted results. Further research is needed to measure implicit weight bias and consequences of providers' perceptions on patient care.

2-4-3

Identification & Assessment of Factors Affecting Patient & Institution Satisfaction with Addiction Services of the South End Community Health Center

Aviva Aguilar BS, Mohamed Hashem*

A survey study was done to determine patient satisfaction and factors influencing initiation to care at South End Community Health Center (SECHC) Addiction Services for substance-use disorder. South End Community Health Center Addiction Services was having trouble with identifying barriers to care. We decided to make a survey questionnaire to gauge what aids patients in getting care at South End Community Health Center Addiction Services and what factors interfere with getting care. Initiation and engagement in care are important as they are quality measures that predict morbidity and mortality in

patients with substance-use disorder (Claude M. Setodji, 2018). For this reason, both patients and referring institutions were surveyed. Three survey questionnaires were designed: 1) Patients who had in-person visits 2) Patients who had phone visits, and 3) Institutions that refer patients to SECHC Addiction Services. A total of 41 patients responded over a 3-week period with a 38% response rate over the phone and in-person and a 62% of patients who did not complete the survey. Our patients' ages ranged between 26-76 years of age. Results from patient surveys showed that most participants rated provider communication as "good" or "excellent" and shared that at South End Community Health Center Addiction Services they are treated like family. An area of growth is accessing the clinic via phone. Results from the questionnaire for institutions echoed similar barriers as patient surveys in having difficulty accessing communication via phone with South End Community Health Center Addiction Services. The survey results indicated that accessing the clinic via phone is difficult and interferes with access to care. The treatment and effective communication providers give patients showed increased patient engagement to care.

2-4-4

Perceived Value of Pediatric Palliative Care Home Visits by Caregivers

Gwendolyn Richner BA, Daniel H. Grossoehme, DMin, MS, Jaime Sellers, MD, MPH, Sarah Friebert, MD*

Home-based hospice and palliative care (HBHPC) is an increasingly important service for pediatric patients with significant medical conditions. On a systems level, HBHPC has been shown to reduce cost and inpatient length of stay. However, there is a lack of available objective data from patient families. The purpose of this qualitative hypothesis-generating study is to identify domains of perceived "value" of HBHPC to the parents/legal guardians of pediatric palliative care patients. This ongoing, IRB approved, grounded theory study utilizes semi-structured interviews. We recruited 16 participants and will continue recruiting until thematic saturation is reached (expected maximum of 24 participants). Participants

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are the parents/legal guardians of patients who have received at least one HBHPC visit. Interviews are conducted by phone, video, or in-person. Interviews are transcribed, verified, and analyzed by the first three authors. NVivo 12.0 software is used for data management and analysis. Preliminary analysis of n=16 caregiver (n=14 identifying female; n=14 Caucasian; patient ages <2 to 23 years) interviews shows that participants value HBHPC for several reasons: reduction of risk (travel, infection), decreased parental burden (cost of transit, economy of time), enhanced quality of care (decreased distractions, greater provider “mindfulness,” improved child cooperation, greater sense of child’s home life), empowerment and validation of the family, and benefit to healthcare conversation (collaboration, emotional safety, content). Families engaged in HBHPC ascribe value to palliative care home that differs from value to providers or health care systems. Offering home visits in a HBHPC program may enrich provider-family collaboration.

2-4-5

Patients Feeling Heard Can Lead to Better Outcomes

Poojajeet Khaira BS, Cynthia Pung MD, Bradley Moore MD*

A 56-year-old African American male presented with shortness of breath, sepsis, and right lower extremity swelling. The patient had been discharged from the hospital a few days prior for new onset congestive heart failure and acute kidney injury. Past medical history notable for diabetes mellitus, hypertension, prior COVID-19 infection, Charcot arthropathy of right foot, and depression. His physical exam was remarkable only for bilateral leg swelling with ulceration on bottom of the right foot. Infectious workup revealed Group B Streptococcus bacteremia with the source likely being his right foot ulceration with osteomyelitis and he was started on IV cefazolin. Orthopedic surgery recommended and discussed the indications for a below the knee amputation, but he refused to have the surgery fearing that it would result in his death. His renal function continued to worsen leading to a discussion of hemodialysis, but he refused this option as well. Over the course of the patient’s

hospital stay, the patient continued to decline recommended treatments. The patient was becoming noticeably more depressed and feeling overwhelmed about his ongoing medical conditions. Psychiatry was consulted and uncovered information that explained the patient’s significant distrust in medical professionals. He was diagnosed with adjustment disorder and was given mirtazapine. Patient’s mood and appetite improved, and he decided to move forward with the amputation. This case report illustrates the importance of investigating the root of patients’ nonadherence and the value of a detailed history. Acknowledging a patient’s fears can result in decreased length of hospital stays and increased adherence.

2-4-6

End of Life Care for the Sikh Patient

Raman K. Bhambra, BS, Gurkiran K. Singh BS, Poojajeet K. Khaira, BS*

The Sikh religion is the 5th largest religion in the world, yet when it comes to palliative care, health care professionals may not have the knowledge base to provide these patients with the care they desire. We believe there is a lack of understanding of Sikh beliefs in the United States healthcare system. Therefore, at the end of life, it is imperative that healthcare providers are aware of Sikh beliefs, so they can respect them and properly care for Sikh patients by including spirituality and religion in the approach to palliative care. Contrary to the Abrahamic concept of heaven and hell, Sikhs believe that after death, the soul will either be subject to the cycle of reincarnation or union with God. Death of the human body is an inevitable process of life, a part of the divine will, or *Hukam*, so Sikhs are taught to live with the constant remembrance of death as an acceptance of God’s will. Furthermore, upon death of the human body, Sikhs undergo cremation. After cremation, a *sehaj paath bhog* is performed as a final prayer. Knowing these basic principles and practices may assist healthcare providers to better understand the Sikh religion and how to incorporate these beliefs to end-of-life situations in the clinical setting. Although there will be individual variations with each patient encounter, understanding these core beliefs will help providers

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initiate these difficult discussions with their Sikh patients.

2-4-7

Novel Interventions to Reduce Fall Risk in Geriatric Patients

Benjamin Arnold BA, Douglas Harley DO*

Creating resources to increase fall awareness is increasingly important because of America's aging society and the increasing costs of medical care. According to WHO, a fall is defined as an event in which a person inadvertently comes to a stop by means of the ground. In 2018, the CDC estimated over 35 million unintentional fall reports in older adults (>65 years old), despite potentially up to 75% going unreported. Falls are the leading cause of unintentional injury in this population. Furthermore, with this data, the CDC predicts that an older adult in the U.S. will die from a fall every seven seconds by the year 2030.³ To address this issue, we designed a brief patient handout to encourage the reporting of falls and address the risk factors that contribute to fall likelihood. However, and perhaps more worrisome, one study reports that only 8% of primary care physicians base fall prevention practices on national clinical guidelines, if used at all.⁴ This is in part due to the time constraints within the healthcare setting, but also due to a lack of effective screening resources. For this reason, we developed an EHR template based off national guidelines – physiological risk (age, sex, BMI), physical examination results, medications, diagnostic comorbidities, and environmental hazards – to screen, standardize, and evaluate a patient's fall risk. Ultimately, both the patient handout and EHR template will help increase the Center for Family Medicine's awareness and risk assessment surrounding geriatric falls, making for a safe, risk-prepared community.

2-4-8

COVID-19 and Mental Health in a Rural Population

S. Jinka BS, J. Natarajan BS, S. Mansoor BS, M. Kubina BS, T. Kotsch BS, C. Leahy BS, J. Glover MD, J. Nam MD, R. Fischbein PhD, and M. Appleman M.Ed.*

PURPOSE: This study aims to determine patient feelings related to COVID-19 within a rural Ohio population. Community-wide containment and an emphasis on social distance reduces asymptomatic and pre-symptomatic spread of COVID-19. However, compliance with social distance comes with challenges including mental health difficulties. Rural communities specifically face unique barriers to health care compared to that of metropolitan areas. To date no studies have been published regarding feelings towards COVID-19 in rural Northeast Ohio.

METHODS: A 20-question Likert-scale based cross-sectional survey design was approved by IRB at NEOMED. The survey was administered over a 6-week period from February to April 2021 among residents of rural Ohio, identified via rural primary care offices. To assess patient mental health related to the pandemic respondents were asked to indicate their tendency to feel Tense, Upset, Relaxed, Worried, and Annoyed when thinking about COVID-19 in the previous month. Chi-squared statistical analysis was used for analysis.

RESULTS: Statistical analysis is still in progress. However, Likert scale question methodology with 23-person sample size and preliminary significant data suggest promising correlations.

CONCLUSION: When completed for presentation this study will be able to identify perceptions/behaviors that correlate with negative feelings towards COVID-19, a sociologically and clinically useful outcome.

System Sciences**3-1-1****Upregulation of Thrombospondin-1 Associates with Accelerated Atherosclerosis and Reduced SMC Differentiation in Metabolic Syndrome**

Shreya Gupta MS, Saugat Khanal BPh, Amy Mathias MS, Jason Lallo BS, Jessica Ferrell PhD and Priya Raman PhD*

Hyperglycemia and obesity, characteristic of metabolic syndrome (MetS), are important risk-factors for atherosclerosis. MetS patients manifest increased vascular smooth muscle cell (VSMC) migration and proliferation, critical for evolution of atherosclerosis. We previously reported that high glucose and high leptin independently upregulate a potent proatherogenic matricellular protein, Thrombospondin-1 (TSP-1), expression in VSMC. The goal of the present study was to interrogate the role of TSP-1 in SMC de-differentiation and development of atherosclerosis in MetS. We utilized a mouse model of combined MetS and atherosclerosis (KKAy^{+/-}/ApoE^{-/-}) by crossing obese hyperglycemic agouti KKAy^{+/-} mice with atherosclerotic ApoE^{-/-}. Upon weaning (4 wks age), male yellow KKAy^{+/-}/ApoE^{-/-} and age-matched black KKAy^{-/-}/ApoE^{-/-} littermates on standard lab diet were monitored monthly for body weight and blood glucose and harvested at 24 wks age after overnight fasting; plasma, aorta and heart were collected for further studies. At 16 wks age, KKAy^{+/-}/ApoE^{-/-} mice showed significant increase in body weight and random blood glucose levels (<0.0001) vs. KKAy^{-/-}/ApoE^{-/-} littermates, validating the MetS phenotype. Prior to harvest, mice were subjected to treadmill exercise test wherein MetS mice showed significantly reduced peak oxygen consumption (VO_{2max}) and maximum running speed, suggesting impaired cardiovascular fitness. Aortic root morphometry revealed 4-fold increase in lesion lipid burden in MetS vs non-MetS mice which was accompanied with reduced LMOD (SM contractile marker), SRF (transcriptional activator of SM contractile genes) and increased TSP-1 expression in aortic vessels. Together, our data suggest a putative role of TSP-1 in SMC de-differentiation and atherosclerotic lesion formation in metabolic syndrome.

3-1-2**Effect of High Fat High Carbohydrate Diet on Histone Acetylation**

Vijay Konka BS, Andrea Arias-Alvarado MD, PhD, Takhar Kasumov PhD, Serguei Ilchenko PhD*

Acetylation is linked to metabolism and protein stability. The objective of this study is to quantify the effects of acetylation on protein stability in high-fat, high-carbohydrate diet (HFHCD). This study was done on wild type and SIRT3 knockout mice. The SIRT3 protein has an influence on mitochondrial beta-oxidation and is involved in metabolism through hyperacetylation of mitochondrial proteins. Mice were divided into groups based on type, sex, and diet. Respiratory exchange ratio was measured using Comprehensive Lab Animal Monitoring Systems (CLAMS) and Echo MRI data were gathered to analyze both lean to fat content. Mice were placed on a normal or HFHCD for 12 weeks. The last 21 days, they had free access to heavy water (D2O). D2O labeling was used to measure the acetylation liver proteins to characterize the effects placed on them. Peptides were analyzed by mass spectrometry. The mice on HFHCD had increased body weight and liver weight compared to mice on the normal diet. Mice had significantly increased fat content, baseline glucose, cholesterol, and LDL levels in the HFHCD. They developed insulin resistance, glucose intolerance, and increased respiratory exchange ratios. The increased respiratory exchange ratio shows a greater glucose oxidation on HFHCD. Acetylation turnover rate decreased in the HFHCD. The mice on the HFHCD had poorer health outcomes regarding metabolic processes and weight levels. The histone acetylation turnover rate decreased in the experimental group, but its mechanism of action is not completely understood and needs to be further studied.

3-1-3**The Effect of Chemotherapy and Radiation on Spinal Gliomas**

Vincent Pham BS, Rituraj Upadhyay MD, Aaron Seo MD, Michael Johnson MD, Susan McGovern MD, Jing Li MD*

The study focuses on progress free survival (PFS) and overall survival (OS) in low grade spinal glioma patients. This study examines patients with a history of radiation therapy (RT), chemotherapy, or resection. A retrospective chart review was conducted to study

the clinical features of low-grade gliomas. Data on age, tumor grade, chemotherapy, radiation dosage, and recurrence were extracted. PFS and OS in all patients as well as patients who received RT were analyzed. Statistical analysis was performed using Kaplan Meier and Cox Regression. The sample consisted of 43 patients with low-grade glioma. There were 34 patients who received RT. Forty-two patients received surgery. The median age was 14. Twenty-one patients received chemotherapy and the median dosage was 45 Gy. The median OS was 51.53 months. The hazard ratio (HR) was 7.21 for dosage greater than 45 Gy ($P=0.025$). The median PFS was 23.9 months; the hazard ratio was 13.51 for chemotherapy ($p=0.013$). 79% of patients received radiation. Radiation dosage greater than 45 Gy was associated with worse local control of tumor. Patients who received chemotherapy are more likely to failure than those who did not. Clinical trials are needed to reevaluate the dosage for low grade gliomas. These contradictory results may be related to later tumor staging and the small sample size. More studies should be conducted to learn about the roles mutations, RT, and surgery play in gliomas.

