

12th annual

Medical Student Research Symposium

February 7th, 2020 · Johns Hopkins University School of Medicine

Cover image courtesy of

Vismaya Bachu, MS1

Cones

(Photograph)

Taken by Michael Kaufman

“Cones” is an actual photograph of antibody-stained cone photoreceptors taken by a very powerful confocal laser microscope at the Brzezinski Lab. It is related to my time studying retinal tissue differentiation with the Department of Ophthalmology at the University of Colorado. At a lab bench was perhaps where the overlap between engineering technology and medical advances intrigued me the most. I was just as fascinated with embryonic eye dissections as with transfection machine circuits. In this photograph, the cone cells and retinal vessel (green) are stained with cone arrestin in red, RXRGamma in blue, and Podxl in green. The small dark room where “Cones” was photographed did much more than teach me how to meticulously image mammalian tissue; it exposed me to the potential of interdisciplinary collaboration and inspired me to appreciate the multifaceted nature of scientific discovery.

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Medical Student Research Symposium 2020

We are pleased to have you join us for the 12th annual Medical Student Research Symposium of the Johns Hopkins University School of Medicine. As clinicians in training, we are fortunate to work among faculty who conduct a broad range of investigation that yields advances in the knowledge of human health. For the past twelve years, we have been privileged to have an event that presents the extensive endeavors that students take to advance this mission at the school.

The mission of the Johns Hopkins University School of Medicine is to educate medical students, graduate students, and postdoctoral fellows in accordance with the highest professional standards; to prepare clinicians to practice patient-centered medicine of the highest standard; and to identify and answer fundamental questions in the mechanisms, prevention and treatment of disease, in health care delivery and in the basic sciences.

The Medical Student Research Symposium is a forum for medical students at Johns Hopkins to present their own research to the greater Hopkins community. It is an opportunity for students to participate in the exchange of intellectual ideas in a professional format and meet faculty who relish the pursuit of better science and more effective medicine. Our mission is for the Medical Student Research Symposium to foster the development of young researchers who will aid in the advancement of scientific medicine for years to come.

The Scholarly Concentrations (SC) program is a faculty-mentored scholarly experience for medical students. This program provides the infrastructure and mentoring necessary for students to produce a scholarly project in an area of individual interest and encourages the acquisition of attitudes and skills for lifelong learning and scholarship.

The SC program offers the following five areas of study:

Basic Science

Sarah Wheelan, MD, PhD

Clinical Research

Meredith Atkinson, MD

Kelly Gebo, MD, MPH

Jennifer Haythornthwaite, PhD

Sapna Kudchadkar, MD, PhD

Steve Sozio, MD, MHS

**HEART: Humanism, Ethics,
Education and the Art of Medicine**

Joe Carrese, MD, MPH

Gail Geller, ScD, MHS

History of Medicine

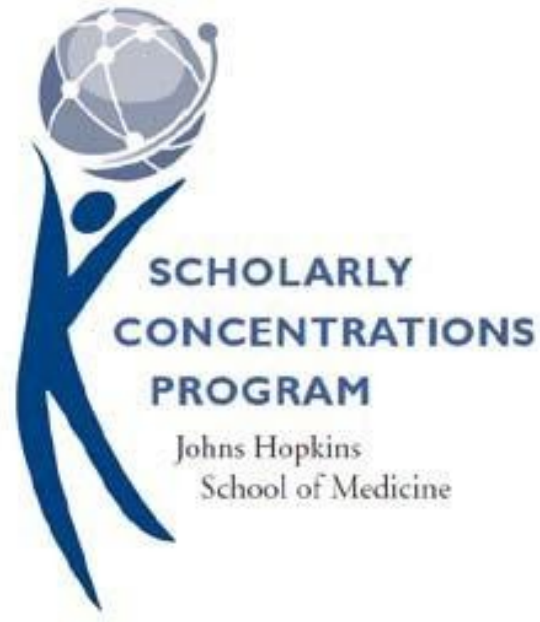
Nathaniel Comfort, PhD

Marta Hanson, PhD

Public Health Research

Eric Bass, MD, MPH

Bhakti Hansoti, MBBCh, MBChB, MPH



The overall goals of the SC program are to promote intellectual curiosity, appreciation of scholarly inquiry, flexibility, passion for discovery, openness to new ideas, and the ability to work both independently and collaboratively.

2020 MSRS Program Schedule

12:00 - 12:15 PM Registration/Lunch
AMEB main lobby

12:15 - 2:00 PM Podium Presentations
AMEB 1st floor lecture hall

2:00 - 3:30 PM Poster Session
AMEB 2nd floor atrium

3:30 PM Refreshments
AMEB 3rd floor

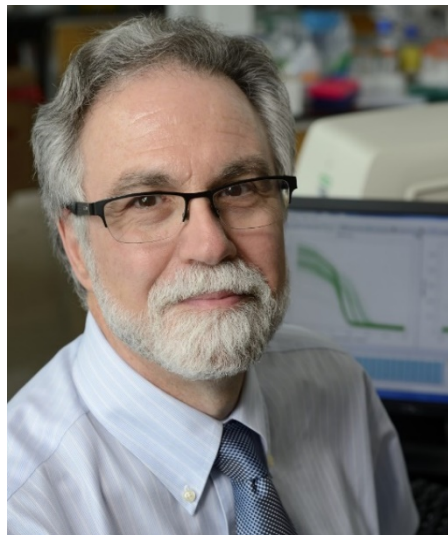
3:40 - 4:45 PM Concurrent Oral Presentations
AMEB 3rd floor presentation rooms

4:50 - 5:30 PM MSRS Awards Ceremony
featuring
Keynote speaker:
Gregg L. Semenza, MD, PhD
AMEB 1st floor lecture hall

Keynote speaker

Gregg L. Semenza, M.D., Ph.D.

Dr. Gregg Semenza received an A.B. in Biology, magna cum laude, from Harvard College; M.D. and Ph.D. (in Genetics) degrees from the University of Pennsylvania; pediatrics residency training at Duke University; and postdoctoral training in medical genetics at the Johns Hopkins University School of Medicine, where he has spent his entire faculty career. He is currently an American Cancer Society Research Professor and the C. Michael Armstrong Professor of Genetic Medicine at Johns Hopkins with appointments in Pediatrics, Medicine, Oncology, Radiation Oncology, and Biological Chemistry; since 2003, he has served as founding Director of the Vascular Program in the Johns Hopkins Institute for Cell Engineering.



Gregg L. Semenza, M.D., Ph.D.

Nobel Laureate

American Cancer Society Research Professor
The C. Michael Armstrong Professor of Genetic Medicine
Director, Vascular Program, Institute for Cell Engineering
Johns Hopkins University School of Medicine

Dr. Semenza is an elected member of the Society for Pediatric Research, American Society for Clinical Investigation, Association of American Physicians, National Academy of Medicine, and National Academy of Sciences. He has received the Canada-Gairdner International Award, Lefoulon-Delalande Grand Prix from the Institut de France, Wiley Prize for Biomedical Sciences, Albert Lasker Basic Medical Research Award, Massry Prize, and the Nobel Prize in Physiology or Medicine. He has published more than 400 papers, which have been cited over 140,000 times.

Dr. Semenza's laboratory discovered, cloned, and characterized hypoxia-inducible factor 1 (HIF-1), which is the founding member of a family of master regulators that direct transcriptional responses to decreased oxygen availability in virtually all metazoan species. His lab has shown that HIFs play important roles in cardiovascular disorders, cancer, COPD, diabetes, sleep apnea, transplant rejection, ocular neovascularization and hematologic disorders. Evolutionary selection of genetic variants at loci that encode HIF pathway components have been identified in Tibetan populations living at high altitude. HIF stabilizers and HIF inhibitors are currently in clinical trials for the treatment of anemia and cancer, respectively.

Faculty Judges

Aarti Mathur	Gerald Brandacher	Noton Dutta
Alan Scott	Gislin Dagnelie	Padmini Ranasinghe
Alejandro Garcia	Graham Redgrave	Paul Fuchs
Alexandra Maertens	Hanseok Ko	Paul Rosenberg
Amin Herati	Heather McKay	Paul Sponseller
Amol Narang	Hernando Lopez-Bertoni	Rachel Salas
Anne Murphy	Israel Gannot	Rafael Llinas
Ashwini Davison	James Brasic	Rajani Sebastian
Balaji Krishnamachary	James Ferriss	Ralph Hruban
Barry Nelkin	Janet Crane	Randall Packard
Barry Solomon	Jeffrey Scott	Raquel Greer
Betty Chou	Jennifer Coughlin	Raul Chavez-Valdez
Brian Caffo	Jonathan Coulter	Robert Sterling
Bruce Klein	Khalil Ghanem	Russell Margolis
Byoung Chol Oh	Kim Davis	Sangeeta Ray
Caitlin Hicks	Kristin Bibee	Sanjay Desai
Carol Newill	Kristin Riekert	Sharon Bord
Charles Steenbergen	Leticia Ryan	Shaun Kunisaki
Christine Ruggere	Logan Weygandt	Sheela Magge
Clint Cappiello	Lois Eldred	Silka Patel
Corey Tapper	Luciane Kagohara	Som Saha
Cozumel Pruette	Marc Halushka	Stefano Schena
Daniel Ford	Marcelo Diaz-Bustamante	Stephen Yang
Debraj Mukherjee	Mariana Brait	Sudipto Ganguly
Donna Magid	Mark Anderson	Thomas Smith
Douglas Gladstone	Marta Hanson	Tim Witham
Elisabeth Marsh	Mary Catherine Beach	Tina Tran
Elizabeth Wise	Mary Fissell	Tracy Friedlander
Eric Bass	Meghan Berkenstock	William Nelson
Frederick Nucifora	Mohammad Hoque	Young Bong Choi
Gail Geller	Nilanjan Chatterjee	Yu-Hsiang Hsieh

Schedule of Podium Presentations

12:20 PM	Eleanor Burton	A novel role for the aryl hydrocarbon receptor in the pathogenesis and treatment of necrotizing enterocolitis
12:32 PM	Andrew Schilling	Novel MRI-based score for assessment of trabecular bone quality to predict vertebral compression fractures in spinal metastatic disease
12:44 PM	Sunyoung Jang	The Association of the Novel Inflammatory Marker GlycA and Incident Heart Failure and its Subtypes of Preserved and Reduced Ejection Fraction: The Multi-Ethnic Study of Atherosclerosis
12:56 PM	Jenny Chen	IL-6 from smooth muscle cells is associated with clinical phenotypes and survival in adults with pulmonary arterial hypertension
1:08 PM	Ethan Morris	Socialized Medicine in mid-20th Century Baltimore: A Local Reflection of the Fight for American Health Care
1:20 PM	Macy Early	Patient education materials regarding reproductive technology: A need for improvement
1:32 PM	Joshua Materi & Giorgio Caturegli	Simplified Prescribing Tool for Tuberculosis Preventative Therapy: A Pilot Study in Matlosana, South Africa
1:44 PM	Jareatha Abdul-Raheem	Left Ventricular Diastolic Dysfunction (LVDD) among Children with Obesity and History of Elevated Blood Pressure (BP)

Schedule of Concurrent Oral Presentations

Room 226: History of Medicine / HEART: Humanism, Ethics, Education and the Art of Medicine

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|----------------|----------------|---|
| 3:40 PM | Margo Peyton | Segregated in Life and Death: Autopsy and the Racial Science of Tuberculosis at Johns Hopkins |
| 3:52 PM | Andrew Lea | MYCIN Explains Itself: Computing, Authority, and Trust in American Medicine |
| 4:04 PM | Erica Lee | Body Image and Race in Online Resources for Breast Reconstruction: What Do Patients See? |
| 4:16 PM | Michelle Recto | Implementation of an Expanded Clinical Reasoning Curriculum in the Pediatrics Core Clerkship |
| 4:28 PM | Larisa Breden | Farm to Clinic: Does Nutrition Education Impact Diet Modification? |

Room 260: Basic Science

3:40 PM	Harsha Malapati	Engineered IGF-1 Nanoparticles Delivered In Nanofiber Hydrogel Carrier To Improve Functional Recovery After Peripheral Nerve Injury
3:52 PM	Rohan Verma	Proteogenomic single cell analysis of skeletal muscle myocytes
4:04 PM	Aria Shi	Microglial Activation and Functional Changes in a Rabbit Model of Cerebral Palsy
4:16 PM	Vismaya Bachu	Intronic Element of Pde6c Acts as an Early Cone-Specific Enhancer in the Murine Retina
4:28 PM	Zaw Phyoo	Site-specific profiling of TCR signaling

Room 320: Clinical Science

- 3:40 PM** Jack Campbell Improving accuracy of intraocular lens formulas in eyes undergoing combined cataract extraction and DMEK
- 3:52 PM** Pavan Shah Mutation Status as a Prognostic Marker for Survival Post-Resection of Non-Small-Cell Lung Cancer Brain Metastases
- 4:04 PM** Vorada
Sakulsaengprapha Analysis of Variation in Pre-Procedural Fasting Duration for Common Inpatient Gastrointestinal Procedures
- 4:16 PM** Jennifer Franke Glycerol Rhizotomy for Tumor Associated Trigeminal Neuralgia: A Case Series
- 4:28 PM** Darya Fadavi Do Capitated Hospital Budgets Influence Rates of Select Procedures?

Room 326: Clinical Science

- | | | |
|----------------|-------------------------|---|
| 3:40 PM | Anna Christina Clements | Preoperative Testing and Outcomes in Pediatric Adenotonsillectomy for Very Severe Obstructive Sleep Apnea |
| 3:52 PM | Waverley He | Comparing Clinical Outcomes for TRAM, DIEP, and Latissimus Dorsi Flap Breast Reconstructions: A Systematic Review and Meta-Analysis |
| 4:04 PM | Dana Huh | Association of Clinical and Demographic Factors with Phototherapy Outcomes in Patients with Atopic Dermatitis |
| 4:16 PM | Srujan Koppurapu | Predictors of Postoperative Visual Improvement Following Surgical Intervention for Craniopharyngiomas |
| 4:28 PM | James Whitbread | VAD Status and Age Impacts Rate of Heart Transplantation for Waitlist Candidates |

Room 341: Clinical Science

3:40 PM	Priyanka Kumar	Age-Based Gaps between Awareness of Photoaging and Photoprotective Practices among Skin of Color Adults: Opportunities for Intervention
3:52 PM	Samantha Ip	Non-Accidental Trauma in Pediatric Patients: Evidence-Based Screening Criteria for Ophthalmologic Examination
4:04 PM	Vasu Munjapara	Exploring Parental Decision-Making Regarding Long-term Ventilation for Children with and without Severe Neurological Impairment
4:16 PM	Jack Gatti	Childhood Arterial Ischemic Stroke and Vasculopathy Subtypes: Etiologies, Natural History, and Outcomes
4:28 PM	Julie Kim	Frequency of Post-Tonsillectomy Hemorrhage Relative to Time of Day

Room 342: Clinical Science

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|----------------|----------------------|---|
| 3:40 PM | Kaushik Parvathaneni | Association Between Mid-Life Physical Activity and Incident Kidney Disease: The Atherosclerosis Risk in Communities Study |
| 3:52 PM | Daisy Dai | The Effect of Language Barriers at Discharge on Pediatric Adenotonsillectomy Outcomes and Healthcare Contact |
| 4:04 PM | Joon Ying Boon | Characterizing Drivers of Medical Resource Utilization Among Adolescents and Young Adults with Sickle Cell Disease |
| 4:16 PM | Angela Liang | Reducing fields of radiation to decrease treatment toxicity in differentiated thyroid cancers |
| 4:28 PM | Michael Bray | Educational Achievement And Youth Homicide Mortality: A City-Wide, Neighborhood-Based Analysis |

Room 343: Public Health

- 3:40 PM** Alexa Mullins Caregivers' healthy eating value systems under economic constraints: perspectives on utilizing federal nutrition assistance benefits in the interest of their children's health
- 3:52 PM** Trevor Glenn Engagement and Affective Communication During Pediatric Nephrology Clinic Visits: Associations with Medication Adherence
- 4:04 PM** Derek Teng Prevalence and Cost of Unnecessary Preoperative Testing in Patients Presenting for Emergent Open Globe Surgical Repair
- 4:16 PM** Carolyn Reuland Barriers and Facilitators to the Implementation of a Pediatric Early Warning Score (PEWS) in a Limited-Resource Setting
- 4:28 PM** Hursuong Vongsachang Students Who Failed School-based Vision Screening: How Significant is Their Refractive Error?

Room 344: Public Health

3:40 PM Yesha Shah Ability to Predict Visual Field Damage in Glaucoma Using Patient Reported Symptoms

3:52 PM Mary Chen The Effectiveness of a Breathing Biofeedback Device on Pediatric Anxiety

4:04 PM Nivedha Kannapadi Risk Factors for LVAD-Associated Stroke and Other Adverse Outcomes

4:16 PM Alyssa Kretz Stakeholders' Perceptions of a School-Based Eye Care Program in Baltimore, MD

4:28 PM Giorgio Caturegli Acute Brain Injury in Infant ECMO: An Autopsy Study

Room 345: Public Health

- | | | |
|----------------|--------------------|---|
| 3:40 PM | Malcolm Matheson | Biomarkers of Ketamine's Antidepressant Effect: A Systematic Review of Neuroimaging Studies |
| 3:52 PM | Amanda Jones | What antenatal fetal surveillance parameters predict fetal demise in Down syndrome? |
| 4:04 PM | Shirley Wang | Barriers to Receipt of Intended Treatment for HIV-Positive Women with Cervical Cancer |
| 4:16 PM | Alexandra Lombardo | Changing Characteristics of Decedents with HIV over 10 Years in South Africa |
| 4:28 PM | Jaclyn Nguyen | Suicide Among Maryland Decedents with Parkinson's Disease |

Poster Directory

AMEB 2nd floor

Listed Alphabetically by First Name of Author and Research Category

Basic Science

No.	Name	Title
1	Catherine Yip	The Application of Epigenetic Modulation to the Immunogenicity of Pediatric Sarcomas
2	Harshath Gupta	Investigating Complex Chromosomal Rearrangements in Prostate Cancer with Synthetic Long Read Assembly
3	Jack Korleski	Verifying genes regulated by PRC2 in Glioblastoma multiforme stem cells
4	Josh Gray	Whole-Genome Sequencing of Staph aureus for Nosocomial Outbreak Analysis
5	Mary Rostom	Potential of Subcutaneous Cell Implantation for Treatment of Lysosomal Storage Diseases
6	Melissa Staley	How does Electroconvulsive Therapy suppress Self-Injurious Behavior associated with Intellectual and Developmental Disabilities: Focus on Mechanism
7	Nancy Zhou	In Vitro Biocompatibility of Engineered Magnetic Nanoparticles in Mouse Organ of Corti Explant Cultures

Clinical Science

No.	Name	Title
8	Abhishek Gami	Decision-making in unruptured intracranial aneurysms: correlation of the Unruptured Intracranial Aneurysm Treatment Score and PHASES score with referral center practice
9	Adaobi Ugochukwu	Medical Cannabis, Cannabinoids, and Myositis: Understanding Patient and Physician Attitudes, Beliefs, and Knowledge
10	Ainsley Taylor	Open Payments: Evaluating sex-based disparities of physician-industry payments within the 2016 American Academy of Orthopaedic Surgeons (AAOS) committee leadership
11	Amancio Romero-Sackey	Multidisciplinary Team Integration Improves Treatment Completion and Reduces Racial Disparity in Cervical Cancer
12	Andrew Supron	Primary Robotic Retroperitoneal Lymph Node Dissection Following Orchiectomy for Testicular Germ Cell Tumors: A Single-Surgeon Experience
13	Anthony Salerno	Bronchoscopic transbronchial biopsies for assessment of lung allograft rejection: factors that impact specimen adequacy
14	Anna Gong	Effect of IV Bevacizumab Therapy on Visceral Arteriovenous Malformations in Patients with Hereditary Hemorrhagic Telangiectasia
15	Annie Cho	Predicting orbitorrhea using optic nerve stretch in anterior skull base fractures
16	Breanne McCarthy	AKAP13 Interacts With the Vitamin D Receptor to Alter Vitamin D-Dependent Gene Activation in Uterine Fibroid Cells

- 17 Caroline Qin** Medication, Supply, and Blood Product Cost Awareness Among Anesthesia Providers
- 18 David Botros** Assessing the Efficacy of Repeat Resection for Glioblastoma
- 19 Elizabeth Liu** Prevalence of aspirin use for prevention of cardiovascular disease in U.S. adults with and without diabetes: National Health and Nutrition Examination Survey (NHANES), 2011-2016
- 20 Emerson Lee** Dysphagia in a geriatric, care-seeking population: a descriptive study
- 21 Erik Almazan** Association of diabetes, cigarette smoking, liver disease, and headache with granuloma annulare: a case-control study
- 22 Evelyn Leland** Leukocytoclastic vasculitis with and without IgA deposition is associated with renal damage: a case-control study
- 23 Feras Shamoun** The Evolving Trends in the Impact Factor of Plastic Surgery Journals: A 22-Year Analysis
- 24 Galen Shi** Erythema Multiforme: Characteristics, Associations, and Treatment in a Series of Johns Hopkins Hospital Patients
- 25 Gilberto Lobaton** Workforce and Compensation Trends in Maryland Hospitals after Introduction of Global Budget Revenue
- 26 Glory Mgboji** Predictive Factors for Fertility Preservation in Pediatric Patients with Planned Gonadotoxic Treatment
- 27 Grace Ma** New Onset Epilepsy during Pregnancy