3-1-4

Doxorubicin-induced Cardiomyopathy: Prevention and Treatment of Doxorubicin-induced Cardiomyopathy

Parker Kim BS, Gregory Mack, Karlina Gerecik, Molly Enrick, Lindsay Shockling, Christopher L. Kolz, William Chilian PhD, Vahagn Ohanyan MD, PhD*

Doxorubicin is an anthracycline-class chemotherapeutic agent that is used alone, or in conjunction with other medications, for patients with different types of cancer. One of the side effects of doxorubicin treatment that limits its use is its cardiotoxicity. Doxorubicin-induced cardiomyopathy (DiC) typically has the morphological and functional abnormalities of dilated cardiomyopathy. Eventually, this can lead to congestive heart failure, which carries a 50% mortality rate. Currently, there is only one FDA-approved drug to prevent and treat DiC: dexrazoxane (iron chelator). The goal of this proposal is to test the hypothesis that Chromonar, a coronary-specific vasodilator, will also be effective in treating DiC because of its established beneficial effects in the treatment of dilated cardiomyopathy and heart failure. C57Bl6 mice (Male N=10, 3 months old) were treated with Doxorubicin (5mg/kg/week) for 6 weeks. After 6

weeks of doxorubicin treatment, the treatment group received Chromonar (3mg/kg/day) for 4 weeks. Cardiac function was assessed using a high frequency ultrasound system (Vevo 2100). 6 weeks after doxorubicin treatment, all mice developed heart failure with ejection fractions below 40%. The Chromonar treatment group showed significantly improved cardiac function (EF of $62\pm 4\%$ vs. $39\pm 5\%$ control). Cardiac functionality continued to worsen in the control group, even after doxorubicin treatment was stopped. Based on these findings, we propose that a cause of doxorubicin-induced cardiomyopathy is inadequate blood flow to the myocardium. Pharmacological coronary-vasodilation with Chromonar increases myocardial blood flow and therefore may stop and reverse the functional decline of DiC.

3-1-5

Mitochondrial Heme Lyase Mediates the Cardiac Resilience to Ischemia and Reperfusion

Stephanie Wolff BS, Chwen-Lih Chen, Thomas Pucci, MS, Vahagn Ohanyan, MD, Ph.D., Yeong-Renn Chen, Ph.D.*

The mitochondrial cytochrome c heme lyase (HCCS) catalyzes thioether bond formation between two vinyl groups of heme and two specific cysteines of *c*-type cytochromes within the electron transport chain (ETC). HCCS functions as the major upstream enzyme of redox pathway in mitochondria. In the disease conditions of myocardial ischemia and reperfusion (I/R), HCCS is a major target of oxidative attack from ROS occurred during acute I/R. Down-regulation of cardiac HCCS is closely related to I/R-induced heme damage, which leads to mitochondrial dysfunction with declining cardiac resilience. We used mouse models overexpressing HCCS in cardiac myocytes (HCCS-tg) to test the hypothesis that enhancing heme biogenesis mediates cardiac adaptation to stress condition and promotes cardiac resilience to I/R. Under the basal conditions, the cardiac function of HCCS-tg exhibited a modestly increased ejection fraction by ~20% (HCCS-tg vs WT) measured by echocardiography. The mitochondria isolated from the HCCS-tg heart showed an increased ADP-dependent oxygen consumption rate by 11.7% and respiratory control index by 46.7%, indicating overexpressing HCCS improves cardiac function via increased mitochondrial function. Mice were subjected to

coronary ligation for 30-min, followed by 24-h reperfusion. Mitochondria were isolated from risk regions of post-ischemic myocardium and subjected to biochemical analysis of ETC activities. Significant impairment of ETC activities were detected in the myocardium from WT, while protection of the ETC activities from I/R injury was observed in the HCCS-tg heart. In conclusion, gaining HCCS function in vivo mediates cardiac resilience to I/R via enhancing mitochondrial function and promoting myocardial adaptation to increased oxidative stress.

3-1-6

The Vascular Basis of Takotsubo Syndrome

Leah Choban BS, Sarah Godel* BS, Anna Martin* BS, Feng Dong MD, PhD, Vahagn Ohanyan MD, P.D, William Chilian, PhD*

Takotsubo Syndrome (TTS) constitutes an unmet medical need as there is no “standard of care.” Although originally considered innocuous, recent reports reveal an in-hospital mortality rate of patients with TTS equivalent to those with an acute myocardial infarction. The incidence of TTS is increasing, likely due to improved diagnoses. A noteworthy disease phenotype in TTS is ballooning of the left ventricular (LV) apex during systole, simultaneous with contraction of the base. The mechanism(s) underlying this disassociation of mechanical activities is(are) unknown, but a murine model may provide insight in understanding the cause. We found that mice null for Kv1.5 channels (Kv1.5^{-/-}) exhibit TTS when stressed with hypertension or with a 3-day protocol of catecholamine administration. In this global knockout, if the Kv1.5 channel is re-expressed only in smooth muscle, the TTS phenotype does not occur. Accordingly, we propose that regulation of coronary vessels in the base and the apex of the left ventricle differs and that there will be regional variations in gene expression. To address this, we examined RNAseq results of genes expressed in the vasculature and differentially expressed between the base and the apex of the LV. Specifically, we found that KCNA2, FGF12, CACNA2D2, SCX, CNTN2, SLC24A2 are upregulated in the base compared to the apex of the LV. Some of the genes are associated with membrane potential (KCNA2), with Ca⁺⁺ regulation (CACNA2D2), and with vascular growth (FGF12),

suggesting different regulatory mechanisms governing vascular control in the base and apex of the heart in TTS.

3-1-7

The Role of SDF-1/CXCR4 Axis in Diet-induced Diabetic Cardiomyopathy

Zara Orozco BS, Matthew Kiedrowski BS, Marc Penn MD, PhD, Feng Dong MD, PhD*

In this study we define a novel role for the SDF-1/CXCR4 axis in the hibernation and treatment of myocardial tissue in diabetic cardiomyopathy (DCM). Wild-type and cardiac CXCR4 null (CM-CXCR4 null) mice were randomly assigned to low-fat diet (LFD) or high-fat diet (HFD) for 30 weeks. Serial echocardiography was used to assess cardiac function. SDF-1 plasmid (80 ug) was injected into the LV wall of half group of the HFD mice (27 weeks). SDF-1, CXCR4, SIRT1, SIRT3, and SIRT6 mRNA levels in the hearts were quantified by qPCR at different times. Compared to age-matched LFD mice, 27-week-old HFD mice showed a 33% decrease in Ejection Fraction (EF). Direct myocardial injection of hSDF-1 plasmid led to a 15% and 30% improvement in EF 1 and 3 weeks later, respectively, compared to control. To determine if CM-CXCR4 expression induces CM hibernation as a mechanism of DCM, we quantified cardiac function in HFD CM-CXCR4 null mice. We observed an early loss of cardiac function in HFD CM-CXCR4 null mice compared to HFD control mice. Interestingly, SIRT1 and SIRT6 were statistically decreased in HFD mice, suggesting that SIRT signaling may be involved in blunted SDF-1 signaling in DCM. Our data demonstrated that the SDF-1/CXCR4 axis has an important role in DCM. Our data suggests that cardiac myocyte over-expression of CXCR4 is involved in cardiac myocyte hibernation. These data suggest that modulation of SDF-1/CXCR4 expression will delay or alleviate DCM

Pharmacology

3-2-1

Metabolomic Features Associated with Carboxylesterase 1 Activity: Biomarker Screening for Sacubitril Therapy Optimization

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Sacubitril selectively activated by carboxylesterase 1 (CES1), is expected to be widely used for treating heart failure. However, significant inter-individual variability in sacubitril pharmacokinetics (PK) has been consistently reported. To date, the reported CES1 genetic markers cannot explain much of the observed variations in sacubitril disposition. The objective of this research is to identify the endogenous metabolites associated with CES1 activities on sacubitril activation, having the potential to be used to predict sacubitril response and ultimately optimizing sacubitril therapy for patients. HEK293 cells transfected with wild type (WT) and mutant CES1 (G143E and E220G) genes were utilized as cell models exhibiting varied CES1 activities. The sacubitril activation rates and the endogenous metabolite profiles in the cells were obtained using a drug incubation assay and metabolomic analysis. The metabolite biomarkers associated with the CES1 activity on sacubitril activation were screened out by 1) comparing the metabolomic profiles among the cells expressing WT and mutant CES1, and 2) analyzing the correlations between the signature metabolites with sacubitril activation rates in these transfected cells. Distinguished metabolite features were observed among the wild type and variant CES1 transfected cells based on a principal component analysis (PCA). Cystathionine sulfoxide levels were positively correlated with the sacubitril activation rates in the cells with different CES1 activities ($p < 0.001$, $R^2 = 0.8164$). Cystathionine sulfoxide was screened out as a potential biomarker that indicates CES1 activity on sacubitril activation. Further studies are warranted to confirm the identification and validate this association in humans.

3-2-2

Evaluating the Role of Pharmacy Technician-Administered Vaccines in Ohio During the COVID-19 Pandemic

Erin Merico P4, Kevin Fuschetto, PharmD, BCACP, BC-ADM, Kunal Amin, BSPS, PharmD, RPh, Dave Gothard, MS*

Before the COVID-19 pandemic, most states limited immunizations to trained pharmacists and interns. In October 2020, the Secretary of Health and Human Services amended the Federal Public Readiness and Emergency Preparedness Act (PREP Act) to increase childhood immunization rates and prepare for the vaccine roll-out. This amendment authorized qualified pharmacy technicians to administer COVID-19 vaccines to persons ages 3 and older and other vaccines to persons ages 3-18 years. This research explores whether pharmacy technician-administered vaccines would benefit the practice of pharmacy following the pandemic. An electronic survey, using Qualtrics, was emailed to all pharmacists and pharmacy technicians in the state of Ohio in July 2021. Twenty-four questions, Likert-scales and rankings, were evaluated. The primary outcomes are answers to the 3 Likert-scaled questions regarding pharmacy technicians administering vaccines pre, post and overall. 2179 responses were collected, with 1439 participants completing the survey. Results showed 366 (41.1%) pharmacy technicians and 232 (41.9%) pharmacists agreed or strongly agreed employers should require pharmacy technicians to administer vaccines. 675 (76.2%) pharmacy technicians and 365 (65.9%) pharmacists agreed that trained pharmacy technicians should be able to administer vaccines to patients post COVID-19 pandemic. Pharmacists, who were faced with an increased workload during the COVID-19 pandemic and have previously worked with technicians experienced in giving vaccines are receptive to the idea of expanding the role of pharmacy technicians in vaccine delivery. Among Ohio pharmacists and technicians, continued pharmacy technician-administered vaccines post-pandemic would have a positive impact by reducing pharmacist workload on the profession.

3-2-3

A Rational Strategy for Characterizing the Beta-Lactam Antibiotic-Induced Multidrug Resistance Patterns

Noah Aguirre, Trae Hillyer BS, Woo Shik Shin PhD*

Acinetobacter baumannii (*A. baumannii*) is a Gram-negative multidrug-resistant ESKAPE (Enterococcus, Staphylococcus, Klebsiella, Acinetobacter, Pseudomonas) pathogen causing severe nosocomial infections in modern public health systems. With a limited number of approved antibiotics in recent years and the prevalence of infections and outbreaks caused by multidrug-resistant *A. baumannii*, few antibiotics effectively treat infections caused by this pathogen. The simultaneous expression of different classes of β -lactamase enzymes has been the biggest obstacle to numerous attempts to overcome drug resistance. Therefore, a practical approach strategy for the treatment of resistant bacteria is required. To provide a detailed understanding of the β -lactamase expression mechanism underlying drug resistance, here we offered a rational strategy for identifying and characterization of β -lactamase-induced drug resistance. *A. baumannii* ATCC19606 was selected and cultured in nutrient media with all five classes of β -lactam antibiotics. Cell-free supernatant was isolated, concentrated, and characterized for β -lactamase biochemical activity using colorimetric substrate nitrocefin. The antibiotic-selected bacteria expressed β -lactamases in the cell-free supernatant were separated by SDS-PAGE, trypsin digested, and identified by LC MS-based proteomics approach. Here, we report for the first time that multidrug resistance of *A. baumannii* can induce by overexpression of several types of β -lactamase. And the different types of antibiotic administration generate different patterns of β -lactamase expression in-vitro. Our study highlights the importance of distinct pattern recognition of multidrug resistance caused by the expression of multiple β -lactamases and a rational strategy to design and optimize precise antibacterial combination therapy to predict and release the future β -lactam drug resistance.

3-2-4

Carboplatin Medication Use Evaluation

Hala Daghlas-Yusuf BS*

In 2019, the National Comprehensive Cancer Network implemented new guidelines for the use and administration of carboplatin. This update focused on specific recommendations based on specific parameters when calculating the appropriate dose for patients, and when to apply these considerations. Administered doses of carboplatin were assessed in patients who received treatment at a northeast Ohio urban hospital and its four infusion centers to determine practice guideline compliance. The new guidelines were implemented at Akron General infusion centers on September 1, 2019. To be included in the study, patients must have initiated treatment between September 1, 2019, and December 31, 2020. In addition to sCr, parameters including weight, age, height, and sex must be utilized when calculating GFR. Any patient that did not have a recorded weight or sCr within 24 hours prior to drug administration was omitted. At Akron General, the accepted variance in dosage administration is 10%. The group with the highest incidence of 10% or less was the combined parameters group for Cycle 1 Day 1 administrations with 98 patients (60.1%), and the combined parameters group again for Cycle 2 Day 1 administrations with 87 patients (58.4%). Ideally, all patients should have combined parameter considerations used when calculating the final dose to administer, however there are countless patient specific considerations which often directly influence the final dose. Although these differences in administration dose could have risen from any extent of multi-factorial influences and extenuating circumstances, a second study may be relevant to determine the appropriateness of these variances further in depth.