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|-----------|-------------------------|--|
| 28 | Ha Vi Nguyen | The Clinical Importance of Postpartum Contraception Upon Hospital Discharge |
| 29 | Heba Mahjoub | Analysis of tumor characteristics and circulating tumor DNA (ctDNA) in women with early stage hormone receptor (HR)-positive breast cancer |
| 30 | Matthew Tan | Accuracy of propofol doses in the electronic medical record (EMR) system |
| 31 | Meghana Jami | Treatment and Prognosis of Patients with Skip Metastasis and Extremity-Only Osteosarcoma: A Case Series |
| 32 | Michelle Colbert | Broadly-neutralizing antibodies with the same antigenic specificity show preference for single polymorphisms within the AR3 epitope |
| 33 | Mitchell Huang | Evidence-Based Analysis of Online Consumer Information about Prostate Artery Embolization for Benign Prostatic Hyperplasia |
| 34 | Prachi Aggarwal | The natural history of prurigo nodularis: an online, global questionnaire-based study |
| 35 | Ravi Medikonda | The Effects of Postoperative Neurological Deficits on Survival in Patients with Single Brain Metastasis |
| 36 | Rohan Bajaj | A Quantitative Method of Grading Fuchs' Dystrophy Using Images Taken at the Slit Lamp |
| 37 | Sharon Pang | Health Outcomes in Older Adults Undergoing Endovascular Therapy for Acute Ischemic Stroke |
| 38 | Xinyi Chen | Factors Influencing Post-Graduate Career Decisions of Ophthalmology Residents |

- 39 Yangshu
Linda Pan** Antenatal and Postpartum Contraceptive Concordance: How Often do Patients Receive Their Requested Method?
- 40 YoonJi Moon** Implementation of a Stroke Center in Panama: benchmarks, demographics, and clinical outcome of a cohort of patients with ischemic stroke

HEART: Humanism, Ethics, Education and the Art of Medicine

No.	Name	Title
41	Ashlyn McRae	Assessing Medical Students' and Residents' Attitudes Towards Student Note Writing and Use of Student Notes for Billing
42	Harisa Spahic	Farm to Clinic – Does Having a Choice Influence Program Adherence and Food Consumption?
43	John Bliamptis	Physician attitudes toward deceptive administration of placebos as therapeutics
44	Lillian Hayes	“One foot in front of the other”: A qualitative exploration of thru-hikers' experiences on the Pacific Crest Trail
45	Vignesh Sadras	Exploring patients' and spiritual care providers' perspectives on a spiritual care program and its influence on patients and their primary care.

History of Medicine

No.	Name	Title
46	Nabila Ali	The Most Magnificent Work of the Most Excellent Art: Anatomical Representation in the 18th Century in Cheselden's Osteographia

Public Health

No.	Name	Title
47	Alexander Blum	Rohingya Refugee Family Perspectives on Birth Delivery Location
48	Austin Peer	HIV, STIs, and pregnancy among women of reproductive age in a Lake Victoria fishing community: a population-based study
49	Chelsea Moriarty	The ACA's Medicaid Expansion on Access to Obesity Treatment
50	Danielle Amundsen	Taking Another Look: Diphtheria in India
51	Hulaimatu Jalloh	Assessing Post-Operative Infection in Patients with Pilon Fractures
52	Hursuong Vongsachang	Are screening failure rates and consent rates in school-based vision programs correlated?
53	Insia Zufer	Assessment of Social Determinants of Health in an Integrated Maternal Mental Health Clinic within an Urban Pediatric Primary Care Practice
54	Isabel Lake	Non-Invasive Management of Pediatric Isolated, Condylar Fractures: Less is More?5

- 55 Jacob Roberts** Determining the prevalence of tuberculosis (TB) in emergency departments in the Eastern Cape region of South Africa and the utility of an emergency department (ED)-based testing strategy.
- 56 Laura Pugh** Multidisciplinary Treatment Planning for Breast Cancer in Tanzania: Time to ACT
- 57 Mohamed Mohamed** Development of a Standardized Breast Cancer Diagnostic Pathway for Bugando Medical Centre
- 58 Mya Abousy** Policies and Price Tags: the public's perception of face transplants and their funding
- 59 Nicholas Daneshvari** Could ischemic stroke infarct volume aid in determining stroke subtype?
- 60 Rochelle Prokupets** The Effect of Re-exploration for Bleeding on Postoperative Outcomes for Cardiac Surgery
- 61 Rohanit Singh** Systematic Review of Selected CKD Websites
- 62 Sarah Frey** Identification of Primary Site of Malignancy in Patients with Skeletal Metastases and Unknown Primary Malignancy in a Modern Cohort
- 63 Shanna Yue** Analyzing outcomes for a school-based directly observed therapy program for asthma.
- 64 Tina Esfandiary** Assessing the Face Validity of Myositis Patient-Reported Outcome Measures

Acknowledgements

The MSRS Organizing Committee would like to thank the following people for their support putting this event together. Without their help, this day would not have been possible.

Faculty Judges
The Office of Student Affairs
The Scholarly Concentrations Faculty
Delena Dodd

Mark Dodd
Doug Hughes
Victor Raspa
John Steele

PODIUM PRESENTATION ABSTRACTS

Listed in order of presentation

Eleanor Burton, MS 2

Mentor(s): David J. Hackam, MD, PhD
Division of Pediatric Surgery

A novel role for the aryl hydrocarbon receptor in the pathogenesis and treatment of necrotizing enterocolitis

Authors: Eleanor Burton BA, Peng Lu PhD, Chhinder Sodhi PhD, David Hackam MD PhD

Background: Necrotizing enterocolitis (NEC) is a gastrointestinal disorder associated with extremely high rates of morbidity and mortality in premature infants. The aryl hydrocarbon receptor (AHR), a transcription factor expressed in immune cells, functions to maintain barrier integrity at mucosal interfaces between the body and the environment. Given the intricate interplay between the maternal and fetal immune systems, maternal activation of AHR may influence neonatal intestinal development. We hypothesized that fetal exposure to AHR results in healthier gastrointestinal development and protects against the development of NEC.

Methods: We used indole-3-carbinol (I3C), a cruciferous vegetable metabolite that promotes AHR activity, as a vehicle to explore these interactions in mice and enteroids. In the mouse model, we fed pregnant mice a diet either lacking or rich in I3C to explore the effect of AHR activation on the intestinal architecture and cell differentiation of their offspring. For the enteroid model, enteroids were obtained by isolating and culturing crypts from ileum of 7-day-old control and Ahr^{-/-} C57-BL/6 offspring of mothers fed the I3C-free diet. We then treated the enteroids with I3C to examine the direct effect of AHR expression on intestinal cell differentiation.

Results: Using qPCR, we determined that I3C promotes goblet and Paneth cell differentiation and cell proliferation in both the mouse and wild type enteroid models. Histology studies of the terminal ileum corroborated these observations. Microscopic visualization of the enteroids further suggested that I3C promotes enteroid differentiation. Notably, there was no significant difference in gene expression or enteroid morphology between Ahr^{-/-} enteroids grown in the presence or absence of I3C, suggesting that the effects observed in the wild type treatment groups were due to I3C induction of AHR activity.

Conclusion: These data suggest that maternal activation of AHR promotes healthy development and function of the neonatal intestine, offering a promising target for preventative therapy.

Andrew Schilling, MS 2

Mentor(s): Daniel M. Sciubba, MD
Department of Neurosurgery

Novel MRI-based score for assessment of trabecular bone quality to predict vertebral compression fractures in spinal metastatic disease

Authors: Andrew Schilling AB, Jeffrey Ehresman BS, Zach Pennington BS, Chengcheng Gui BS, Xuguang Chen MD PhD, Daniel Lubelski MD, A. Karim Ahmed BS, Ethan Cottrill MS, Majid Khan MD, Kristin J. Redmond MD MPH, Daniel M. Sciubba MD

Background: Vertebral compression fractures (VCFs) in patients with spinal metastasis can lead to destabilization and often carry a high risk profile. It is therefore important to develop tools that enable providers to predict new VCFs. To address this, we introduce an MRI-based scoring system to estimate trabecular vertebral bone quality and assess its ability to predict new VCFs in metastatic spine patients.

Methods: Adult patients with a diagnosis of spinal metastasis who underwent stereotactic body radiation therapy or neurosurgical intervention between 2012 and 2019 were retrospectively reviewed at a single institution. A novel Vertebral Bone Quality (VBQ) score was calculated for each patient using lumbar MRIs by dividing the median signal intensity of the L1-L4 vertebral bodies by the signal intensity of cerebrospinal fluid. Multivariable logistic regression analysis was used to identify associations of demographic, clinical, and radiological data with new VCFs.

Results: Among the 105 patients included in this study, 56 patients were diagnosed with a new VCF compared to 49 who were not. On univariable analysis, the factors associated with new VCFs were smoking status ($p < 0.02$), steroid use longer than three months ($p < 0.04$), Spinal Instability Neoplastic Score (SINS, $p < 0.01$), and VBQ score ($p < 0.01$). On multivariable analysis, only SINS (OR = -0.88 per point, 95% CI = [-1.37, -0.51], $p < 0.0001$) and VBQ score (OR = -3.05 per point, 95% CI = [-4.60, -1.86], $p < 0.0001$) were significant predictors of new VCFs and when combined, had an AUC of 0.89.

Conclusion: The novel VBQ score as a measure of bone quality significantly predicted the occurrence of new VCFs in metastatic spine patients, independent of SINS. This suggests that baseline bone quality is a crucial factor that requires assessment when evaluating these patients; the VBQ score is a simple MRI-based method to accomplish this.

Sunyoung Jang, MS 2

Mentor(s): Erin Michos, MD, MHS
Department of Cardiology

The Association of the Novel Inflammatory Marker GlycA and Incident Heart Failure and its Subtypes of Preserved and Reduced Ejection Fraction: The Multi-Ethnic Study of Atherosclerosis (MESA)

Authors: Sunyoung Jang, BS, Oluseye Ogunmoroti, MD, MPH, Vishal N. Rao, MD, MPH, Oluwaseun E. Fashanu, MBBS, MPH, Di Zhao, PhD, Martin Tibuakuu, MD, MPH, James D. Otvos, PhD, Eve-Marie Benson MD, Chiadi E. Ndumele, MD, MHS, Pamela Ouyang, MBBS, Erin D. Michos, MD, MHS

Background: GlycA, a nuclear magnetic resonance composite marker of systemic inflammation, reflects serum concentration and glycosylation state of major acute phase reactants. Prior studies have shown plasma GlycA levels were associated with cardiovascular disease (CVD), heart failure (HF) and mortality even after adjusting for other inflammatory markers. However, little is known about the association of GlycA with the HF subtypes of preserved (HFpEF) or reduced (HFrEF) ejection fraction. GlycA is linked with obesity and thus may be more strongly associated with HFpEF.

Methods: We evaluated 6507 MESA participants aged 45-84 without baseline CVD or HF who had data on GlycA and incident hospitalized HF. We used multivariable-adjusted Cox hazards models to evaluate the association of GlycA with incident HF and its subtypes in a multi-ethnic cohort. We progressively adjusted models for sociodemographic variables, CVD risk factors, and inflammatory biomarkers.

Results: The mean (SD) for age was 62 (10) yrs and for GlycA was 381 (61) $\mu\text{mol/L}$; 53% of participants were women, 39% White, 27% Black, 21% Hispanic, 12% Chinese. Median (IQR) follow-up time was 14.0 (11.5-14.7) yrs. Incidence rates per 1000 person-yrs for HF, HFpEF, and HFrEF were 4.0 (3.6-4.5), 1.7 (1.4-2.0), and 2.0 (1.7-2.4), respectively. In fully adjusted models, compared to the lowest quartile of GlycA, participants in the highest quartile had the greatest risk of developing HF [Hazard Ratio 1.48 (95% CI 1.01-2.18)]. However, this increased risk was only seen for HFpEF [2.18 (1.15-4.13)] and not HFrEF [1.06 (0.63-1.79)].

Conclusion: GlycA was associated with an increased risk of HF and HFpEF. Future studies should examine mechanisms underlying the differential association of GlycA with HF subtypes, which may guide whether GlycA has utility as a biomarker to improve HF risk prediction or to direct therapy.

Jenny Chen, MS 2

Mentor(s): Allen Everett, MD
Department of Pediatrics

IL-6 from smooth muscle cells is associated with clinical phenotypes and survival in adults with pulmonary arterial hypertension

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Background: The pro-inflammatory cytokine interleukin-6 (IL-6) has been associated with adverse outcomes in small pulmonary arterial hypertension (PAH) cohorts composed largely of idiopathic subjects with severe disease. It is unclear whether IL-6 is a general marker of critical illness or a mechanistic biomarker of pulmonary vascular remodeling and thus, a potential therapeutic target. We sought to explore IL-6 associations with clinical phenotypes and outcomes across diverse PAH subtypes and severities and to determine the cellular source of IL-6 in the pulmonary vasculature.

Methods: IL-6 levels were measured by ELISA in 1) serum samples from the NIH PAH Biobank from well-characterized subjects representing multiple subgroups (N=2017) and 2) the conditioned media of pulmonary microvascular smooth muscle and endothelial cells from PAH patients (N=22) and healthy controls (N=11) from Vanderbilt University. Relationships between IL-6 levels, clinical variables, and mortality were analyzed with multivariable regression adjusted for age and sex and with Cox proportional hazard modeling adjusted for demographic, hemodynamic, and functional variables.

Results: Serum IL-6 was highest in portal hypertension and connective tissue disease-associated PAH and was significantly associated with worse hemodynamics and functioning. Higher IL-6 levels were significantly associated with increased mortality in the overall cohort (adjusted HR 1.21, $p=0.003$) and remained significantly associated with survival in subjects with less severe disease. PAH smooth muscle cells produced significantly more IL-6 than PAH endothelial cells ($p<0.001$), though there was no difference in levels between cell types among the controls.

Conclusion: IL-6 is predominantly released from pulmonary artery smooth muscle cells, and circulating IL-6 is associated with specific clinical phenotypes and worse outcomes in PAH, including in subjects with less severe disease. IL-6 is a mechanistic biomarker for PAH that may aid in the selection of patients most likely to benefit from novel targeted therapies in the future.

Ethan Morris, MS 2

Mentor(s): Graham Mooney, PhD
Department of The History of Medicine

Socialized Medicine in mid-20th Century Baltimore: A Local Reflection of the Fight for American Health Care

Authors: Ethan Morris BA, Graham Mooney PhD

Background: In 1948, Baltimore physicians and public health leaders inaugurated the Baltimore Medical Care Program, a doctor-inspired and locally tax-supported medical care system, which attempted to provide comprehensive medical care for indigent patients on Welfare. Local, socialized programs like this are missing from the federally focused historical literature on twentieth century American health care. Examining the Baltimore Medical Care Program is a local window through which to critically examine the fundamental tensions that govern American health care.

Methods: I reviewed archival documents, including official city health department reports and correspondence, from the Chesney Medical Archives that pertained to the creation and administration of the Baltimore Medical Care Program in order to determine the motivations for creating a local health care program. I also examined Baltimore newspaper and other firsthand accounts of the Program to assess its public perception and to account for its eventual replacement by Medicare and Medicaid.

Results: The Baltimore Medical Care Program was paradoxical in both its intentions and its administration. It aimed to incorporate progressive reforms for its era, including coordinated care, capitation-based payments for physicians, and public health preventive efforts. Antithetically, however, the program reinforced prevailing notions and practices in American health care, upholding the sovereignty of the physician in health care administration, racial segregation in medical care delivery, and most of all, the fundamental desire to avoid federal government intervention into health care.

Conclusion: The Baltimore Medical Care Program attempted to widen health care access while simultaneously reinforcing the traditional system of health care delivery and the authorities that govern such a system. The fundamental arguments that dictated the Baltimore Medical Care Program endure today as progressives and traditionalists contend for the future of American health care.

Macy Early, MS 2

Mentor(s): Lydia Pecker, MD; Mindy Christianson, MD
Department of Reproductive Endocrinology and Hematology

Patient education materials regarding reproductive technology: A need for improvement

Authors: Macy L. Early BA, Priyanka Kumar BA, Arik V. Marcell MD, Cathleen Lawson MS Mindy Christianson MD, Lydia H. Pecker MD

Background: Preimplantation genetic testing (PGT) with in vitro fertilization (IVF) reduces the risk of having a child affected by a heritable condition, yet only one-third of eligible patients are aware of this option. Access to patient education materials (PEM) written at an appropriate literacy level could raise awareness. Research shows that PEM about other medical topics exceeds millions of American's reading abilities. To address this mismatch, the Joint Commission and Centers for Disease Control and Prevention set reading level standards for PEM, but they are rarely met. This study aimed to determine whether PEM about IVF/PGT exist and evaluate their readability, understandability, and comprehensibility/clarity.

Methods: An environmental scan, a modified systematic review, was performed to identify PEM from academic databases, decision aid indexes, and public websites. Two independent raters used three validated scales to analyze materials. The Simple Measure of Gobbledygook (SMOG) measures reading level by counting the polysyllabic words in thirty sentences. The AHRQ's Patient Education Material Assessment Tool (PEMAT) and the CDC's Clear Communication Index (Index) measure understandability and clarity/comprehensibility, respectively, using questionnaires. Arithmetic mean of the raters' SMOG scores was calculated. The raters reached consensus on each item of the PEMAT and Index.

Results: Seventeen patient education materials about IVF/PGT were identified. The median reading level was 14.5 grade (IQR: 13.9 - 15.5 grade), median understandability was 74.2% (IQR 67.3 – 82.8%), and median clarity/comprehensibility was 73.3% (IQR 51.6 – 80.3%). Most materials failed to meet standards known to support reader comprehension such as: provides a summary (1/17), uses words the audience uses (2/17), or uses visual cues (5/17).

Conclusion: Written patient education materials for IVF/PGT exceed the reading level, understandability, and clarity recommendations set by the Joint Commission and CDC. Educational materials should be developed that communicate this complicated subject effectively to general patient populations.

Joshua Materi, MS 2; Giorgio Caturegli, MS 2

Mentor(s): Christopher Hoffmann, MD, MPH
Department of Medicine, Division of Infectious Diseases

Simplified Prescribing Tool for Tuberculosis Preventative Therapy: A Pilot Study in Matlosana, South Africa

Authors: Joshua Materi* BS, Giorgio Caturegli* BS, Jonathan Golub PhD, Christopher Hoffmann MD MPH

Background: South African guidelines for HIV management state that all people with HIV not being investigated for active TB should be provided tuberculosis preventive therapy (TPT) using isoniazid. However, TPT implementation remains below target goals. This study sought to better understand TPT prescribing in primary care clinics in South Africa and to pilot a simplified prescribing approach.

Methods: A mixed-methods study was conducted in three primary care clinics (Jouberton, Alabama, and Gateway) in Matlosana, South Africa. Nine nurses were recruited and underwent training on the 2018 WHO guidelines. A simplified prescribing tool (stamp and/or sticker) containing ART and TPT prescriptions was introduced into clinic workflow. Prescription data were collected during a two-week period. Open-ended interviews for thematic analysis were conducted with eight prescribers.

Results: Query of on-site electronic database indicated baseline TPT prescription for the first six-months of 2019: 137 TPT initiations out of 278 ART initiations (49%) at Jouberton, 129 of 233 (55%) at Alabama, 256 of 262 (98%) at Gateway, 522 of 773 overall (68%). During the study period, forty-one newly diagnosed HIV patients eligible for ART were evaluated. Thirty-four files (83%) used a stamp or sticker; tool uptake was 100% at two clinics and 70% at another. Thirty-seven (90%) patients were deemed eligible for same-day ART and TPT initiation; 36 (97%) of these had ART and TPT prescription documented in their file and/or simplified prescribing tool.

Qualitative analysis revealed TPT prescription is complicated by inadequate upper-level support, paucity of training opportunities, stock-outs, cognitive load, work burden, and patient-related factors. Provider acceptability of the intervention was favorable, with unanimous recommendation to colleagues on the basis of streamlined documentation.

Conclusion: This study demonstrated that simplified TPT prescribing can reduce organizational challenges by streamlining documentation and reminding providers to prescribe TPT. Further investigation is needed to assess the tool's impact on patient's TPT adherence.

Jareatha Abdul-Raheem, MS 2

Mentor(s): Tammy Brady, MD PhD
Department of Pediatric Nephrology

Left Ventricular Diastolic Dysfunction (LVDD) among Children with Obesity and History of Elevated Blood Pressure (BP)

Authors: Jareatha N. Abdul-Raheem BS, Edem Binka MD, Jennifer Roem MS, Christy B. Turer MD, Elaine M. Urbina MD, Tammy M. Brady MD PhD

Background: LVDD denotes poor cardiac filling, predicts incident development of heart failure, and is associated with hypertension and obesity in adults. Data are needed regarding LVDD in children with obesity and hypertension.