3-2-5

Macrolide Prescribing Patterns for Preventing Exacerbations of Chronic Obstructive Pulmonary Disease (COPD) in a National Representative Outpatient Population

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Acute chronic obstructive pulmonary disease (COPD) exacerbation correlates to increased risk of hospitalization and mortality. This study evaluated the prevalence of macrolide use for the prevention of exacerbation among patients with COPD without other acute indications for azithromycin or erythromycin use in the United States. This was a national, retrospective, multicenter study conducted using the National Ambulatory Medical Care Survey from 2013 to 2016. Patients diagnosed with COPD over 40 years of age were included. Patients were excluded from the study if they had any other indication for macrolide usage. The primary outcome was to determine the percentage of patients receiving treatment with either azithromycin or erythromycin. Logistic regression was used to determine predictors of macrolide prescribing. A total of 4,486 patients with a diagnosis of COPD met inclusion criteria and 208 of these patients received a macrolide antibiotic (4.64%). Positive predictors of macrolide prescribing were females (OR: 1.613; CI 1.055-2.466), patients on multiple maintenance COPD medications (19.779; CI 5.069-77.175), and patients prescribed glucocorticoids (3.149; CI: 1.677-5.915). Macrolide antibiotics were less likely to be prescribed in older adults (OR: 0.476; CI 0.246-0.922) and in patients with more chronic conditions (OR: 0.242; CI: 0.138-0.472). While overall macrolide utilization remains low, these findings support there was an increase of macrolide prescribing in patients with multiple COPD interventions. By identifying prescribing patterns, this study provides a framework for future investigation of adverse effects and resistance patterns of chronic macrolide therapy for the prevention of COPD exacerbations.

Translational Models I

3-3-1

The Lysosomal Trafficking Regulator (LYST) Gene is Regulated Through FGF2 via an FGF-Receptor Signaling Mediated Pathway

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The lysosomal trafficking regulator (LYST) gene encodes a large, approximately 430kDa LYST protein

known for its involvement in the size and trafficking of lysosomes. While mutations in the LYST gene result in cellular defects including macrophage signaling, platelet degranulation, fibroblast membrane repair, and enlarged lysosomes, it also impacts global biological processes. Prior work by our group has revealed LYST as a potential novel modulator of regenerative repair processes. Therapeutic interventions aimed at LYST remain elusive, however, due to a limited understanding of its regulatory factors. In this study, we elucidate the underlying mechanisms of LYST gene expression regulation to inform future therapeutic interventions aimed at the LYST protein. We utilized primary adult derived fibroblasts from wild-type, beige (LYST gene mutant), and novel LYST exon 52 KO mice. We demonstrate that serum starvation significantly upregulates LYST gene expression and exacerbates its enlarged lysosomal phenotype due to an absence of transcriptional downregulation via FGF2 signaling through the FGF receptor mediated pathway. Induction of cellular autophagy revealed that the enlarged lysosomal phenotype in beige fibroblasts is not directly related to LYST gene expression and is independent of autophagy, but is responsive to UV light induced damage. We further demonstrate that LYST protein cellular localization (nuclear vs cytoplasmic) is cell cycle dependent. These results highlight a novel role for FGF signaling in LYST gene expression. Future work aimed at modulating LYST gene and subsequent protein expression in a tissue regeneration environment may be achieved through drug therapy targeting the FGF receptor signaling pathway.

3-3-2

Identifying the Multifactorial Therapeutic Mechanisms of Irisin Against Emerging Neuropathology in htau and 3xtg Mice

KA Bretland BS, KM Bretland, L Lin, S Terrill, G Leone, CM Dengler- Crish*

Alzheimer's disease (AD) is an age-related neurodegenerative disorder that continues to exact a disabling and lethal toll on patients. Late-onset AD, the most common form of dementia, has a multifactorial etiology that has challenged the development of disease-modifying drugs due to the need for these agents to address multiple mechanisms. However, the recently-discovered exercise-evoked hormone irisin could provide a unique therapeutic

opportunity to address all of the key pathologies seen in AD: amyloid- beta plaques, neurofibrillary tangles, and neuroinflammation, as well the major midlife metabolic diseases that confer increased risk for late-onset AD (e.g. diabetes, obesity). Previously, our lab published work showing that four weeks of exogenous irisin treatment prevented the emergence of hippocampal pathology in female htau mice, a transgenic model of AD like tauopathy. Here, we present data expanding this work that a) investigated irisin's effects in 3xtg mice that develop both amyloid and tau pathology, and b) identified specific cytokines altered by irisin treatment in htau mice that support its anti-inflammatory effects in the hippocampus. Adding further complexity to irisin's potential, we identified sex-divergent effects in irisin treatment-response in both AD mouse models. Our results further support irisin's potential as a neuroprotectant against AD-related etiology and emphasize the importance of identifying critical sex differences in treatment response.

3-3-3

An Organ-On-Chip Neuronal Model

Logan Galbraith BS, Patrick Kang PhD, Judith Fulton PhD*

Conventional pre-clinical trials of drugs to evaluate the safety and efficacy relies on 2D in-vitro cell culture and animal models. Microfluidics 3D cell culturing system, which can recapitulate cell-cell interaction due to their proximity, is a rapidly growing market with the compound annual growth rate estimated to be 17.9%. To create a 3D organ-on-chip neuronal model with the capability of carrying out clinical neuronal drug trials more accurately. More specifically, to create a neuronal environment that mimics Leigh syndrome with the potential to test the safety and efficacy of PTC-743. A 3D static and a 3D microfluidics neuron model were created and compared. The static neuron model was created using iPS cells seeded in various (5, 10, 30 and 50%) concentrations of Matrigel. In the static model, the iPS colonies were formed but it failed to allow cells to thrive, as colonies died over time because of diffusion failure to the most central cells, as well as Matrigel collapse. Both 30% and 50% concentrations of Matrigel matrix were then used in our organ-on-chip model. Active perfusion allowed the cells to differentiate within the chip and the cells were viable for up to two months. The engineered cells were

Doxycycline induced, green fluorescence protein expression for in situ fluorescence microscope imaging. We have the iPS cells of Leigh patients and would like to run studies on drugs that are from pre-clinical to phase 3 trials for the treatment of this disease.

3-3-4

Study of Maternal Behavior and Oxytocin Through Mouse Model

Deepasri C. Ananth BS, Luisa F. Schuster BA, Robert C. Froemke PhD, Adam C. Mar PhD*

Our objective was to study maternal behavior patterns and explore the effects of oxytocin on maternal behavior. We designed a habitat for mice to collect behavioral data. It is semi-automated, and uses a soundproofed, temperature-controlled system. This was used to collect behavioral data near-continuously over extended periods of time. The videos were coded by assigning numbers to different behaviors, which quantified the data. Wild-type dams were monitored across multiple litters for changes in maternal behaviors. A few patterns were observed as mothers reared more litters. Firstly, there was a decreased incidence of infanticide. Infanticide is a common occurrence in first time mothers, however we saw a reduced recurrence in subsequent litters of these mothers. Furthermore, first-time moms that were co-housed with experienced, non-infanticidal moms also demonstrated decreased incidences of infanticide. We also found that the quality of the nest built was predictive of infanticide likelihood, even before birth. Previous findings show that oxytocin plays a role in promoting long-term neuroplasticity and mediating experience-dependent changes in neural circuits. This leads to increased sensitivity to pup cues, causing increased maternal response behavior to pups in distress. Disruption of oxytocin signaling was explored by monitoring the first pregnancies of oxytocin knockout dams (OXTR KO). The knockout dams expressed inferior maternal behaviors compared to their wild type counterparts. This included lower quality nests, less pup interaction and increased pup mortality. An interesting observation is that WT dams that exhibited poor maternal behaviors showed similar nest building patterns to the OXTR KO dams.

3-3-5**The Detrimental Effects of Low Aerobic Capacity on Bone Metabolism**

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Low aerobic capacity is linked to metabolic disorders, skeletal muscle dysfunction, and as a predictor of premature death. To date, the direct effect that low aerobic capacity has on bone homeostasis remains to be elucidated. To determine the impact of low aerobic capacity in bone, we assessed rat models selectively bred as low (LCR) and high-capacity runners (HCR) for bone microstructure and cell differentiation and function. For this study, we utilized geriatric (28-month) and adult (10-month) female rats and assessed the effect that variation in running capacity has on bone homeostasis using *in-vivo* and *in-vitro* approaches. First, we tested whether LCR rats demonstrated increased bone loss in comparison to HCR. Femurs and tibiae were harvested and analyzed using micro-computer topography (μ -CT). Analyses of trabecular segmentation demonstrated a significant decrease in trabeculae connectivity between age groups in both LCR and HCR rats. Furthermore, trabecular segmentation was significantly decreased in the LCR in comparison to HCR rats. Using *in-vitro* cellular and biochemical assays, bone marrow-derived stem cells were isolated from LCR and HCR rats and used for the assessment of cell viability, proliferation, and differentiation into osteoclasts (OC). Pre-OC (OC progenitor) viability and proliferation were significantly reduced in the 28-month HCR rats when compared to same-age LCR counterparts. Together, *in-vitro* and *in-vivo* analyses suggest that stem cells isolated from each strain maintain strain-specific cellular responses despite identical culture conditions. These data support the osteoprotective effects of recurring exercise and establish the use of the LCR/HCR rat model in future skeletal studies.

3-3-6**Using PET/CT Imaging to Monitor Chemotherapy-Induced Vascular Toxicity in Pediatric, Adolescent, and Young Adult Lymphomas**

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Lymphoma treatment with chemotherapy, alone or with radiation therapy, can have off-target effects that lead to vascular toxicity, which has recently gained attention in the field of cardio-oncology. PET/CT imaging with fluorine-18 (^{18}F)-fluorodeoxyglucose (FDG) is standard of care for monitoring lymphoma treatment responses and is a widely accepted tool for non-invasively assessing vascular inflammation. We hypothesized that ^{18}F -FDG PET/CT imaging could detect and quantify chemotherapy-induced increases in vascular inflammation following the first cycle of lymphoma treatment in pediatric, adolescent, and young adult (AYA) patients. ^{18}F -FDG PET/CT images of pediatric and AYA lymphoma patients (n=63; mean age=13.0 \pm 4.5 years) were retrospectively acquired at initial staging of disease and first treatment follow-up. Regions of interest were manually drawn on each axial slice of CT images for the femoral vein/artery and the popliteal vein/artery to quantify serial changes in uptake of ^{18}F -FDG. Serial changes in the average standard uptake value maximum (aSUV_{max}) were calculated for each vein and artery of interest. The patient population consisted of Non-Hodgkin and Hodgkin lymphoma patients. ^{18}F -FDG PET/CT imaging detected and quantified a significant increase in the mean SUV_{max} from baseline to first treatment follow-up for the femoral and popliteal veins. No changes in femoral or popliteal arterial retention of ^{18}F -FDG were found. ^{18}F -FDG PET/CT imaging can non-invasively quantify chemotherapy-induced venous inflammation in young cancer patients in response to the first cycle of treatment, thus representing a novel approach for evaluating the cardiovascular side effects of cancer treatment and potentially creating opportunities for personalized medicine.

3-3-7

Cardiovascular Function in GDF 11 Knockout Mice

Megha Mokkalapati BS, Liya Yin MD PhD, Molly Enrick BS, James Gadd BS*

Recent evidence has shown that Growth Differentiation Factor 11 (GDF 11) which has anti-aging and proliferative roles in multiple body systems was able to reverse symptoms of heart failure in older mice and restore skeletal muscle stem cell function to enhance repair. Consequently, studies have shown that levels of GDF 11 correlates with outcomes for patients who have cardiovascular disease and other pathologies. To explore the specific role of GDF 11 on the heart, we analyzed cardiovascular functioning in adult GDF 11 knock out mice. Adult wild type mice at 2 months of age were given tamoxifen injections to create GDF 11 global knockouts through the Tamoxifen (TAM) inducible Cre recombinase system. Echocardiograms were done before and after the knockout to obtain data on cardiovascular function. Post-induction echocardiograms done at different months were compared to assess GDF 11 knockout over time. Currently, results are still being processed but Echocardiograms taken monthly after the injection were analyzed for 12 mice. Ejection Fraction (EF), Cardiac Output (CO), and stroke volume (SV) measurements were recorded and averaged for each echo date between animals. Currently, trends are non-conclusive as they do show a slight but insignificant decrease in EF, CO, and SV for the first 3 months after induction with a slight increase in SV and EF in the fourth month.

3-3-8

Mechanisms of Prolonged Auditory Maturation in Adolescence

Shivani Yerigeri BS, Julia Jones Huyck PhD*

Little is known of the maturation process of auditory function during adolescence despite its central role in effective communication and learning. The objective of this project is to evaluate the extent to which auditory processing and cognition contribute to auditory perception during adolescence. The auditory tasks that have the longest developmental courses tend to be tasks that require the encoding of rapid changes in a sound over time, or temporal processing. The hypothesis of this project is that immature performance on auditory and speech

perception tasks can be attributed to both maturational changes in temporal encoding and developmental improvements in the specific cognitive processes required by each task. This hypothesis will be assessed by evaluating the contribution of auditory temporal processing and cognitive functions to immature performance on basic auditory tasks and speech perception tasks during adolescence. Perception will be measured on two temporal auditory tasks, one non-temporal task and one degraded speech perception task. Attention will be measured during perceptual testing using pupillometry (wider pupils indicate greater attentional engagement), and blink-rate (less frequent blinking indicates greater attentional engagement). Auditory encoding during unattended stimulus presentations will be indexed using auditory evoked potential responses. Lastly, cognitive skills will be evaluated using standardized neuropsychological and language tests. This project will yield experimental protocols applicable to the development of diagnostic tests for auditory processing in adolescents and young adults. It may also inform future therapies that aim to support or improve the processes underlying auditory perception in adolescents with communication disorders.