Methods: Cross-sectional analyses of 74 children with obesity and elevated BP contributing 118 visits over a 4-year period of follow up. Diastolic filling was calculated using the ratio of trans-mitral early (E) to late (A) peak atrial flow velocity. We determined the prevalence of LVDD_{adult} using the adult definition of $E/A < 1$. Then, defining LVDD_{peds} as having an E/A in the lowest quartile of the pediatric cohort, we examined factors associated with LVDD_{peds} using Wilcoxon rank sum and Chi-square tests. Univariate and multivariable logistic regression analyses were used to evaluate the associations of body-mass-index z-score (BMI_z) and BP with LVDD_{peds} utilizing generalized estimating equations to account for repeated measures.

Results: Study participants ranged in age from 5-21 years; 60% males, 76% African American (AA), 30% with diabetes. The prevalence of LVDD_{adult} ($E/A < 1$) was 2.7%. The median E/A in the cohort was 1.91 (IQR: 1.63, 2.22). Those with LVDD_{peds} ($E/A \leq 1.6$) were older, predominantly male and non-AA, and had higher weight, diastolic BP index and non-HDL cholesterol compared to those without LVDD_{peds} (Table 1). In logistic regression analyses, BMI_z was associated with significantly greater odds of LVDD_{peds} (OR 5.1; 95%CI 1.2, 22.8) adjusted for age, sex, race, and systolic BP z-score (Table 2). Systolic and diastolic BP z-scores were not associated with LVDD_{peds} after adjustment for age, sex, race, and BMI_z.

Conclusion: LVDD_{adult} was present in nearly 3% of participants. Participants with LVDD_{peds} had significantly higher weight and BP index compared to those without LVDD, and BMI_z remained independently associated with LVDD_{peds} in multivariable analyses. Children with obesity and comorbid CVD risk factors may be at greater risk for developing LVDD and ultimately heart failure.

CONCURRENT ORAL PRESENTATION ABSTRACTS

Listed alphabetically by first name of author

Alexa Mullins, MS 2

Mentor(s): Rachel Thornton, MD PhD
Department of Pediatrics

Caregivers' healthy eating value systems under economic constraints: perspectives on utilizing federal nutrition assistance benefits in the interest of their children's health

Authors: Alexa Mullins BA, Ashlyn McRae BA, Rosemary Ansah MD, Sarah Flessa, Sara Johnson MD, Rachel L. J. Thornton MD PhD

Background: Significant attention is dedicated to the ways federal nutrition assistance benefits such as the supplemental nutrition assistance program (SNAP) incentivize healthy eating. However, few policy proposals consider the perspectives of families receiving benefits and how they utilize them to optimize children's health. This study aims to improve understanding of how families receiving SNAP conceptualize healthy eating and its relationship to child wellbeing.

Methods: A secondary, qualitative analysis was conducted using in-depth-in-person interviews with primary caregivers of children ages 4-10 receiving SNAP benefits in Baltimore, MD. Interviews took place July to December 2017. Two independent coders facilitated content analysis of interview transcripts. An iterative process was used to define distinct themes around categories of knowledge and roles of food among study participants. Key themes were identified based on participants' nutrition knowledge and other health-related implications influencing food purchasing.

Results: Participants demonstrated knowledge of nutritious food groups, specific unhealthy nutrients, and the importance of food in managing chronic conditions. However, nutrition was often balanced with a need for ready-made foods that children could safely prepare on their own, shelf stable goods to ensure food availability despite resource fluctuation, and low-cost foods. Several additional themes emerged expanding caregivers' views beyond the nutritional health impacts of food. These themes highlighted the roles of food in child socialization and development including its value in parenting, treating children despite resource scarcity, and supporting family cohesion.

Conclusion: This study suggests families receiving SNAP conceptualize child health benefits of food beyond nutrition. Families use benefits as a resource to provide for children in an environment of scarcity to address nutritional, social, emotional, and developmental needs. Future policy interventions aimed at optimizing SNAP should address this perspective and the potential for benefits to foster positive social, emotional, and developmental outcomes among children in low income families while meeting nutritional needs.

Alexandra Lombardo, MS 2

Mentor(s): Christopher Hoffmann, MD MPH MSc
Department of Medicine, Division of Infectious Diseases

Changing Characteristics of Decedents with HIV over 10 Years in South Africa

Authors: Alexandra R Lombardo BA, Minja Milovanovic MA, Neil Martinson MD MPH, Ebrahim Variava MBBCh, Jonathan Golub PhD MPH, Christopher J Hoffmann MD MPH MSc

Background: Despite a decline with the expansion of ART in sub-Saharan Africa, elevated HIV-associated mortality persists. In South Africa, the majority of deaths occur in health facilities providing an opportunity to compare decedent characteristics over time.

Methods: This is a secondary data analysis of a prospective mortality registry of 15,367 patients who died during the study period (Jan 2008 to May 2019) in the adult medical wards or ICU at Tshepong Hospital in South Africa. Recorded data included demographics, causes of death, HIV status, ART regimen, and TB history.

Results: The annual number of decedents with HIV declined from 2008 to 2018 (847 to 649) while the number of decedents without HIV remained stable (1514 to 1297). Over the study period, the median age at which HIV patients died in the hospital increased from 39.3 to 45.1 years; an increasing proportion of decedents were male (46% to 53%; female 54% to 47%). The proportion of decedents with HIV ever started on ART increased from 21% to 62%. The proportion of overall patients dying from TB and other AIDS-defining illnesses decreased from 27% to 17%. There was an increase from 9% to 14% for malignancy as a cause of death ($p < 0.001$).

Conclusion: This study shows the benefit of a public health approach to universal treatment of HIV-infected individuals with antiretroviral therapy. Our aggregate data demonstrate a longitudinal decrease in HIV mortality, as well as a shift in the characteristics of decedents with HIV and the causes of death. However, the high proportion of deceased patients on ART who die prematurely require further research and evidence-based interventions.

Alyssa Kretz, MS 1

Mentor(s): Megan Collins, MD, MPH
Dana Center for Preventive Ophthalmology

Stakeholders' Perceptions of a School-Based Eye Care Program in Baltimore, MD

Authors: Alyssa M. Kretz BA, Hursuong Vongsachang AB, M. Rani Mukherjee BA, Amanda Inns PhD, Jonathan Callan BS, Madison Wahl BA, David S. Friedman MD PhD MPH, Megan E. Collins MD MPH

Background: School-based vision programs address disparities in health care access by providing students with vision screenings and, if necessary, eye exams and eyeglasses. Parents and teachers are key stakeholders in students' health and academic success. While previous work has explored attitudes toward eye care, eyeglasses usage, and reasons for lack of follow-up care, there is limited work focusing on stakeholders' perceptions of school-based vision programs, including perceived limitations and suggested improvements.

Methods: We conducted 20 focus groups with 105 parents and teachers at schools in Baltimore, MD, that participated in a school-based vision program. Facilitators used a semi-structured interview guide to discuss participants' perceptions of school-based vision programs. Focus groups were audio-recorded, transcribed, and coded using inductive thematic analysis.

Results: Participant perceptions fell into three categories: benefits of school-based eye care, limitations of school-based eye care, and observation of impact. The majority of participants had positive comments about the program; benefits included convenience (location, time, cost, and continuity of care), the quality of the eyeglasses and ability to receive replacements, and a positive screening/exam experience. Limitations included communication and organization, the time to receive the glasses, and the need to miss instructional time. Observations of impact included academic and classroom improvements, visual improvements, and behavioral improvements.

Conclusion: With widespread inequities in vision care access, school-based vision programs play a potentially invaluable role in ensuring students have access to the care they need. Our study showed that parents and teachers reported mostly positive perceptions regarding the school-based vision program. Their appreciation for the convenience indicates that location, cost, time, and continuity of care are crucial aspects for implementing a successful program. However, programs must also implement robust communication campaigns to keep parents and teachers informed about program operations. Collectively, this can help inform the implementation of future successful school-based vision programs.

Amanda Jones, MS 2

Mentor(s): Angie Jelin, MD
Department of Gynecology & Obstetrics

What antenatal fetal surveillance parameters predict fetal demise in Down syndrome?

Authors: Amanda Jones BS, Juliet Bishop MD, Angie Jelin MD

Background: Down syndrome (DS) is associated with high risk for fetal demise (IUFD). Avoidance of preterm delivery of DS fetuses, so commonly affected by anomalies, compounds the difficulty of managing these cases because achieving a term delivery must be balanced against the risk for IUFD with increasing gestational age. Our study was undertaken to investigate continuing DS pregnancies for predictors of IUFD.

Methods: We conducted a retrospective cohort study of all continuing pregnancies with a cytogenetically confirmed DS fetus between 2009 and 2019 at a single institution. Cases were investigated for abnormalities in fetal anatomy, growth, amniotic fluid, and umbilical artery (UA) Doppler assessments to determine their association to perinatal outcome.

Results: A total of 39 DS pregnancies >20 weeks were included. Eight (21%) resulted in IUFD while 31 (79%) resulted in livebirth. Between these groups, there was no significant difference in the incidence of fetal structural anomalies. Four of 31 livebirth cases underwent iatrogenic delivery secondary to worsening fetal surveillance. UA Doppler was assessed in all but two periviable IUFD cases. Abnormal UA Dopplers were noted in 83.3% of IUFD and in 83.9% of liveborn cases, despite growth restriction (IUGR) being present in only 12.5% and 22.6% in each group, respectively. Although there was an increased frequency of abnormal neonatal stress tests (NSTs) in the IUFD group (66.7% vs 23.8%), this difference did not reach statistical significance. Polyhydramnios was more frequent in the IUFD group (62.5% vs 16.1%, $p=0.031$).

Conclusion: A majority of fetuses with DS demonstrated abnormal UA Dopplers in the absence of IUGR. Although abnormal UA Dopplers and NST did not appear to be predictive of IUFD, they may prompt increased fetal surveillance or delivery resulting in livebirth; both are worthy of further investigation. Given its greater frequency in DS IUFDs, polyhydramnios should trigger closer fetal surveillance in continuing DS pregnancies.

Andrew Lea, MS 2

Mentor(s): Jeremy Greene, MD, PhD
Institute of the History of Medicine

MYCIN Explains Itself: Computing, Authority, and Trust in American Medicine

Authors: Andrew Lea

Background: In the early 1970s, the young MD-PhD student Edward Shortliffe started work on his dissertation within Stanford University's Department of Computer Science. His PhD thesis, completed in 1975, involved the development of a computer program called MYCIN, an early expert system that aimed to furnish advice concerning the diagnosis and treatment of bacterial infections. MYCIN immediately attracted wide attention: it matured into a larger research enterprise at Stanford and spawned conversations about whether and how to apply computers to the problem of medical diagnosis. This paper recounts this early effort to computerize medical diagnosis and decision-making, paying particularly close attention to the interrelations among computing, authority, and trust.

Methods: This paper relies upon archival collections pertaining to the development of MYCIN as well as the published medical and computer science literature.