Translational Models II

3-4-1

Study of Smooth Muscle Function by Localized Intradermal 6-Hydroxydopamine (6-OHDA) Sympathectomy

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Somatically controlled striated muscle is the major model for complex central neuromotor control. Autonomically controlled smooth muscle, in contrast, is generally viewed as not requiring complex control. However, birds possess smooth muscles at each feather follicle that control antagonistic actions which typically require central control. The *in vivo* firing patterns of these muscles are currently unknown since smooth muscle activity cannot be recorded via EMG. Feather muscles are exclusively adrenergically innervated, so disruption of adrenergic nerves is a potential way to investigate the function of these muscles. Prior work has focused on systemic disruption and *in vitro* muscle function. The purpose

of this ongoing study is to test localized, intradermal sympathectomy using 6-hydroxydopamine (6-OHDA) to investigate feather muscle function *in vivo*. The goal is to find the optimal dose and placement of 6-OHDA that will successfully reduce the function of the expansor secundariorum muscle while minimizing potential side effects to adjacent muscles. We accomplish this by varying the concentration and injection location of 6-OHDA. After injection, direct nerve stimulation on anesthetized birds is used to elicit feather movement. Video recording of feather position during stimulation is used to assess the resulting muscle function. Preliminary results suggest that a total dose of 36 mg/kg applied in four 50 μ L injections over a 24-hour period is sufficient to eliminate control of smooth muscle in a 4 cm² target region without affecting adjacent muscle function. Further experiments will test the efficacy and radius of effect of smaller doses.

3-4-2

Age-Related Changes to the Bone of Bowhead Whales

Gina Tubo BS, Chris Vinyard PhD, Lisa Cooper PhD*

The lifespan of the Bowhead whale (*Balaena mysticetus*) exceeds 200 years. Bowhead whales employ a unique mineralization strategy where ribs of newborns have abundant mineral with small medullary cavities. As they reach sexual maturity, ribs possess greater mineral density with larger medullary cavities. The purpose of this study is to examine the phenotypic differences of rib mineralization between bowhead whales and their terrestrial relatives (pigs and cows). Second ribs were procured from each species. Rib cross-sections were cut, polished, and embedded in field's metal. Sections were micro indented in four anatomical locations (cranial, caudal, medial, lateral). Elastic moduli (stiffness) were calculated from Vickers hardness values and were compared using a one-way ANOVA between species and between regions within species. For species differences, cow ribs showed a significantly larger elastic modulus than pigs and whales ($p < 0.001$). Pigs were significantly stiffer than bowhead whales ($p < 0.0001$). As for regional differences, bowhead whale

ribs were stiffer on the lateral aspect than the caudal portion ($p = 0.02$). Cows and pigs displayed similar regional variability; the medial region was stiffer than the lateral region ($p < 0.0001$), and the cranial and caudal regions showed no significant differences. Overall, terrestrial animals (pigs and cows) possessed harder, and therefore stiffer, second ribs. Additionally, terrestrial, and aquatic animals displayed regional differences in bone hardness and elastic modulus/stiffness. These findings highlight the different underlying bone mineralization strategies required for life under water and on land.

3-4-3

Impact of Nipple Properties on Oral Function in Term and Preterm Infant Feeding

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One cause of the gap between preterm and term infants in size and development may come from feeding performance. Feeding performance is influenced by sensory input, which for infants is largely through the nipple, especially in preterm infants that are bottle fed. We asked is there a difference in tongue kinematics during sucking and swallowing between term and preterm infants with variation in nipple properties, such as stiffness and hole size. With IACUUC approval, we used highspeed, bi-planar video fluoroscopy to record the tongue movements of 3 preterm and 6 term infant pigs on day 7. We designed four nipples, with two stiffness and two-hole sizes. The data was then analyzed with XROMM where we measured the spatial placement of the tongue during sucking and swallowing. The results showed that preterm infants did not change their tongue excursions based on the differing hole size and stiffness of the nipples during sucking. However, term infants, did respond to nipple changes, with shorter tongue excursions for stiff nipples compared to the compliant, and longer tongue excursions for the nipples with larger holes compared to ones with smaller holes. These results are evidence that term infants can respond to these nipple properties, while the preterm infants cannot. This suggests that preterm infant feeding issues may be related to an immature sensory system.

3-4-4**Assessment of 3D-Printed PLA Scaffolds as a Platform for Bone Delivery of Gallium Acetylacetonate (GaAcAc)**

Pratyusha Ghanta M. Pharm, Larrisa Melnyk Pharm. D, Timothy Winschel BS, Ramya Chandrasekaran Ph. D, Moses Oyewumi Ph. D*

Bone consists mainly of osteoclasts (OC) and osteoblasts (OB) that function cohesively to maintain homeostasis. However, any disruptions in either cell function can translate into homeostatic imbalance, leading to skeletal fragility or abnormal bone formation. Earlier studies have shown that gallium compounds interfere with osteoclast differentiation & prevent bone resorption. There are no delivery systems currently designed to deliver GaAcAc in a controlled and sustained manner. The focus of this study is to assess 3D-printed scaffolds as a controlled delivery platform for GaAcAc against osteoclastic bone resorptive disorders. PLA scaffolds were printed using a PRUSA i3MK3 MMU2.0 and characterized for their swelling rate, *in-vitro* degradation, *in vitro* release, and biocompatibility. Different drug loading strategies were tested for effective loading. GaAcAc alone at 50 mg/mL inhibited the OC differentiation process. PLA scaffolds (2- & 4.5-mm thickness & diameter) were successfully printed and characterized. The scaffold exhibited 46% increase in weight in water and after 2 months of storage at 37 °C and 4 °C showed negligible structural loss. The PLA scaffold did not interfere with the OC differentiation as exhibited by TRAP activity and presence of TRAP-stained multinucleated cells. The 3D printed scaffolds were coated with 2mg/mL poly-dopamine (PDA) for 24 hours and then immersed in GaAcAc solution (100 µg/mL) solution for 72 hours effective loading. GaAcAc alone revealed no cytotoxic effect against pre-osteoclasts. PLA scaffolds were successfully printed, characterized, and loaded with GaAcAc. PDA coating improved drug loading and release parameters. Current research is underway in evaluating the bone resorptive properties of GaAcAc loaded PDA-PLA scaffold.

3-4-5**Distraction Vector Along the Posterior Border of the Ramus Corrects the Underlying Mandibular Discrepancy Robin Sequence**

Levi Franson BS, Sanjay Jinka BS, Ananth Murthy MD, Nick Kochenour DMD*

Robin Sequence (RS) is associated with mandibular hypoplasia. Early correction of mandibular hypoplasia is often needed to avoid tracheostomy. Historically, correction took place in the body of the mandible to improve airway obstruction and posterior base of the tongue. Evaluation of mandibular morphology identifies the location of bone deficit to correct the dentofacial discrepancies. The purpose of this research is to investigate the effectiveness of mandibular distraction in the ramus for long term relief and normalization of mandibular morphology compared to growth study norms. We reviewed images of 24 consecutive RS patients of the same surgeon at one institution. The patients underwent distraction osteogenesis (DO) along the posterior border of the ramus. The segments were distracted 1mm daily for 1-3 weeks until the desired length was achieved. Using X-rays from the Bolton Brush Growth Study, we compared the patients' before and after measurements (ramus and mandibular length) to age-specific standard values. Results show statistically significant improvements in mandibular body and ramus length after distraction. The average ramus height increased from 20.15mm to 24.31mm. The body length increased from an average of 34.99mm to 40.21mm, indicating significant growth in the adjacent bone and improved overall mandibular form. The p-value for both measurements was 0.01. We conclude that patient mandibular morphology was normalized using the vector distraction. Therefore, distraction osteogenesis can be performed along the posterior border of the ramus to correct mandibular dysmorphology.

3-4-6**Early-Life Stress Disrupts Amplitude Modulation Detection in Gerbils**

Neha Srinivasan BS, Kate A. Hardy, Matthew Sunthimer, Merri J. Rosen PhD*

Early-life stress (ELS) alters learning, cognition, and emotional regulation. In childhood, conductive hearing loss (CHL) may result from otitis media (middle ear infection), which can lead to difficulty with speech perception later in development. ELS and CHL independently decrease gerbils' ability to detect rapid changes in sound that comprise speech, i.e., amplitude modulations (AM). However, it is unknown whether ELS and CHL together impair sensory perception of AM more than either one alone. Here we

used operant conditioning to test whether ELS+CHL affect gerbils' ability to detect AMs that arise intermittently in ongoing unmodulated sound. To induce ELS, we exposed young gerbils to an unpredictable stressor: they were maternally separated during postnatal days 9-24 and restrained for 2 hours on ten non-consecutive days. To induce CHL, we placed earplugs using sticky tack. To determine the effects of CHL alone and ELS+CHL on AM detection, animals were trained using a conditioned avoidance procedure. AMs varied in depth with each session, allowing for calculation of a threshold for detecting the modulations. Animals were tested every day for 10 days, yielding 10 thresholds. Relative to one another, CHL and CHL+ELS thresholds were similar but were both worse than ELS alone and Control. CHL+ELS initially performed well but worsened during later sessions while Controls improved over sessions. Our results indicate that CHL, ELS and CHL+ELS groups had trouble detecting AMs compared to Controls. Our findings indicate that the poorer performance may be a result of both attentional issues and perceptual ability.

3-4-7

Circadian Disruption in 3xTg Alzheimer's Disease Mice

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Circadian rhythms are generated by a transcriptional-translational feedback loop in the hypothalamus and occur with a 24-hour period. Brain-generated rhythms are transmitted to the periphery to ensure synchrony between internal physiology and the external environment. Hepatic genes exhibit circadian regulation by controlling bile and lipid homeostasis. These clocks may become impaired with sleep disorders and increase the occurrence of metabolic syndrome, a hallmark risk factor for Alzheimer's Disease (AD). Whether a relationship exists between altered circadian rhythms and AD progression is currently unclear. Long-term circadian disruption was induced in female C57Bl/6J control wild type mice (WT) and triple transgenic AD mice models (3xTg-AD) using automated sleep disruption machines (6 hrs daily, 5 days per week, for 3 months). Bile acid and lipid metabolism were investigated, qPCR was performed to characterize metabolism signaling pathways, and histology was performed to assess liver

morphology. Liver *Clock* and *Bmal1* were significantly suppressed in both mice groups following long-term sleep deprivation. *Per1*, *Per2* and *Dbp* were induced in the sleep-deprived 3xTg-AD mice. All hippocampal core clock genes were significantly reduced in sleep-deprived WT mice and increased in sleep-deprived 3xTg-AD mice. Intestinal bile acids were significantly reduced in 3xTg-AD mice only. Serum bile acids were reduced, while expression of bile acid synthesis genes remained unchanged. Liver lipids were significantly upregulated in 3xTg-AD mice and reduced following sleep deprivation. Alzheimer's mice have altered bile acid and lipid metabolism, and core circadian clock genes are differentially affected by chronic circadian disruption in these mice.

3-4-8

Reverse Dynamization Accelerates Distraction Osteogenesis Regenerate Bone Maturation in a Large Animal Model

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Reverse dynamization is the process of manipulating the mechanical environment surrounding callus, transitioning from flexible to rigid fixation. Previous dynamization studies have shown accelerated bone healing in animal models however, it is unknown if reverse dynamization can also be successfully applied to distraction osteogenesis. This study aims to determine whether reverse dynamization can accelerate the mineralization and remodeling of regenerate bone in limb lengthening. Eighteen Spanish cross wethers underwent identical surgical application of a circular external fixator followed by midshaft tibial osteotomy. The goats were divided into three groups: a) Static fixation (SF); b) Dynamized fixation (DF); c) Reverse Dynamization (RDF). 3D-printed dynamizers allowing 2 mm axial micromotion were utilized for dynamization groups. Each goat tibia was lengthened 2 cm with a rate of 0.25 mm three times per day. The goats were euthanized after 8 weeks of consolidation, and both hind limbs were evaluated using X-rays, micro CT, and mechanical testing. Earlier bone formation was present in the DF and RDF groups with evidence of accelerated consolidation in the RDF group. These results were confirmed by micro CT. The RDF group had significantly reduced callus size, less bone volume,

yet higher bone mineral density indicating advanced remodeling (Figure 1). Biomechanical testing showed the RDF group was significantly stronger than comparison groups, including the control. Reverse dynamization significantly accelerates regenerate bone formation and advanced remodeling compared to static and dynamized groups. The regenerate bone in reverse dynamized distraction osteogenesis was significantly stronger and had a higher mineral density.

Quality Improvement and Evaluation

4-1-1

Is Pregnancy a Risk Factor to Developing Postoperative Nausea and Vomiting?

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Postoperative nausea and vomiting (PONV) is a common and unpleasant complication of general anesthesia. There are well known risk factors that predispose a patient to developing PONV. While studies exist that explore PONV incidence in gravid and non-gravid patients separately, limited studies exist to compare the two cohorts to identify if pregnancy is associated with increased risk for PONV. This is a retrospective case-control cohort study, with 1:2 matching based on age, year of surgery, and surgical procedure. The electronic medical records were abstracted for demographic information, predisposing risk factors, prophylactic antiemetics, PONV documentation, rescue antiemetics, length of time in post anesthesia care unit (PACU) and length of hospitalization. Multivariable analysis of risk factors was performed with p-values <0.05 considered statistically significant. 240 gravid women underwent non-obstetric procedures under general anesthesia and were compared with 480 non-gravid women. The number of prophylactic antiemetics were less among gravid (median 1 [1, 2]) than non-gravid (2 [2, 2]) women (P<0.001). Compared to non-gravid women, gravid women were at increased risk of PONV (adjusted odds ratio 1.69 [95%CI 1.07, 2.64], P=0.024) and had longer hospital lengths of stay (P<0.001), despite having shorter surgical duration (P=0.015). Gravid patients have a greater risk for PONV compared to similarly aged women. In addition, anesthesiologists administer fewer prophylactic antiemetics to gravid patients during surgery.

4-1-2

Examination of Advance Care Planning Policy Using the PZL Model

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This study used the Patton-Zalon-Ludwick (PZL) Policy Assessment Framework© to determine gaps in the literature on advance care planning (ACP) policy

and help promote early participation in ACP to alleviate care burden for patients, families, and clinicians associated with end of life. The PZL model highlights the different levels of policy work. We conducted a literature search on ACP policies using Google Scholar, PubMed, and CINAHL, and keywords: advance care planning, advance directive, policy, law, legislation, and implementation. A sample was generated from articles that looked at ACP policy as it relates to the different dimensions of the PZL model: scope, partnerships, and policy engagement. We identified two major gaps. First, a large number of papers examined policy literacy, but few went beyond literacy to look at using strategic policy expertise or using recognized influential advocates to increase policy implementation. Second, few policy papers focused on broad-based coalitions between institutions and community-based organizations. Most were focused on ACP policy by a single discipline or work group. Many articles focused on legal barriers for patients, including poor readability of legal forms, surrogate restrictions, and making forms legally valid. It is important to analyze policy at every level of the PZL Policy Assessment Framework to better understand the context for implementation of ACP to various demographics. More work, including new policy proposals and research evaluating ACP policy impact, is needed to bridge the gap beyond single discipline work by building strategic policy expertise and using recognized influential experts.

4-1-3

Economic Challenges to Medication Adherence in Urban Populations and Providers' Efforts to Address Patient Barriers

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The rising cost of health care continues to be a barrier to individuals, especially the underinsured and uninsured. More specifically, the cost of medication impacts an individual's ability to adhere to medical recommendations and effectively treat conditions. Medical providers play a role in identifying the Social Determinants of Health that impact how to effectively treat a patient. However, this information is often either not obtained or considered when prescribing medication. As MetroHealth is a county hospital with a patient population facing financial barriers, providers participated in a survey with a set of questions aimed at identifying the economic

challenges of medication adherence. A 10-question survey was distributed to physicians, physician assistants and nurse practitioners within the MetroHealth hospital system. Survey responses are continuing to be collected; however, more than 30 responses have been collected thus far. Results are being analyzed to evaluate the frequency in which cost is a barrier, a physician's prescribing habits, as well as the educational opportunities available for physicians to learn about Social Determinants of Health. Conclusions will be shared with MetroHealth leaders in efforts to continue to evaluate their policies and efforts in addressing patient barriers.

4-1-4

Improving Routine Cervical Cancer Screening Rates at My Community Health Center: A Quality Improvement Proposal

Michaela Ward BS*

PURPOSE: The purpose of this proposal is to improve cervical cancer screening (CCS) by 5% in the family medicine department at My Community Health Center (MCHC). In this department, 40% of eligible patients are either past due or have no record of CCS. The main roadblocks include patient education on the purpose, importance, and updated screening guidelines. The main improvements to patient care are patient empowerment, improved accuracy of the EHR, avoidance of medical procedure waste, and improved long-term compliance. The main expected outcome is surpassing MCHC's target proportion of eligible patients up to date with routine screening of 70%.

METHODS: The Institute for Healthcare Improvement (IHI) Open School Quality Improvement Practicum Handbook was used to design this proposal. The Model for Improvement was utilized in an initial charter form. A cause-and-effect diagram was used to analyze potential issues in the clinic and develop a Plan-Do-Study-Act (PDSA) cycle that would guide the clinic team members on how to test this intervention.

CONCLUSION: The planned changes to be tested include obtaining lists of patients in the family medicine division that are between the ages of 24-29 and do not have a record of CCS, follow a protocol of messaging at the beginning of the month, checking the status weekly, repeating this for a maximum of three

intervals, and documenting patient status. The main prediction includes an increase in routine screening follow-up, patients will note that they have already completed screening, patients will ignore the message, or patients will not receive the message.

4-1-5

Qualitative Analysis of Health Equity in Portage County, OH

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PURPOSE: Health equity is identified as a “cross-cutting factor” that impacts health outcomes in Portage County's Community Health Improvement Plan (CHIP). The goal of our project was to understand health equity in Portage County and provide recommendations on how it can be improved to address 2 of 3 health priorities identified in the CHIP: chronic disease and maternal, infant and child health.

METHODS: We adapted the Health Equity Assessment Tool (HEAT) to assess health equity in Portage County. Interviews were conducted with 23 community stakeholders identified by the research team to obtain primary data. Original interview questions from the HEAT were adjusted to facilitate conversation about health equity according to Portage County's health priorities. Thematic analysis was conducted to analyze interview responses.

RESULTS: Stakeholder perspectives about health equity varied based on their involvement in the community and were organized into 5 major themes based on their relation to the following health inequalities: (1) low socioeconomic status; (2) geographical isolation; (3) barriers to accurate, sharable information; (4) barriers to formal education opportunities; and (5) discrimination and marginalization.

CONCLUSION: Based on our analysis, we developed 4 recommendations on how to improve health equity in Portage County: (1) expansion of transportation services and access; (2) personalization of care approach; (3) expansion of health and wellness programs and services; and (4) improvement of two-way education and communication among residents and stakeholders. Looking ahead, implementation of

these recommendations along with evaluation of progress will improve health equity and outcomes for Portage County residents.

4-1-6

Improving Patient Engagement with Online Health Portals

Teresa J. Whetstone BA*

Current research shows improved patient outcomes when utilizing online patient portals to be more active in their care. Only 51% of Summa Barberton Hospital's patient population currently has their Epic MyChart activated. The Family Practice office recognized the opportunity to increase engagement by augmenting the number of patients who signed up for MyChart during the summer of 2021. With IRB approval, surveys in the lobby of the office were to be conducted to determine which patients do not have MyChart and what the possible barriers could be. Surveys were conducted once weekly over four weeks and 100 responses were received. Preliminary results identified that 70 people surveyed already had MyChart activated. Qualitative data from the surveys concluded that the messaging, prescription refill, and viewing test results were among the most popular features. Of the 30 people without MyChart, 16 people were not interested in signing up at the time of being surveyed, while 14 people activated their accounts. The patients who did not have a MyChart identified that lack of access to a computer/smartphone was the most common barrier. Others simply were uninterested in gaining access. Further research on this topic may include utilization rates of the features or demographics of patients without access. Year of birth was the only identifying information collected per IRB approval.

4-1-7

Pilot Program Implementing Exercise and Nutrition Zoom Sessions and Impact on Lifestyle Factors in the Hispanic/Latino Community in Akron, Ohio

Aviva Aguilar BS, Ashley Houston* BS*

A lifestyle health intervention was done over thirteen Zoom sessions, for families served by non-profit organization, Proyecto Raíces, in Akron, Ohio. The goal was to provide culturally competent healthcare in a non-traditional setting. Most sessions covered nutrition and exercise during Proyecto Raíces' bi-

weekly meetings. Pre and post-surveys were designed and administered in Spanish and English, to gauge impact of the program on participants' lifestyle choices. Results from the survey data indicated that there was an overall increase in participants' vegetable consumption and exercise activity. Participants increased vegetable consumption in the categories for 2 cups from 5.6% to 36% participants and 4 cups from 5.6%-29% participants. There was an upward trend in physical activity throughout the program sessions with 29% of participants exercising 3-5 times a week in the post-survey compared to 17% in the pre-survey. Two respondents in the post-survey stated practicing yoga and mindfulness meditation Often (every week) compared to zero in the pre-survey. The post-survey showed high satisfaction with the exercise portion of the program with 79% of participants rating a score of 5/5 being most beneficial, on a 0-5 scale. This pilot program was successful in providing nontraditional healthcare access in a culturally relevant way while tracking lifestyle changes as an impact of programming.

4-1-8

Chart Review to Inform Understanding of Ulceration Recurrence Associated with Remote Foot Temperature Monitoring

Michael Grasso BS, Alyson Littman, PhD, MPH*

Diabetes Mellitus is extremely prevalent in veterans, and foot ulcers are one of the most common complications associated with the disease. Preventative measures to reduce the risk of developing foot ulcers can reduce amputations and save the lives of high-risk patients. Remote temperature monitoring of the feet has been proven to be an effective route for prevention of foot ulcers by alerting high-risk patients to 'hot spots' that could potentially become an ulcer before they are even detectable to the eye. The aim of this quality improvement project was to inform the parent study related to proposed inclusion and exclusion criteria, as well as, assessment of ulceration, for which diagnostic codes lack important information related to progression, size, and severity. We identified a sample of 100 patients, including those who were enrolled and not enrolled in remote foot temperature monitoring. Inclusion criteria included a prior ulcer, amputation, or a diagnosis of Charcot foot. Exclusion criteria were non-ambulatory status, dementia, and bilateral amputation. The two groups were matched on age, diabetes, amputation level,

Veterans Integrated Service Network (i.e., VA location), rurality, and history of ulceration. The results of the chart review over a period up to 2 years include the development of a data collection tool and code book used for the systematic collection of relevant patient data in a standardized format. In addition to the development of the data collection tool, we documented substantial variation in language used by healthcare professionals for defining ulceration and describing ulcer healing.

Education and Program Evaluation

4-2-1

Clarifying Code Status via Patient Education

Cheyenne Dryer BS*

Working in the Center for Family Medicine at Cleveland Clinic Akron General prompted the realization that patients often experience confusion about code status. The unfamiliarity that patients have with code status often results from poor patient education and doctors not fully explaining patients' options to them. This confusion can lead to patients not getting the medical care they need because they do not understand their choices. To address this problem a handout was developed that could be used to educate patients on the differences between code statuses and to clearly define the different options. Information regarding the specifics of each code status was researched using the Ohio Department of Health and the Cleveland Clinic websites. Information provided by the Palliative Care Network of Wisconsin was used to better understand how to initiate code status discussions with patients. Using this research, a handout was developed that defined and explained the differences between full code, DNR-CCA, and DNR-CC; outlined the various risks and benefits of resuscitation measures; and provided questions that patients could ask their physicians to facilitate code status discussions. The handout can be used in the office to give to patients who have questions about their code status and their options.

4-2-2

Staff Education in Diversity and Implicit Bias at a Federally Qualified Health Center

Maya Schnell BS, David Cola DO*

As requested by Dr. Cola and Nurse Practitioner Kasey, the leading providers at Lifecare, a federally

qualified healthcare center in Canton, collaboration with staff was undertaken to create a handout to be used for incoming students and employees in order to educate them about the population Lifecare serves and the nature of care provided. In patient care for underserved populations, society generally puts the onus of education on patients, who are already working tirelessly to make ends meet and keep many moving parts in action. For this reason, a set of questions were crafted to be used in semi-structured interviews with each staff member that was patient-facing in the practice, including the medical records coordinator, front desk staff, optometrist, nurses, and primary care providers. The questions delved into staff perceptions of those they care for and the widely held misconceptions about federally qualified health centers. Given the answers to these questions and a personal background education in social inequity and interracial dynamics, a handout was created including the relevant statements made by employees and gaps in education that could be filled. Specific misconceptions, such as the view that underinsured patients are manipulative or unwilling to care for their personal health were contrasted with important perspectives that dispel such myths. This handout has been distributed to current staff and the organization that works with Lifecare. After viewing the work, they have decided that implicit bias training and other aspects of the educational sheet will be formally added to yearly staff education.

4-2-3

Diabetic Group Visits: Methods and Impact on Patients

Tara Winebold BS*

Diabetes is an illness that affects an estimated 34.1 million people in the United States. To help educate those who have been diagnosed, diabetic group visits were created. One such program was created at Boardman Primary Care through the Mercy Health System. This program was designed over a six-month period and aims to educate those individuals through various measures. These include education about diet, exercise, and lifestyle overall. Recipes were put together that were specifically designed for diabetics and hand-picked healthy foods were passed out in "goodie bags" after each meeting. The meetings took place once a month and had a different focus for each one such as diet, exercise, and learning how to educate those around the patient. Overall, the goal was to

educate those with diabetes and help them understand how diabetes was not the end of their lives but the beginning of a modified lifestyle. As this is currently ongoing, patient feedback has yet to be assessed. Current research has also shown great promise with other trials seeing an increase in lifestyle modifications and an increase in control of diabetes. This method can then be expanded to a larger audience and eventually become more inclusive in general practice.

4-2-4

Health Professions Students' Perceptions of and Experiences with Philanthropy

Vindya Perera MPH, Mary E. Fredrickson, PharmD*

Philanthropic support of medical universities is crucial. Students tend to donate as alumni if they are made aware of the importance and impact of giving.^{1,2} The Council for Advancement and Support of Education (CASE) suggests implementing student philanthropy educational programs to enhance student giving.³ This research project evaluated perceptions and experiences with philanthropy among students at a health sciences university. Students enrolled at the Northeast Ohio Medical University were invited to participate in a survey that assessed students' perceptions and experience with philanthropy. Statistical testing via SPS was two-sided with $p < 0.05$ considered statistically significant. 139 students completed the survey. Most respondents do not make monetary donations or volunteer at their undergraduate/high school institutions. 32.1% strongly disagree that contributions to their alma mater make a difference and 42.9% stated they plan to contribute monetarily/volunteer time to NEOMED as alumni. Students who donate financially to their undergraduate institution/high school were more likely to strongly agree with, "I believe contributions to my alma mater make a difference." Students who volunteer at their undergraduate institution/high school were more likely to strongly agree with, "I plan to contribute/volunteer time as a NEOMED alumni." This data suggests students who engage in philanthropic initiatives are more likely to continue as alumni. Educating on the importance of philanthropy may enhance perceptions and willingness to contribute after graduating. Further research is needed to determine how to structure educational initiatives and measure their impact.