Results: This paper demonstrates that questions about trust and transparency animated the development of, and responses to, the MYCIN project. As MYCIN's potential users expressed concerns about a computer system's opacity, accuracy, and trustworthiness, the developers of MYCIN pursued a number of strategies to make the system's reasoning comprehensible to human physicians.

Conclusion: The MYCIN team largely pursued technological solutions to the problems of trust and transparency, creating novel technologies, programs, and interfaces that purportedly allowed MYCIN to explain itself. These technological fixes, however, fell short: they did little to resolve the profound moral and professional uncertainties of ceding important medical decisions to a machine, nor did they address broader legal and regulatory questions around blame, responsibility, and oversight. Repeatedly the MYCIN project ran up against epistemological challenges inherent to the work of medical decision-making—the uncertainties of medical knowledge and the complexities of medical decision-making. As artificial intelligence and machine learning are increasingly integrated into modern clinical care, the problems, concerns, and limitations encountered during MYCIN's time endure today.

Angela Liang, MS 2

Mentor(s): Ana Kiess, MD PhD

Department of Radiation Oncology and Molecular Radiation Sciences

Reducing fields of radiation to decrease treatment toxicity in differentiated thyroid cancers

Authors: Angela Liang BA, Ana Kiess MD PhD

Background: In treating differentiated thyroid cancer with external-beam radiation therapy (EBRT), it is currently standard for radiation to target all cervical nodal levels bilaterally, regardless of the extent of the tumor. This study seeks to assess whether reduced fields of radiation can decrease toxicities while maintaining disease control.

Methods: Patients treated with EBRT for malignant neoplasms of the thyroid gland between 2009 and 2019 at a single academic medical center were identified by ICD-9 and ICD-10 codes. Treatment plans were reviewed for planning treatment volumes (PTVs), mean doses to PTVs, and mean doses to normal tissues. Toxicities and locoregional control were obtained from a prospective database.

Results: The cohort of 48 patients had a median follow-up of 16 months (range: 0-118). Out of the 47 patients for whom treatment plans were available, 16 received full bilateral neck radiation, 18 partial bilateral neck radiation, 5 full unilateral neck radiation, and 8 partial unilateral neck radiation. Based on the 43 patients who received definitive or post-operative radiation (>5000 cGy), lower PTV volumes were associated with lower radiation doses to normal tissues, especially to the parotid and submandibular glands, and the oral cavity. Based on late toxicities, Grade 2 xerostomia was more common in patients with full bilateral neck radiation, affecting 17% of patients compared to 10% of patients with unilateral neck radiation. Only one patient needed a PEG or NG tube. Moreover, only one of 48 patients developed locoregional recurrence, and the recurrence occurred outside the field of treatment.

Conclusion: This study provides preliminary evidence that full bilateral neck radiation may not be necessary for all differentiated thyroid cancers. Reduced fields of radiation indeed may be associated with fewer toxicities while maintaining locoregional disease control. These findings may help inform future guidelines so as to improve the quality of life for patients after radiation.

Anna Christina Clements, MS 2

Mentor(s): Marisa Ryan, MD, MPH

Department of Otolaryngology - Head and Neck Surgery

Preoperative Testing and Outcomes in Pediatric Adenotonsillectomy for Very Severe Obstructive Sleep Apnea

Authors: Anna Christina Clements BS, Xi Dai BA, Jonathan M. Walsh MD, Marisa A. Ryan MD MPH

Background: First-line treatment for obstructive sleep apnea (OSA) in children is often adenotonsillectomy (T&A). There is concern that children with very severe OSA are at increased risk of cardiopulmonary abnormalities and postoperative complications. The objective was to assess if a degree of OSA severity justifies more preoperative testing or closer postoperative monitoring.

Methods: All pediatric patients who underwent T&A at a tertiary children's hospital from June 1, 2016 to June 1, 2018 were included if preoperative polysomnogram showed Apnea-Hypopnea Index (AHI) > 10 . Demographics, polysomnogram results, comorbidities, preoperative evaluations, and postoperative outcomes were collected. Chi-square and logistic regression were used to evaluate associations between OSA severity, preoperative tests, and outcomes for severe (AHI 10-49) vs. very severe OSA (AHI ≥ 50).

Results: 360 children (52% males) were included, with mean age of 5.8 years. Mean preoperative AHI and O₂ saturation nadir were 30.3 (± 23.7) and 80.7% (± 9.1). Patients with AHI ≥ 50 were more likely to have preoperative echocardiogram ($P=0.02$) or chest X-ray ($P=0.04$). Incidences of abnormalities on these tests were each 46%. There was no association between echocardiogram or X-ray abnormalities and OSA severity, as measured by preoperative AHI, O₂ nadir, and hypercarbia. Having known cardiopulmonary comorbidities was associated with abnormalities on echocardiogram (OR=31.7, 95% CI 3.6-278.5). AHI ≥ 50 was associated with increased postoperative complications (OR=2.2, 95% CI 1.03-4.6) and inpatient CPAP requirement (OR=5.7, 95% CI 1.9-17.2) after adjustment for age, sex, BMI, cardiopulmonary comorbidities, congenital syndromes, and craniofacial abnormalities.

Conclusion: Although children with very severe OSA underwent more echocardiograms and chest X-rays before T&A, lack of abnormal findings suggests these tests may be unnecessary. Known cardiopulmonary comorbidities may be a better indication for preoperative testing. However, patients with very severe OSA (AHI ≥ 50) warrant additional postoperative monitoring and care due to an increased risk of complications.

Aria Shi, MS 2

Mentor(s): Sujatha Kannan, MD

Department of Anesthesiology & Critical Care Medicine

Microglial Activation and Functional Changes in a Rabbit Model of Cerebral Palsy

Authors: Aria Shi BS, Elizabeth Smith Khoury PhD, Kevin Liaw BS, Anjali Sharma PhD, Rangaramanujam M. Kannan PhD, and Sujatha Kannan MD

Abstract: Cerebral palsy (CP) is a pediatric neurodevelopmental disorder that manifests in a range of motor and cognitive symptoms with no effective cure. The microglial response to neuroinflammation during fetal and infant brain development is a major contributor to CP pathogenesis; in fact, inducing microglial activation by in utero exposure to lipopolysaccharide in rabbits results in a robust animal model of CP. We have previously demonstrated that microglia of CP rabbits undergo change to a pro-inflammatory phenotype, that these activated microglia uptake dendrimer nanoparticles while healthy microglia do not, and that delivery of anti-inflammatory drugs to activated microglia can reverse motor deficits in a rabbit model of CP. However, the functional changes in microglia associated with this activated phenotype and related mechanisms of dendrimer uptake is not well characterized. Here, we established a method for isolating microglia from the neonatal rabbit brain and consequently assessed the difference in (1) phagocytic activity and (2) dendrimer uptake of microglia from CP and healthy rabbits. Flow cytometry studies showed that surface marker CD11b is reliably expressed and could be used to isolate microglia in rabbit brain tissue. Phagocytic activity was studied by exposing isolated microglia to fluorescent E. coli-coated beads, and uptake was quantified by flow cytometry. Phagocytic activity was found to be significantly higher in CP animals compared to healthy controls. To assess differences in dendrimer uptake, dendrimer conjugated with fluorescent dye (D-Cy5) was dosed intravenously and microglia were collected 24 hours later. D-Cy5 was found to localize in a subset of microglia but not in CD11b⁻ cells. Ongoing studies are focused on further characterization of this subpopulation of microglia. A better understanding of inflammatory microglial function will inform design of specific microglia-targeted therapies for treatment of neuroinflammatory disorders such as cerebral palsy.

Carolyn Reuland, MS 2

Mentor(s): Nicole Shilkofski, MD
Pediatric Critical Care

Barriers and Facilitators to the Implementation of a Pediatric Early Warning Score (PEWS) in a Limited-Resource Setting

Authors: Carolyn Reuland BS, Galen Shi BS, Paula Pilar G. Evangelista MD, Mark Deatras MD, Mellinor A. Ang MD, Lucila A. Perez MD, Nicole Shilkofski MD

Background: Pediatric intensive care units (PICUs) can be overburdened with high patient volumes and limited capacity. Globally, hospitals have implemented Pediatric Early Warning Score (PEWS) systems, which standardize escalation of care decision-making, to improve detection of clinical deterioration of pediatric inpatients and prevent unnecessary PICU transfers. PEWS systems are more accurate and effective when constructed to fit a hospital's specific context, particularly if the hospital operates under limited resources. We performed a qualitative assessment in order to adapt a PEWS system to a low-resource hospital- specific context at Philippine Children's Medical Center (PCMC) in Quezon City, Philippines, a tertiary care center with a highly overburdened PICU.

Methods: The study employed qualitative methodology within the normative process theory framework: the inclusion of future participants in PEWS system implementation should aid in successful adaptation of the program. Semi-structured interviews about current processes for clinical monitoring and PICU transfer, as well as attitudes towards implementation of a PEWS system were conducted and audio-recorded with nurses, residents, fellows, and consultant physicians at PCMC until thematic saturation was reached. Four weeks of in-person hospital observations served to triangulate interview findings. Data analysis consisted of thematic and axial coding of interview transcripts.

Results: Major themes included: multidisciplinary support of PEWS implementation, the facilitators of well-trained clinical staff, and the barriers of limited equipment and hospital capacity for patients determined to require PICU admission. Observations by study personnel confirmed validity of these themes as considerations in any proposed implementation framework.

Conclusion: The barriers and facilitators to PEWS implementation identified during interviews can guide the construction of a framework for PEWS implementation at PCMC and in other similarly under-resourced hospitals. The systems engineering initiative in patient safety (SEIPS) model serves a guide for the development of this framework.

Daisy Dai, MS 2

Mentor(s): Jonathan Walsh, MD
Department of Otolaryngology - Head and Neck Surgery

The Effect of Language Barriers at Discharge on Pediatric Adenotonsillectomy Outcomes and Healthcare Contact

Authors: Xi Dai, BA, Anna Christina Clements, BS, Marisa A. Ryan, MD, MPH, Emily F. Boss, MD, MPH, Jonathan M. Walsh, MD

Background: Effective delivery of discharge instructions plays a critical role in outcomes after pediatric surgery. Previous studies in the pediatric ED suggest patients with limited English proficiency have less comprehension of discharge instructions despite use of interpretation services. This study examined the effect of parental language during discharge on outcomes and modes of healthcare contact following pediatric otolaryngology procedures.

Methods: A retrospective cohort study was conducted on pediatric patients who underwent tonsillectomy or adenotonsillectomy at a single tertiary care pediatric hospital from July 1, 2016 to June 1, 2018. Patients were stratified into English and non-English groups based on primary language. Data was collected on consecutive non-English patients and systematic sampling of English patients. Chi-square and logistic regressions were performed to assess the association between primary language and incidence of healthcare contact regarding post-operative care and complications.