4-2-5

Rural Patient Education: The Importance of Newborn Hearing Screenings

Madison Cox BS*

The state of Ohio requires newborn screenings to be performed on all babies born in the state. However, parents may deny these screenings due to religious beliefs or may refuse to follow up with practitioners. The refusal of these screenings may be particularly high in rural areas or areas with a large Amish population. To educate new parents among these demographics on the importance of newborn hearing screenings, an informational pamphlet was created. The pamphlet defined newborn hearing screenings and described how they are performed, why they are important, and next steps for parents. It also listed other educational resources including the Center for Disease Control and the American Speech Language Hearing Association. Information for this pamphlet was gathered from scholarly sources such as Auditory and language outcomes in children with unilateral hearing loss¹ and Communication and behavioural disorders among children with hearing loss increases risk of mental health disorders². The objective of this pamphlet was to decrease the number of refused newborn screenings by raising awareness of the effects of hearing loss in children and the value of early intervention.

4-2-6

Health Literacy, Perceptions, and Preferences for Muslims: Mosque-Based Study in Central Ohio

Sondos Al Sad MD, Nooralhuda Alhashim BS, Mahmoud Abdel-Rasoul MS*

A growing number of studies link limited health literacy to poor health outcomes and avoidable health care costs. Care providers tend to overestimate health literacy levels among patients from underrepresented communities. Muslims are not an exception; given the current turbulent political atmosphere as well as language and cultural barriers. Mosque-based interventions for health promotion show the potential for improving health outcomes when partnered with communities to tailor health promotion methods to their needs. In collaboration with the largest mosque in Columbus, Ohio, we used convenience sampling through digital media to disseminate an online survey to gather data about Muslims' basic health literacy levels, preferences, and perceptions of the role of

mosques as a platform for health promotion. Our study protocol was reviewed and approved by the Ohio State University Institutional Review Board, and our online survey was created in Qualtrics for anonymous link sharing. Our findings show that Muslims view their mosques as effective platforms for health promotion and that they prioritize mental health literacy and prefer care from a Muslim provider for mental and reproductive health.

4-2-7

Demographic, Treatment, Clinical, and Socioeconomic Determinants of Patient Satisfaction post-Breast Surgery

Brett Lowden BS, Nancy Gant MD FACS, David J. Gemmel PhD*

Approximately 1 in 8 women will be diagnosed with breast cancer in their lifetime. Despite an abundance of literature on breast cancer treatment and outcomes, little research has looked at the impact of socioeconomic status on patient satisfaction following breast cancer surgery. The objective of the study was to determine if patient satisfaction post-breast cancer treatment and surgery is associated with socioeconomic status. A post-procedure survey of tissue confirmed breast cancer patients (n=324) at a Midwest urban community teaching hospital after breast surgery was conducted to assess quality of life, lymphedema, treatment characteristics, clinical characteristics, and socioeconomic status. This survey included the EORTC-QLQ-C30, EORTC-QLQ-BR23, Fact-B, SF-36, lymphedema assessments, and treatment decision assessments. The results of multivariate logistic regression modeling with forward selection found that having managed care health insurance as the guarantor, having simple total mastectomy, and feeling uninformed on surgical treatments were all associated with increased dissatisfaction with breast cancer treatment. Of note, none of the remaining variables – demographics, clinical variables, other treatment modalities, or SES – were associated with dissatisfaction with breast cancer treatment. Understanding the risk factors for dissatisfaction will give surgeons and their teams the opportunity to enhance delivery of information to at-risk patients and reinforce shared decision-making models of care to provide optimal patient outcomes in all spheres.

4-2-8

Anatomy Academy: Assessing the participant experience of an immersive medical education outreach program

Alex Tang BS, Amanda Tam* BS, Megan Fritz BS, Catherine Mattinson PhD, Erin Franks PhD*

NEOMED's Anatomy Academy is an intensive two-week anatomy experience that provides foundational knowledge and hands-on gross anatomy exposure to high school and undergraduate students and adult learners. This immersive workshop covers the human anatomy of the musculoskeletal, thoracic, and abdominal regions as well as neuroanatomy, using a combined lecture and laboratory format. Participants engage in lectures, small group activities, and clinically based case discussions that are led by NEOMED faculty and current NEOMED medical and graduate students. Within the Yassine Gross Anatomy Laboratory, participants partake in cadaveric dissections and prosection-based reviews. Our goal of this analysis was to assess the quality of the Anatomy Academy learning experience so that the program can continue to be improved and expanded on. This past summer, Anatomy Academy enrolled a total of 15 participants among two sessions held in June and July 2021. We utilized anonymous pre- and post-surveys to allow participants to self-assess knowledge gained and to obtain feedback on improvements that could be made in the future. On a scale of 1-10, participants' median knowledge increased significantly from 3.5 to 8 (p=0.001). Participants also rated their overall experience as 9.5 on the same scale. Participants overwhelmingly felt that their anatomy knowledge was enhanced at the end of the two-week session thus illustrating the value of this unique opportunity.

COVID-19

4-3-1

Impact of the COVID-19 Pandemic on Pediatric Emergency Department Utilization for Head Injuries

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PURPOSE: Head injuries are a leading cause of death and disability in children, accounting for numerous emergency department (ED) visits and nearly 3,000 deaths annually. It is unclear if the COVID-19

pandemic has exacerbated pediatric head injuries. We hypothesize that the presence and severity of medically-attended head injury will increase during the COVID-19 era.

METHODS: Retrospective study using electronic health record data to compare prevalence and severity of head injury for children 0 to 21 years-of-age from three urban mid-Atlantic EDs in the pre-COVID-19 era (March-June 2019) and COVID-19 era (March-June 2020). Controlling for confounders, logistic regression analyses assessed odds ratios of head injury outcomes. Chi-square analyses identified differences in patient characteristics.

RESULTS: The odds of an ED visit for head injury (aOR= 1.2, 95% CI:[1.0-1.3]) and likelihood of hospital admission increased in the COVID-19 era compared to pre-COVID-19 (aOR= 2.6, 95% CI:[1.4-4.7]). Blacks had a lower odds of being diagnosed with head injury (aOR= 0.5, 95% CI:[0.5-0.6]), hospitalization (aOR= 0.4, 95% CI:[0.2-0.8]), and receiving head CT imaging (aOR= 0.4, 95% CI: [0.3-0.7]) compared to Whites. A significant drop in ED utilization was observed in Blacks during the COVID-19 era (46.8%, 95% CI:[0.4-0.5]), but not among Whites.

CONCLUSION: The proportion of ED visits and hospitalizations due to head injury increased during the COVID-19 era, but was lower among Blacks compared to Whites. This could be due to differences in exposures, but could also reflect disparities in access to ED services and utilization.

4-3-2

Improving Risk Prediction for Pulmonary Embolism in COVID-19 Patients using Echocardiography

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PURPOSE: SARS-CoV-2 infection is associated with increased risk for pulmonary embolism (PE), a potentially fatal complication that can cause right ventricular (RV) dysfunction. Serum D-dimer levels are a sensitive test to suggest PE, however lacks specificity in COVID-19 patients. The goal of this

study was to identify a model that better predicts a PE diagnosis in hospitalized COVID-19 patients using clinical, laboratory, and echocardiographic imaging predictors.

METHODS: We performed a cross-sectional study of 302 adult patients admitted to the Johns Hopkins Hospital (March 2020-February 2021) for COVID-19 infection who underwent a transthoracic echocardiography and chest CT angiograms. Clinical, laboratory and imaging predictors including, but not limited to, D-dimer and RV dysfunction were used to build prediction models for PE using logistic regression. Model discrimination was assessed using area under the receiver operator curve (AUC) and calibration using Hosmer-Lemeshow X2 statistic. Internal validation was performed.

RESULTS: The prevalence of PE was 7.6%. The model with positive D-dimer above 5 mg/L, RV dysfunction on echocardiography, and troponin had an AUC of 0.77, and cross-validated AUC of 0.74. D-dimer (>5 mg/L) had a positive association with PE (adj OR=4.40;95% CI:[1.80,10.78]).

CONCLUSION: We identified a model including clinical, imaging and laboratory variables that predicted CT-confirmed PE in hospitalized COVID-19 patients. Positive D-dimer >5, RV dysfunction on echocardiography, and troponin were important predictors for calculating likelihood of PE diagnosis. This approach may be useful to aid in clinical decision-making related to diagnostic imaging and treatment. Prospective studies are needed to evaluate impact on patient outcomes.

4-3-3

Assessment of the COVID-19 Pandemic on Skin Cancer Incidence as a Quality Improvement Initiative

Laine Goff BS, Athulya Murali* BS, L. Austin Fredrickson MD*

PURPOSE: Skin cancer is the most common diagnosed cancer in the United States, affecting 1 out of every 5 Americans. During the COVID-19 pandemic, diagnosis of cutaneous melanomas decreased by 43.1%, SCCs decreased by 44.1%, and BCCs decreased by 51.2% in the United States when compared to the same time period in 2019. The ongoing effect of the COVID-19 pandemic has

underscored the need for more skin cancer screenings as delaying screenings could not only lead to missed diagnoses but also to progression of later stages of disease. The purpose of this quality improvement project is twofold: To encourage patients to undergo skin cancer screenings; and to detect cases sooner and initiate appropriate treatment/referral to prevent further incidence of skin cancer.

METHODS: Data were collected at Salem Regional Medical Center over an 8-week-period at an Internal Medicine practice. Patients completed a screening questionnaire which asked about natural skin color as well as skin sensitivity and reaction to the sun. We examined skin areas that were of concern to patients or receive high amounts of sun exposure.

RESULTS: 150 patients consented to undergo a skin cancer screening; 14% of patients were found to have a concerning lesion for which further evaluation was recommended. Using a chi square test, we identified a positive correlation between a history of skin cancer ($p=0.001321$) with the incidence of suspicious lesions.

CONCLUSION: Our results highlight the need for continued emphasis on cancer screenings during the pandemic, as well as patient education on skin cancer prevention.

4-3-4

The Effects of Inducible SARS-CoV-2 Spike Protein Expression in Human iPSC Cardiomyocytes

Athulya Murali BS, Amber Dinchman, Ava Cutright, Eva Cohen, Angelo DeLucia PhD, William Lynch PhD, William M. Chilian PhD, FAHA, FCVS and Patrick T. Kang PhD*

PURPOSE: COVID-19 affects not only the respiratory system but multiple other organ systems. COVID-19 has been reported to be associated with an increased risk of myocarditis in patients without pre-existing cardiovascular disease. This raises the question as to whether SARS-CoV-2 spike protein could directly cause cardiac damage and must be investigated.

METHODS: Using cardiac tissue derived from human induced pluripotent stem cells (iPSCs) is the most direct route for prospective and clinically relevant studies on the effects of cardiac viral infection. A plasmid construct designed with doxycycline (Dox)

inducible spike protein expression was integrated into the host iPSCs genome, and then iPSCs were differentiated into cardiomyocytes. The cardiomyocytes were subjected to different levels of doxycycline treatments which would induce the expression of spike protein.

RESULTS: Cardiomyocyte beating rate was collected prior to and after Dox-induction of spike protein expression and revealed that cardiomyocytes stopped beating after Day 1 for Dox-high (2 $\mu\text{g/mL}$) treatment and slowed for Dox-low (200 ng/mL) treatment and stopped beating by Day 3. Immunofluorescence microscopy imaging of the different Dox treatments showed that spike staining appeared to be highest 24-hours after Dox treatment.

CONCLUSION: Overall, we can see the negative impact of induced spike expression in cardiomyocytes and that spike is causing an effect on the beating of the cardiomyocytes. The spike sequence used in this study is an original construct and slightly different from the COVID-19 vaccine. Further evaluation is needed to determine the potential mechanism that spike may use to affect the cardiomyocytes.

4-3-5

Covid-19 and Central Line Associated Bloodstream Infection (CLABSI): A Single Tertiary Center Experience

Daniel Vazquez MD, Illeana Horattas MD, Jessica A. Krizo PhD, Ali Mallat MD, MS, FACS, Kaitlin Vazquez DNP, CRNA, Alexis Schweibinz BS*

PURPOSE: An increase in the rates of CLABSI during COVID-19 has been described. Factors driving this increase are not clear. The purpose of this investigation was to identify risk factors for CLABSI in COVID-19 patients.

METHODS: A retrospective, case series review of all CLABSI events since the emergence of COVID-19 was performed. Data includes demographics, line and CLABSI characteristics and details regarding hospital stay. Descriptive statistics were used to explore the relationship between COVID status and CLABSI infections. Fisher's Exact Test and Mann-Whitney U Test were used to compare proportions and averages between groups.

RESULTS: 18 total CLABSI were identified, 8 with active COVID-19. The mean age was 62 (\pm 15) years old, patients were predominately white (61%), male (66%), and on Medicare (55%). More COVID+ CLABSI patients were male (87.5%). Primary diagnoses varied widely with secondary diagnoses including bacteremia (66%) and fungemia (22%). There was no difference in number of lines, ventilator, ICU, or hospital days between groups. Antibiotic use during line placement and type line were consistent between groups. Steroid use during line placement was more common in COVID+ patients (88%, $p=.01$).

CONCLUSION: The power of this study restricts analysis: however, steroid use and male patients illustrated higher rates of COVID+ CLABSI at our institution. These findings suggest that susceptibility to CLABSI in COVID+ patients' results from an underlying etiology rather than procedural limitations in COVID+ care, warranting further investigation.

4-3-6

Risk of Thromboembolic Events in COVID-19 Patients

Raquel Fricker BS, Jamie Fries* BS, Kunal Amin PharmD, BSPS, Rhianna Godios PharmD, BCACP, CACP, Stefanie Lehmier BS, PharmD, BCPS, Christopher Shelby PharmD, BCPS, Patrick Gallegos PharmD, BCPS*

PURPOSE: To determine if prior anticoagulated patients admitted to the hospital for COVID-19 have more or less thrombotic events than non-anticoagulated patients.