Results: 136 patients were included: 85 English and 51 non-English patients. The groups were comparable in demographics and complication rates, except more non-English patients had public insurance ($p < 0.001$). Number of encounters and types of complications following discharge were not significantly different, but non-English patients were significantly more likely to utilize the ED compared to phone calls (OR=8.6, 95% CI 1.8-40.7), even after adjustment for insurance type (OR=8.3, 95% CI 1.3-51.7).

Conclusion: Discordance of discharge instructions and language barriers following pediatric otolaryngology procedures results in a significant difference between how English and non-English speaking patients utilized medical care. These barriers, despite use of interpretation services, suggest that interventions to improve comprehension and access may have large implications on healthcare costs and utilization.

Dana Huh, MS 2

Mentor(s): Noori Kim, MD
Department of Dermatology

Association of Clinical and Demographic Factors With Phototherapy Outcomes in Patients with Atopic Dermatitis

Authors: Dana Huh BA, Youkyung Sophie Roh BA, Noori Kim MD

Background: For many patients with Atopic Dermatitis (AD), first-line interventions fail to alleviate symptoms. UVA, PUVA, and UVB phototherapy has been utilized as a safe, well-tolerated, and cost-effective therapeutic option for a variety of inflammatory skin conditions including AD. We conducted a retrospective cohort study to examine the efficacy of phototherapy in the management of AD and to identify patient characteristics associated with treatment compliance and outcomes.

Methods: 145 AD patients treated at the Johns Hopkins Phototherapy Unit from 2009-2017 were isolated from EPIC using ICD diagnosis codes and phototherapy CPT codes. We conducted a chart review to characterize the demographics, comorbidities, concomitant medications, number of treatments, and UV irradiation dosing, as well as the post-treatment outcomes. All analyses were conducted with STATA (College Station, TX: StataCorp LLC).

Results: 43% of the cohort was male, median [IQR] age 41 [26-56], median [IQR] BMI 25.98 [22.87-31.32], 36% White, 51% Black, 0.7% Indian or Alaska Native, and 12% Asian or Pacific Islander. 53% reside within Baltimore and 70% are enrolled in private insurance. 60% were compliant to the full course of treatment, 72% experienced improvement of symptoms, and 13% experienced side effects. Patient compliance significantly correlated with improvement of symptoms ($p < .0001$). Insurance status, dosage of therapy, and side effects also influenced whether a patient benefited from phototherapy. Cited reasons for noncompliance included time commitment, inconvenience, and cost of treatment.

Conclusion: Insurance status, dosage of therapy, side effects, and compliance to treatment are significant contributors to the efficacy of phototherapy. As the ability of a patient to complete 20+ phototherapy sessions is critical to the success of phototherapy, patient-clinician conversations regarding compliance may be helpful prior to prescribing treatment. Providers and payors need continued education to ensure that socioeconomic factors or insurance coverage are not barriers for patients to access phototherapy.

Darya Fadavi, MS 2

Mentor(s): Oluseyi Aliu, MD
Department of Plastic and Reconstructive Surgery

Do Capitated Hospital Budgets Influence Rates of Select Procedures?

Authors: Darya Fadavi BS, Oluseyi Aliu MD MS

Background: In January 2014, the state of Maryland instituted the Global Budget Revenue (GBR) hospital funding policy. This one-in-the-nation hospital funding policy caps hospital spending for all hospitals in Maryland. Historically, there have been concerns from previous experiences with global budgets in other advanced western economies that cost savings might be realized at the expense of providing services. In this study, we sought to examine the effect of Maryland's GBR on the rates of surgery for Hidradenitis Suppurativa, a progressive, functionally debilitating inflammatory disease of apocrine sweat glands that disproportionately affects minority populations, who may have variable access to care.

Methods: We used data from the Maryland State Ambulatory Surgery Database from 2009 – 2016 to examine rates of surgical treatment for Hidradenitis. Using adjusted Segmented Regression Analysis with a Time Series model, we estimated the influence of the GBR policy on the change in rates of surgical treatment for Hidradenitis over the study period. Variables of interest included gender, number of chronic conditions, and insurance status.

Results: The mean age was 37.2 years (SD 0.11), 61.7% of the patients were black, 96.8% of patients were female, and 79.4% had greater than 1 chronic condition. Female patients had higher odds of surgical treatment (OR 1.31 (95% CI:1.17, 1.47)) as did patients with greater than 1 chronic condition (OR 2.26 (95% CI:1.86 – 2.76)). The analytical model showed a 0.7% per quarter decline in surgical Hidradenitis Suppurativa treatment after GBR implementation (-0.7(-0.011, -0.003)).

Conclusion: Patients in Maryland had a decreased likelihood of receiving a surgical Hidradenitis procedure for each subsequent quarter after implementation of capitated hospital spending. These findings raise questions about the impact of contractionary hospital spending policy on provision of services to vulnerable populations, which can ultimately lead to differences in health outcomes.

Derek Teng, MS 2

Mentor(s): Fasika Woreta, MD
Wilmer Eye Institute

Prevalence and Cost of Unnecessary Preoperative Testing in Patients Presenting for Emergent Open Globe Surgical Repair

Authors: Derek Teng BA, Sidra Zafar MBBS, Tina Tran MD, Ank Agarwal, Aman Patel, Andrew Cho, Divya Srikumaran MD, Fasika A. Woreta MD MPH

Background: Pre-operative testing in patients without indication or history of comorbidities has proven to be inconsequential to surgical outcome and significant towards the burden of rising healthcare costs.

Methods: Retrospective chart review was conducted on patients who underwent emergent open globe repair at the Wilmer Eye Institute between July 2016 and June 2019. 204 patients were identified through electronic health record meta-categorization of surgeries performed at 2 Johns Hopkins Hospital sites. Charts were analyzed for patient demographics, character of injury, co-morbidities and medications, preoperative tests ordered, and order cost. Patients were stratified by ASA score (1= healthy patient, 2-4 = mild to severe systemic disease).

Results: Type and screen was ordered for 165 (80%) of all patients, despite absence of transfusion during open globe repair procedures. 59 (29%) presented as healthy ASA class 1 patients, all of who were contraindicated for pre-operative medical testing. The prevalence of tests within this cohort was: hemostatic screening test (PT/INR) (47, 80%), complete blood count (CBC) (50, 85%), complete metabolic panel (CMP) (46, 78%), 12-lead Electrocardiogram (EKG) (21, 36%). 145 (71%) presented as ASA class 2-4. 107 (85%) of all PT/INR tests ordered were without history or indication of anticoagulant medication use, bleeding disorder, or liver disease. 113 (84%) of all CBCs ordered were without history or indication of anemia, bleeding, hematologic, liver, or renal disease. 95 (77%) of all CMPs ordered were without history or indication of liver, renal, or diabetic disease. 69 (71%) of all 12-lead EKGs ordered were without history or indication of any cardiovascular disease, excluding asymptomatic hypertension. The estimated aggregate cost of non-indicated testing for the cohort was \$13,802.

Conclusion: A high prevalence of unnecessary testing exists in the ED for patients requiring emergent ophthalmic surgery. Educational and administrative interventions aimed at reducing such tests may help decrease healthcare costs and improve healthcare resource utilization.

Erica Lee, MS 2

Mentor(s): Kristen Broderick, MD
Department of Plastic & Reconstructive Surgery

Body Image and Race in Online Resources for Breast Reconstruction: What Do Patients See?

Authors: Erica Lee MS, Pooja Yesantharao MS, Chao Long MD, Carissa Cooney, MPH
Justin Sacks MD MBA, Kristen Broderick MD

Background: Body image distress (BID) is common in women with breast cancer who undergo mastectomy and can persist years after breast reconstruction (BR). However, there is a paucity of literature evaluating the role online patient resources play in mitigating BID. Thus, this study assessed 1) body image discussion in current United States online BR resources, and 2) racial demographics of the images in these resources.

Methods: The top 10 Google websites identified for key phrases “breast reconstruction” and “breast reconstruction [and] body image,” were assessed for presence of body image discussion and images. The first 200 Google Images for each phrase were included for analysis. Images were categorized as: “Before/After Reconstruction,” “Surgical/Anatomical Diagram,” “Step-by-Step,” or “Complications.” Patients in images were classified by skin tone into “White” or “Non-White” using the Fitzpatrick scale and by body habitus.

Results: Sixty-percent of the 20 websites analyzed contained discussion of body image, only three of which appeared in the “breast reconstruction” search ($p < 0.05$). Fifty-percent included images: predominantly “Before/After” photographs (67.1%), followed by “Surgical/Anatomical” (26.1%) and “Step-by-Step” (6.8%) illustrations. Of the total 561 images analyzed, the majority were of “White” skin tones (94.9%) and slender body type (85.6%). “Before/After” photographs were more likely to show overweight/obese women and “Non-White” skin tones than “Surgical/Anatomical” and “Step-by-Step” illustrations ($p < 0.0001$).

Conclusion: Our findings demonstrate that BR online resources lack information on body image. Patients who do not include “body image” within their online search may not be aware of resources to alleviate BID. Additionally, visual aids largely depict slender Caucasian subjects and do not reflect the population of BR patients nor the population of the United States. By better representing the populations we serve, online patient resources addressing body image concerns can provide more comprehensive information to patients and better frame their expectations regarding the reconstructive process, helping mitigate body image distress.

Giorgio Caturegli, MS 2

Mentor(s): Sung-Min Cho, DO
Department of Neurology

Acute Brain Injury in Infant ECMO: An Autopsy Study

Authors: Giorgio Caturegli BS, Sung-Min Cho DO, Bartholomew White MD, Liam L. Chen MD PhD

Background: Despite increases in prevalence and advances in management in recent decades, infant ECMO still carries significant morbidity and mortality risks, of which the most severe is intracranial injury. The aims of this study were to describe prevalence and classification of ABI in a group of neonatal and infant ECMO patients by using clinical and neuropathologic evaluation. Of specific interest was the timing of injury, particularly whether ABI occurred before or during ECMO support.

Methods: This retrospective cohort study was conducted at a single tertiary pediatric center with a target population of infants less than 1 year in age who were supported on ECMO and elected autopsy. Clinical and pathological records were reviewed for infant ECMO patients who had undergone brain autopsy in a single center between January 2009 and December 2018.

Results: Twenty-four infants supported on venoarterial ECMO had postmortem examination with brain autopsy. Median age at ECMO initiation was 82 days (IQR, 11-263); median age at time of death was 20 weeks (IQR, 5-44); median ECMO support duration was 108 hours (IQR, 35-366). The most common ABI documented on autopsy was hypoxic-ischemic brain injury (HIBI; 44%) followed by intracranial hemorrhage (29%). The most common types of intracranial hemorrhage were intracerebral (17%), subarachnoid (17%), and subdural (8%). Only 5 (21%) infants with autopsy did not have ABI. Correlates of ABI included low pre-ECMO oxygen saturation as well as elevated liver enzymes, bilirubin, and lactate on days 1 and 3 of ECMO. Gestational age, Apgar scores, birth weight, ECMO duration, cannulation site, anticoagulation therapy, renal and hepatic impairment were not associated with ABI.