METHODS: Multicenter retrospective data collection of patients in Northeast Ohio, admitted to the hospital for COVID-19. Inclusion criteria included patients 18+ years who were admitted to the hospital with a positive COVID-19 diagnosis. Individuals were classified into two subgroups: anticoagulation (N=2,313) or no anticoagulation (N=11,080) at the time of COVID-19 diagnosis. The primary outcome looked at the composite event rate of ischemic stroke, deep vein thromboembolism (DVT), pulmonary embolism (PE), and myocardial infarction (MI) between the two groups. A p -value < 0.05 was considered statistically significant.

RESULTS: Composite of ischemic stroke, DVT, PE, or MI during hospitalization occurred in 10.9% in the anticoagulation group and 5.8% in the no anticoagulation group ($p < 0.001$). A higher incidence of prior thromboembolic events, coronary artery disease, chronic obstructive pulmonary disease, asthma, heart failure, atrial fibrillation, diabetes, hypertension, hyperlipidemia, active cancer, and history of cancer ($p < 0.05$) was seen in the anticoagulation group at baseline.

CONCLUSION: Individuals on anticoagulation prior to their COVID-19 hospitalization were more likely to develop ischemic stroke, DVT, PE, and/or MI compared to those without anticoagulation at admission. The increased prevalence in the primary outcome observed among the anticoagulation group correlates with the differences in demographics between the groups at baseline. Based on the demographic data provided, the anticoagulation group had more risk factors for developing a thrombotic event and experienced more thrombotic events despite anticoagulation.

4-3-7

Initial COVID-19 Treatment Project: An AAFP Sponsored Study

Timothy Fetterman M.D., Anthony Paolucci BS*

PURPOSE: Throughout the early months of the COVID-19 pandemic, there lacked guidelines or data on the efficacy of differing treatment plans. To better understand regimens that can improve COVID-19 outcomes, an AAFP sponsored project was done to compare one treatment plan's results to the national averages during a time when little to no information regarding treatment was available.

METHODS: Approximately three hundred patient's data from a primary care practice were analyzed to examine their hospitalization rate and recovery time when given a specific treatment. The study treatment consisted of Remdesivir, Dexamethasone, Zithromax, Pepsid, Vitamins C and D, as well as zinc. The primary aspect of the treatment was the Remdesivir, as patients were instructed to take 100 mg daily during their COVID-19 illness and the data was used to compare outcomes to other studies regimen of supportive treatment and quarantine.

RESULTS: Out of approximately 300 patients seen for COVID-19, the average recovery time for patients was approximately 10 days as opposed to 15 days with patients treated with just supportive care. Additionally, only 12 patients were hospitalized through the study's treatment plan with no fatalities.

CONCLUSION: With minimal knowledge on the treatment of COVID-19 during the early pandemic, the study's treatment regimen appears to have a significantly improved recovery rate and prognosis in comparison to supportive treatment.

4-3-8

Population-level Analysis Of COVID-19 in Ohio

Amy Adik BS, Natalie Bonfine PhD, Stacey Barrenger PhD*

PURPOSE: The US had the most COVID-19 cases/deaths in the world in April 2020. Within Ohio, prevalence rose to a peak in December of 2020. COVID-19 spread asymmetrically, showing disparities by race, SES, and prior illnesses. Studies have shown that older people, those in rural areas, counties with higher levels of African Americans population, counties with higher social vulnerability, and those facing social determinants had higher incidence and mortality rates due to COVID-19. We explored these patterns in Ohio.

METHODS: Population-level data at the county level (n = 88) was collected to examine the association among COVID-19 fatality rate and variables of interest, including classification of the county (rural, urban, Appalachian), race/ethnicity (percent black or African American), gender (percent female), age (percent of population over age 65), rates of overdose and suicide, poverty, and social vulnerability index. Bivariate correlations between each of these variables and the county COVID-19 fatality rate were completed using SPSS V. 26.

RESULTS: Population age (% 65 and older, $r = .606$, p -value $.000$) and median household income ($r = -.409$; $p = .000$) were significantly correlated with the COVID-19 fatality rate. Rural counties ($r = .300$, $p = .005$) and Appalachian counties ($r = .291$, $p = .006$) had a positive correlation, and urban counties having a negative association ($r = -.468$; $p = .000$) with the COVID-19 fatality rate.

CONCLUSION: The findings suggest that COVID-19 fatality rates in Ohio are higher in rural counties, Appalachian counties, in counties that have lower median income or in those counties with an older population.

Specialty Medicine

4-4-1

Language, Race, Ethnicity, and Insurance-Related Disparities in Blepharoptosis Surgery

Alice Dalo BS, Jake E. Radell MA, Ayden G. Case Albert Y. Wu MD, PhD, FACS*

PURPOSE: This study assesses differences in blepharoptosis (drooping of the upper eyelid) surgical rates, wait-times, and outcomes in different patient demographics. We hypothesized that patients' primary language, race, ethnicity, and insurance may affect their healthcare. Limited research has focused on how these variables affect ophthalmologic surgical rates and outcomes.

METHODS: Patients older than 18 years old with a ptosis diagnosis were included in this hospital IRB approved study protocol #61488. Patients were included if their ptosis-related encounter was between January 1, 2014 and December 31, 2020. Collected variables included race, ethnicity, age, body mass index, gender, preferred language, interpreter requirement, Elixhauser comorbidity sum, patient ICD-10 codes, encounter CPT codes and encounter dates. Data analysis was performed using R and Python.

RESULTS: Hispanic and Asian blepharoptosis patients underwent surgery at a significantly higher rate than White and Black patients. In non-English speakers, surgery occurs more frequently, while in patients requiring an interpreter, surgery occurred more frequently and quicker. Hispanic patients presented at a younger age than the overall cohort (63 vs 68 years old) and underwent surgery at the highest rate (20.8%), followed by Asian (18.5%), White (13.0%), and Black (12.8%) patients.

CONCLUSION: Our data indicates that Hispanic-identifying and primarily non-English-speaking patients undergo significantly higher rates of ptosis repair surgeries than White and English-speaking patients. Additionally, Hispanic patients present with

ptosis at a younger age and higher BMI than non-Hispanic white patients. Future studies should analyze why Hispanic, Asian, and non-English speaking patients are undergoing surgery more frequently or more rapidly.

4-4-2

Sunscreen Utilization Among Medical Students

Arjun Pandya BS, Maleck Saleh MBA, Jay Patel BS, Natalie Ganos BS, Sarah Eley BS, Nishant Surapeneni BS, Amy Adik BS, Vincent Hensperger BS, Eliot Mostow MD*

PURPOSE: Skin cancer is a highly prevalent malignancy in the United States with most cases caused by UV radiation from sun exposure. Studies have shown low usage of sunscreen and sun protection among the US population. The objectives of this study were to research medical student knowledge on solar protection and its relation to skin cancer, to quantify sunscreen use by medical students, and to determine strategies to help improve sunscreen use and practice.

METHODS: An online anonymous survey was administered to all 599 students in the NEOMED College of Medicine. This project protocol was approved by the NEOMED IRB (protocol 21-017).

RESULTS: A total of 151 students completed the survey. Around 53% of participants reported using sunscreen half of the time or less. Frequency varied significantly between males and females (p -value=0.0014), with females more likely to use sunscreen more often. The most common cited reason for not using sunscreen in both genders is due to convenience. Females were more likely than males to cite adverse effects (acne, irritation) as a reason for prohibiting sunscreen usage (p =0.0003), whereas males were more likely to lack education on proper sunscreen application (p -value=0.0018).

CONCLUSION: There is room for improvement for proper and adequate sunscreen use to prevent skin photo-damage in the NEOMED medical student cohort. Males fall behind in comparison to females in many categories such as frequency of application, sunscreen features, and extent of location on the body applied. Targeted interventions can be beneficial for both males and females. Initiatives such as educational seminars addressing importance and proper use can benefit both genders.

4-4-3

A Sarcoma Stem Cell Model for Studying Chemoresistance in Human Osteosarcoma (initial stages)

Ty Gallogly BS, Kenneth Wong* BS, Christine Mella M.S., Catherine Hord, Steven Kuerbitz M.D.*

Osteosarcoma (OS) is the most common primary malignancy of bone affecting children, adolescents, and young adults. While development of adjuvant treatment has improved outcomes, over 50% of OS patients encounter resistance to the standard chemotherapeutic regimen of methotrexate, doxorubicin, and cisplatin (MAP). Therefore, investigating the mechanisms of MAP drug resistances is of interest. One theorized method of resistance is the presence of cancer stem cells (CSC). According to this theory, CSCs comprise a subset of OS tumor cells which have the unique characteristics of relative hypoxia tolerance, self-renewing properties, and intrinsic drug resistance allowing for tumor persistence. A method for isolation of OS cells with CSC properties (OS-CSC) has been demonstrated using OCT4 expression. In this scheme, a gene coding for green fluorescence protein (GFP) with an OCT4 promoter is added to cells. GFP-positive cells exhibited properties of mesenchymal stem cells and enhanced serial tumorigenesis in previous studies. In addition, cultures of OS within anchorage and serum-deprived conditions have been shown to form spheres of OS-CSC rich cells (sarcospheres). The OS-CSC cells identified by the processes above have yet to be characterized via CD105, CD44, and ICAM or show increased drug resistance. Aims of this study are: (1) demonstrate serial sarcosphere formation, (2) indirect and direct sarcosphere formation procedure, (3) demonstrate sarcosphere expression of GFP, (4) compare low expressing OCT4 cell lines against high expressing OCT4 cell lines in sarcosphere formation efficiency.

4-4-4

Geriatric Patients with Periorbital Trauma Have a Higher Probability of Death in Five Year Follow Up

Vincent Pham BS, Hannah Miller MD, Elise Fernandez BS, David Fleischman MD*

The study focuses on mortality and comorbidities associated with traumatic eye injuries in geriatric patients. This study examines patients with periorbital injury, orbital fractures, and ocular trauma who have a

health care visit 5 years from time of injury. This study aims to determine if geriatric patients that suffer from traumatic eye injury have a greater mortality rate than non-traumatic cataract patients serving as age-matched controls. Data on age, time of injury, medications, comorbidities, and mortality was extracted. Mortality rates, comorbidities, and medications in patients who have sustained ophthalmic trauma or had cataract surgery were analyzed. Statistical analysis will be run including 2 sample proportion tests, logistic regression, and Pearson correlation. A $p < 0.05$ was chosen as statistical significance. The study group consisted of 92 patients over age 65 and the control group had 120 patients, both of which had data available at 5-year follow up. From a sample of 704 patients, 93 patients died and suffered from ocular trauma. From a sample of 3292 patients who did not sustain ocular trauma, 71 patients died. The study group mortality rate was 13.2% and the control group rate was 2.2%. Geriatric patients who have sustained periorbital trauma are more likely to have died within five years compared to age-matched controls without periorbital trauma. These data are important for focusing on etiologies of geriatric periorbital trauma, such as tendency to fall and its associated conditions.

4-4-5

Sacral Insufficiency Fracture in Third Trimester of Pregnancy: A Case Report

Christian Seif BS*

PURPOSE: Sacral insufficiency fractures are a rare cause of lumbar and hip pain that can occur in association with pregnancy. Although more commonly reported as a postpartum manifestation, few cases have been reported during the third trimester of pregnancy. This study aims to report a case and discuss the clinical presentation, diagnosis, and management of a sacral insufficiency fracture in the third trimester of pregnancy.

METHODS: We report the case of a 39-year-old woman who presented with lower back and gluteal pain during her 29th week of gestation. The onset of pain occurred after she had slipped on ice. The severity of her symptoms interfered with her physical activities such as standing and walking. After thorough examination, the patient underwent magnetic resonance imaging, which revealed a sacral insufficiency fracture.

RESULTS: Her pain was managed conservatively using acetaminophen and cyclobenzaprine. Pt was referred to physical therapy to learn how she can reduce weight bearing on the sacrum to allow for healing. Patient was closely monitored for the remaining course of her pregnancy. Finally, the patient gave birth to a healthy child by Caesarean section, which was preferred over vaginal delivery due to the minimized stress on the sacrum.

CONCLUSION: A sacral insufficiency fracture should be included in the differential diagnosis of lower back and gluteal pain during pregnancy. Conservative management and close observation is an effective therapeutic option.

4-4-6

Is Undergoing General Anesthesia Safe During Pregnancy?

Anuradha Kanaparthi BS, Atousa Deljou MD, Jalal Soleimani MD, Juraj Sprung MD, PhD, Darrell R Schroeder MS, Toby N. Weingarten MD*

PURPOSE: Surgical indications for gravid women are typically emergent due to unclear effects of general anesthesia and surgery on maternal and fetal wellbeing. In this retrospective study of gravid women undergoing non-obstetric procedures under general anesthesia, pregnancy related outcomes were assessed by the trimester when surgery occurred.

METHODS: This is a retrospective cohort study of 240 gravid subjects who underwent non-obstetric surgery in a ten-year period at a tertiary academic medical center. Electronic medical records were reviewed for baseline characteristics, type of surgery, anesthetic choice, length of stay, anesthetic complications, and maternal (postoperative pre-eclampsia, need for tocolysis or cerclage placement) and fetal (fetal demise within 7d of surgery and preterm delivery) complications. Complications were statistically analyzed by trimester at surgery with p-values < 0.05 considered statistically significant.

RESULTS: Maternal outcomes are summarized in Table. Need for tocolytic therapy was significantly higher in the 3rd trimester ($P=0.018$). Term at delivery in this cohort was not significantly associated with the trimester of surgery. Three individuals had fetal or newborn demise (one had miscarriage 7 weeks after

procedure, one had elective termination, and one had newborn die following hemorrhagic shock complicated by first surgery). Two individuals required cerclage placement not temporally related to surgery.

CONCLUSION: Women having surgery in third trimester have greater need for tocolytic therapy. Other outcomes of pregnancy do not appear to be related to trimester when the procedure occurs.

4-4-7

Electrode-to-Modiolus Distance in Round Window versus Cochleostomy Surgical Approaches: A Meta-Analysis

Sanjay Jinka BS, Vardhan Avasarala BS, Anita Jeyakumar MD, MS, FACS, FAAP*

PURPOSE: To contrast the electrode-to-modiolus distances achieved from round window (RW) and cochleostomy (C) surgical approaches.

METHODS: A meta-analysis of available literature published after 2000 was conducted. Thirty-seven peer-reviewed articles comparing RW & C approaches were identified with the inclusion criteria of being published with an English version and involving only human subjects (cadaveric or alive). Analysis of electrode-to-modiolus distance only included data from Med-El standard 12-electrode contact arrays. Electrode-to-modiolus distance for each electrode was found with flat-panel computed tomography (FPCT) and curved multiplanar reconstruction (MPR) for each included study. Electrode distances were compared with two-sample independent t-tests.

RESULTS: Forty-eight electrode arrays were analyzed with a mean patient age of 26. Two-sample independent t-testing revealed RW provided a significantly smaller (0.15 mm smaller on average, $p < 0.05$) electrode-to-modiolus distance when compared to C. Also when compared to C, RW specifically allowed for electrode placement to be significantly ($p < 0.05$) closer to the cochlear modiolus in electrodes 1-3, 5-10, and 12. No significant difference was found in electrodes 4 or 11.

CONCLUSION: The RW approach allows for electrode insertion to be significantly ($p < 0.05$) closer to the cochlear modiolus than the C approach across pediatric and adult populations. Decreased distance

correlates with increased probability of perimodiolar placement and minimized electrical impedance. Further study looking at trauma and hearing preservation is necessary to delineate potential adverse effects with decreased electrode-to-modiolus distance.

4-4-8

Efficacy of Conventional Therapies for Perianal Fistulizing Disease in patients with Ileal Pouch Anal Anastomosis

Karina Pedersen BS, Stacye Toups BS, Amy Lightner MD*

PURPOSE: Restorative proctocolectomy with formation of an ileal pouch anal anastomosis (IPAA) has become the mainstay treatment in patients with refractory Ulcerative Colitis (UC). Despite excellent 20-year outcomes with pouch failure rates documented as low as 4%, up to 14% of patients will present with a fistula of the pouch. Current literature has examined the efficacy of individual procedures to treat perianal fistulas and pouch associated fistulas, however, it has yet to examine overall treatment outcomes in one study, specifically in patients with IPAA. When completed, this study also aims to identify perioperative risk factors associated with healing or recurrence of these fistulas in patients with IPAA.

METHODS: Patients older than 18 who underwent an operation for perianal or pouch associated fistulas with a concomitant IPAA between 1995 and 2021 at the Cleveland Clinic Foundation were retrospectively analyzed following IRB approval (protocol #20-169 from the Cleveland Clinic Foundation). Electronic medical records of 221 patients were reviewed for class of fistula, use of medical and/ or surgical intervention, the number of subsequent operations and perioperative parameters. Multivariate logistic regression and univariate analyses will be used to determine efficacy of current therapies. Results from statistical analyses are currently pending.

CONCLUSION: Patients with IPAA's unfortunately still suffer from recurrent fistula formation after undergoing conventional treatments. Current fistula therapies are fraught with lower efficacy than intended, so newer therapies such as mesenchymal stem cell injections should be considered in combination with current therapies or as a primary

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treatment modality as clinical trials for these new treatments progress.

Career Pathways

5-1-1

Transparency in the Ophthalmology Residency Match: Study and Medical Student Perspective

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Medical students are applying to dramatically more ophthalmology residency programs than in the past, causing increased administrative burden for programs and financial harm to students. This study considers the medical student perspective of this situation and looks at how a lack of transparency of potential match filters contributes. The purpose of this study was to determine the availability and consistency of potential ophthalmology residency match filters through training program websites and the American Medical Association's (AMA) Residency & Fellowship Database (FREIDA). This was a cross-sectional observational study of 119 residency program websites and AMA FREIDA database entries. Five potential filters were evaluated for both availability and consistency on individual residency websites and FREIDA. 1) Whether a program required a minimum USMLE (United States Medical Licensing Examination) Step 1 score, 2) minimum number of letters of recommendation required, 3) whether a minimum USMLE Step 2 score was required, 4) if the program accepts the COMLEX (Comprehensive Osteopathic Medical Licensing Examination) sequence in lieu of the USMLE, and 5) ability of the residency to sponsor a visa (J-1, H-1B, or F-1). Only two ophthalmology residency programs (2%) made available and consistent information about all five filters on both their website and FREIDA. Information about potential filters used in the ophthalmology residency match is neither publicly available nor consistent. A standardized database of these filters is needed to increase transparency to applicants, which may reduce medical student expenses and program director workload.

5-1-2

Evaluating the Health Humanities as Essential Curriculum

Maria Colvis BS, Maya Schnall* BS, Jad Saleh* BS, Julie Aultman PhD, Rachel Bracken PhD, Rebecca Fischbein PhD*

PURPOSE: This project aims to determine how integrated ethics and health humanities medical education fosters essential cognitive behaviors and knowledge crucial to the development of the AAMC's Core Competencies for Entering Medical Students. It further seeks to elucidate how training in ethics and the health humanities impacts patient care, professionalism, and personal well-being for clinical students and physicians currently/previous enrolled in a longitudinal health humanities curriculum throughout their medical education.

METHODS: 1800 individuals, 1650 NEOMED/NEOUCOM MD alums (2010-2021) and 150 current NEOMED M4 students, were invited via email to complete an online survey of open-ended and Likert scale questions. Descriptive statistical analysis was performed via SPSS alongside qualitative coding and thematic analysis of written responses.

RESULTS: 61 participants completed the survey, with 44 completing at least one open ended question. Quantitative data revealed no statistically significant differences between cohorts. Qualitative data proved useful in gauging the intrinsic value of health humanities training: thematic analysis reveals that the curriculum instilled values; aided knowledge and practice; increased interpersonal abilities; allowed for personal preservation; and increased perceived reflective capacity. A limited number of respondents criticized the curriculum as "out of touch."

CONCLUSION: Our survey results suggest health humanities education at NEOMED fosters Core Competencies and has proved useful in practice for physicians. However, results are limited by the size of our sample and the ongoing COVID pandemic. Moreover, an instrumental approach to measuring the long-term effects of health humanities curricula is both complicated and its efficacy debated in medical education.

5-1-3

A Descriptive Analysis of Neurosurgery Residency Programs' Website Data

Peter Palmer BS, Robert D. Winkelman, MD/MS, Daniel Lilly MD, Christina Wright MD, Ghaith Habboub MD, Ajit Krishnaney MD, Edward C. Benzel MD, Michael P. Steinmetz MD*

PURPOSE: Neurosurgery program websites serve as a valuable resource for applicants to learn about current residents. However, each website exists in isolation, and it is difficult to understand general trends in US neurosurgery resident demographics. Here, we collected data from program websites and analyzed trends in demographics of current US neurosurgery residents.

METHODS: We used a program list obtained from the American Association of Medical Colleges Electronic Residency Application System to extract data from the current resident complement listed in each program website, including program, year in program, medical school, gender, and graduate/PhD degrees, and to assess the trends over 7 years of resident data using linear regression.

RESULTS: We identified 112 neurosurgery residency programs in the United States with 111 providing information on their current resident complement, yielding a dataset of 1556 residents (<https://tinyurl.com/yykpo243>). Of these 1556 residents, 21% (n=325) were female, 18% (n=280) had a graduate degree in addition to MD/DO degrees, 9.3% (n=144) had a PhD, 18% (n=287) matched at the program affiliated with their medical school, and 6.4% (n=100) graduated from a foreign medical school.

CONCLUSION: The proportion of matriculating female residents increased an average of 2.1% per year (95% CI, 0.5% to 3.8%) from 2014 to 2020. Other demographics did not change significantly over the same time period. In addition to summarizing current resident demographics, our analysis identified a significant increase in the proportion of female residents between 2014 (18.0%) and 2020 (26.3%). This publicly available dataset should enable additional

Specialty Medicine II

5-3-1

Skincare from the Inside Out: A Pilot Project Addressing Social Determinants of Health through Dermatology

Kelly Kimball BS, Rachel Krevh BS, Adrianna Nicholson BS, Payas Shah BS, Shreya Gurumurthy BS, Jacqueline Graham MD, Eliot Mostow MD, MPH*

Many women's shelters across the nation have programs that emphasize and empower women through career workshops and skills training. However, what isn't typically addressed is their dermatologic and mental health needs, which are equally important. Through this dermatology pilot project, we aim to address the diverse interrelated issues concerning the whole woman and her body/mind systems including aging, skin cancer awareness, skincare, healthy sun habits, self-esteem, mental health, stress management and body image. By addressing the woman holistically, we hope to positively impact the way she views and values herself. Our ultimate hope with this seminar is that when she leaves the shelter, she will be able to reenter society with the knowledge and confidence that she can be successful. We are partnering with a local women's shelter to host a 3-hour seminar focused on dermatological and mental health education. Pre- and post-seminar surveys will be collected from participants. Surveys will be anonymous and will not aim to generalize or draw conclusions about this population of women, but rather assess the success and efficiency of the workshop to guide and improve future seminars. The seminar will have 3 workshops: skin cancer and sun protection, skincare, and mental health and wellness. At the end of the seminar, the attendees will have the opportunity to receive free skin examinations by two board-certified dermatologists and referrals will be made to NEOMED's Free Clinic. Upon completion of the seminar, attendees will be provided with items such as sunscreen, skincare and mental health resources.

5-3-2

Hearing Preservation in Round Window versus Cochleostomy Surgical Approaches: A Meta-Analysis

Vardhan Avasarala BS, Sanjay Jinka BS, Anita Jeyakumar MD*

To contrast the Hearing Preservation achieved from round window (RW) and cochleostomy (C) surgical approaches. Peer-reviewed articles were selected from PubMed and Google Scholar using the MeSH search terms "round window" AND "cochleostomy." Only articles in English and non-animal studies were selected, and date of publication was not considered. Studies analyzed for detailed review collected data analyzing residual hearing under 3 categories, complete hearing loss, partial hearing preservation (>10 dB), and complete hearing preservation (<10dB loss) following either a cochleostomy or round window surgical method. Quality and validity was determined by PRISMA guidelines. Extracted data was made comparable by analyzing RW and C hearing preservation data that was homogenous across all studied. A chi-squared was used to compare the distribution between hearing preservation categories between the two surgical approaches. The distribution between the round window and cochleostomy groups were found to be significant ($p < 0.05$) with the percentages indicating that the round window surgical approach is better at preserving hearing than the standard cochleostomy method. Understanding the differences between the RW and C surgical approaches maintaining residual hearing preservation. Understand differences between RW and C surgical approaches. Learn how to use surgical approach as an avenue to improve residual hearing preservation. Consideration of hearing preservation when selecting between RW and C approaches. Additionally, inspiring further research with greater sample size collecting the same homogenous data to increase strength of the results.

5-3-3

Pediatric Odontogenic Tumors: A perspective on management

Prachi Lele BS, Maleeh Effendi MD, Raquel Ulma DDS MD, Brian Pan MD FAAP FACS, Haithem Elhadi-Babiker MD DMD FAAP FACS*

PURPOSE: Pediatric odontogenic tumors are rare and account for 12.7% of all odontogenic tumors. Because of their rarity, there is no consensus on their management. Moreover, tumors in the pediatric population present several dilemmas including timing and type of surgical intervention; conservative vs aggressive resection; and long-term surveillance plan. The purpose of this study is to provide some insight on the management of such tumors.

METHODS: After IRB approval, a retrospective review of all pediatric odontogenic tumors treated at Cincinnati Children's Hospital between 2014 and 2020 was performed. Thirteen patients were identified. Our management protocol consisted of a conservative approach with enucleation and curettage combined with peripheral ostectomy. An incisional biopsy was not obtained prior to proceeding to the operating room, to minimize the number of operations to the child. Teeth directly embedded in the tumor were removed en bloc with the specimen.

RESULTS: All patients were successfully treated with no recurrence of the tumor. Our mean follow up is 2 years.

CONCLUSION: Pediatric odontogenic tumors can be successfully treated with a conservative approach with one surgery only. This mitigates the physical and emotional risks of repeated trips to the operating room and decreases surgical costs with fewer operations. Children and parents also benefit from fewer missed school days or workdays and decreased total recovery time. Disadvantages of this approach include the lack of a definitive histologic diagnosis at the time of tumor excision and the need to extract teeth involved in the lesion.

5-3-4

Impact of Obesity in Reduction Mammoplasty

Shayda Mirhaidari MD, Emily Petrinec BS, Vitali A zouz MD, Douglas Wagner MD*

PURPOSE: Over 106,000 breast reduction surgeries were performed in 2017 making it one of the most frequently performed procedures. Reduction mammoplasty relieves symptoms of macromastia and improves patient self-image. Patients facing elective surgery are increasingly overweight with larger breasts. While obesity has been known to increase complication rates, its effect in the breast reduction population remains inconclusive. The purpose of this study is to evaluate outcomes following breast reduction surgery. Specifically, we want to evaluate how obesity in relation to body mass index (BMI) may affect complication rates.

METHODS: A retrospective review of patients undergoing breast reduction was performed from January 2014 - December 2018 following IRB

approval (Protocol Number 011). The incidence of complications such as hematoma, seroma, infection, fat necrosis and wound dehiscence was recorded and reviewed with respect to patient BMI.

RESULTS: 455 patients underwent 860 breast reductions (405 bilateral, 50 unilateral). The average age and BMI were 44.5 and 32.4 respectively. Inferior pedicle was the most performed technique with an average resection of 714.2 grams. Nearly all women had an improvement in symptoms of macromastia. The most common complication was wound healing issues (62 breasts, 7.2%). One distal vein thrombosis (DVT) episode occurred in a lower extremity. A BMI >35 was found to correlate with an increase in wound healing complications.

CONCLUSION: Despite increased likelihood of wound healing complications, breast reduction surgery remains a safe, effective treatment of macromastia in patients with BMI >35.

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