Conclusion: ABI was observed in 79% of autopsies conducted in infants supported on ECMO. HIBI was the most common type of injury, suggesting that approximately half of patients sustained ABI around cannulation.

Harsha Malapati, MS 2

Mentor(s): Sami Tuffaha, MD
Department of Plastic & Reconstructive Surgery

Engineered IGF-1 Nanoparticles Delivered In Nanofiber Hydrogel Carrier To Improve Functional Recovery After Peripheral Nerve Injury

Authors: Harsha Malapati, BS; Karim A Sarhane, MD, MSc; Chenhu Qiu, BS; Benjamin S Slavin, BS; Zhicheng Yao, BS; Hai-Quan Mao, PhD; Sami Tuffaha, MD

Background: Poor outcomes following peripheral nerve injury result primarily from a prolonged period of latency prior to reinnervation of distal targets. With time, denervation causes progressive, irreversible muscle atrophy and Schwann cell (SC) senescence that limits functional recovery. Locally delivered insulin-like growth factor 1 (IGF-1) can potentiate axonal regeneration and ameliorate the effects of chronic denervation on muscle and SCs; however, due to the short half-life of IGF-1 in vivo, a robust delivery strategy is needed that can provide sustained therapeutic levels in muscle and nerve. Previously, we successfully engineered a biodegradable nanoparticle delivery system that provided stable release of biologically active IGF-1 over 21 days. Here, we developed a tunable PCL nanofiber-HA hydrogel composite (NHC) carrier to further extend the duration of IGF-1 release, in vitro, and maintain the nanoparticles within target tissues, in vivo.

Methods: We first measured the in vitro release kinetics of IGF-1 from nanoparticles within NHC vs. fibrin gel carriers. In rats, IGF-1 nanoparticles in either NHC or fibrin gel carriers were injected into and around nerve and muscle to compare in vivo nanoparticle stability and IGF-1 tissue concentrations over time. We also evaluated NHC bio-integration and immunomodulation in vivo.

Results: The NHC carrier provided in vitro release of biologically active IGF-1 for greater than 42 days vs. 21 days with the fibrin carrier. Local IGF-1 concentrations in muscle and nerve tissue were 10-fold higher than serum concentrations for the duration of release. The NHC elicited minimal foreign body response in comparison to fibrin gel, with polarization of macrophages from a pro-inflammatory to a pro-regenerative phenotype.

Conclusion: These results suggest that the NHC is an ideal carrier for IGF-1 nanoparticles that potentiates the release kinetics in vitro and facilitates sustained release in vivo by preventing nanoparticle degradation and diffusion for the duration of release.

Hursuong Vongsachang, MS 3

Mentor(s): Megan Collins, MD, MPH

Wilmer Eye Institute, Dana Center for Preventive Ophthalmology

Students Who Failed School-based Vision Screening: How Significant is Their Refractive Error?

Authors: Hursuong Vongsachang BA, Xinxing Guo MD PhD, Angeline M. Nguyen MD, Alyssa M. Kretz BA, Moneesha R. Mukherjee BA, Amanda J. Inns PhD, David S. Friedman MD PhD MPH, Michael X. Repka MD MBA, Megan E. Collins MD MPH

Background: Uncorrected refractive error is the leading cause of vision impairment in children. School-based vision programs can detect vision problems in children. We report on the refractive findings in a group of predominantly African-American children in pre-kindergarten through grade 8 that failed school-based vision screening in Baltimore.

Methods: Vision for Baltimore is a school-based vision program that provides vision screenings, eye exams, and if needed, glasses or pediatric ophthalmology referral to pre-Kindergarten to grade 8 students enrolled in Baltimore City public schools. In the 2016-2017 and 2017-2018 school years, 5172 students failed vision screening. These children received eye examinations, which included non-cycloplegic autorefraction, by on-site optometrists. Glasses prescriptions or pediatric ophthalmology referrals were made following the exams.

Results: Of 5172 students who failed vision screening and consented to research, 4606 (89%) received a school-based eye exam and were included in analysis. Of students who failed vision screening, 90.7% had refractive error, with 35.9% having clinically significant refractive error. Mild myopia (51%, -0.50D to <-3.00 D SE) and mild astigmatism (54%, 1.00 D to <3.00 D cylindrical power) were the most prevalent types of refractive error identified. Severity of myopia increased with increasing grade, ranging from -0.15+/-1.73D in pre-Kindergarten and Kindergarten to -1.24+/-2.13D in grades 7-8. Older children were more likely to be myopic (Ptrend<0.001) and proportions of students with myopia increased with grade, with proportions of high myopia increasing most significantly with grade (Ptrend<0.001). Asian, Black, and Hispanic students were more likely to have myopia than their White or non-Hispanic counterparts.

Conclusion: In this urban population, 35.9% of children who failed vision screening in a large school-based vision program exhibited clinically significant refractive error. Racial/ethnic disparities in refractive error were also observed. School-based eye care may address uncorrected refractive error and disparities in refractive error outcomes in this setting.

Jack Campbell, MS 2

Mentor(s): D. Srikumaran, MD
Wilmer Eye Institute

Improving accuracy of intraocular lens formulas in eyes undergoing combined cataract extraction and DMEK

Authors: Jack Campbell BA, Kendrick Wang BA, John Ladas MD, Fasika A. Woreta MD, Divya Srikumaran MD

Background: A hyperopic error has been reported following Descemet's membrane endothelial keratoplasty (DMEK) combined with cataract surgery for eyes with Fuchs endothelial corneal dystrophy (FECD). This study compares the accuracy of existing intraocular lens formula and proposes a modification in corneal power calculation to reduce refractive error.

Methods: This is a retrospective chart review of eyes with FECD that underwent uncomplicated combined DMEK and cataract surgery at Johns Hopkins Hospital. Mean absolute error (MAE) was calculated using optical biometry for the Hoffer, Holladay I, SRK/T, Barrett II, and Haigis formulas. MAE calculations were repeated for each formula with a modified corneal power that accounts for the cornea as a thick lens system with two refracting surfaces. Modified corneal power was calculated using anterior and posterior corneal radii and corneal thickness from Pentacam imaging. Wilcoxon signed-rank tests were used to compare MAE differences between each formula using optical biometry and modified corneal power.

Results: In 86 eyes, the mean error ranged from 0.90 D for the Barrett II formula to -0.10 D for the Haigis formula, with 4 out of 5 formulas resulting in a mean hyperopic error. As compared to the optical biometry corneal power, the modified corneal power resulted in a significantly lower MAE for the Hoffer formula (from 1.02 to 0.82 D; $p < 0.005$), Holladay I formula (from 0.97 to 0.85 D; $p < 0.005$), SRK/T formula (from 0.93 to 0.85 D; $p < 0.01$), and Barrett II formula (from 1.16 to 0.90 D; $p < 0.005$). There was no significant difference between the modified corneal power or optical biometry corneal power using the Haigis formula to calculate MAE.

Conclusion: The modification in corneal power showed significant refractive accuracy improvements in 4 out of 5 IOL formulas when substituted for optical biometer measured corneal power in eyes undergoing DMEK combined with cataract extraction.

Jack Gatti, MS 2

Mentor(s): Lisa Sun, MD
Department of Pediatric Neurology

Childhood Arterial Ischemic Stroke and Vasculopathy Subtypes: Etiologies, Natural History, and Outcomes

Authors: Jack Gatti BS, Lisa Sun MD

Background: Head and neck vasculopathies are the most frequent cause of childhood arterial ischemic stroke (AIS), and abnormal vascular imaging is associated with higher risk of stroke recurrence. Our objective was to report how vasculopathy subtype impacts risk of initial and recurrent stroke and neurocognitive outcomes following a stroke.

Methods: We conducted a single-center retrospective cohort study using ICD-9 and ICD-10 codes to identify children treated for a head or neck vasculopathy at our tertiary care center between 2003 and 2019. We included patients with imaging-confirmed head or neck vasculopathy diagnosed between the ages of 28 days and 18 years. Data collection included vasculopathy subtype, occurrence/recurrence of stroke and transient ischemic attack (TIA), and pediatric stroke outcome measure (PSOM) to measure of stroke recovery. Fisher's exact test was used to compare proportions with stroke recurrence by vasculopathy subtype.

Results: Of the 93 patients who met inclusion criteria, 55 experienced a stroke. Stroke recurrence rates differed significantly by vasculopathy subtype. Patients with primary moyamoya disease (MMD), sickle cell disease, and neurofibromatosis (NF)-related vasculopathy demonstrated significantly higher five-year stroke recurrence rates (14%, 50%, and 100%, respectively) than patients with arterial dissection (0%) or vasculopathy of unknown etiology (0%) ($p=0.030$). There was a non-significant increased rate of stroke recurrence among patients with secondary versus primary MMD ($p=0.06$). Stroke patients with MMD (1.43, $n=35$) had worse average PSOM scores at final follow-up than those with other vasculopathy etiologies (1.17, $n=18$) at a median of follow-up time of 1708 and 827.5 days, respectively, following initial stroke.

Conclusion: Children with MMD have a higher risk of stroke recurrence than children with other vasculopathy subtypes. Further studies are needed to evaluate the association of vasculopathy subtype and other factors on stroke recurrence risk so that appropriate treatment strategies can be implemented early in these high-risk patients.

Jaclyn Nguyen, MS 2

Mentor(s): Paul Nestadt, MD
Department of Psychiatry

Suicide Among Maryland Decedents with Parkinson's Disease

Authors: Jaclyn Nguyen BS/BA, Melissa Shepard MD, Kate Perepezko MSPH, Gregory Pontone MD, Paul Nestadt MD

Background: Persons with Parkinson's disease (PwP) exhibit many risk factors for suicide, with depression being one of the most prevalent. Despite extensive research in the general population, current literature on characteristics of suicide in PwP is limited and often conflicting. Objective: To better understand the epidemiology and circumstances of suicide in PwP compared to the general population.

Methods: Death investigation data including demographics and physician's autopsy narrative was obtained from the Office of the Chief Medical Examiner of Maryland for all 8651 completed Maryland suicides from 2003 through 2018. Parkinson's disease status was determined by medical examiner narrative and decedent prescription records. Chi2 testing was used to compare PwP suicides to general suicides. Logistic regression was run to generate odds ratios.

Results: Between 2003 and 2018, there were 39 suicides among PwP and 8,612 suicides among the general population. PwP decedents were significantly older and more often Caucasian, with an increased proportion of males which did not reach significance. PwP suicides were less likely to involve alcohol ($\chi^2(1) = 8.51, p < 0.01$), but there were no differences in the presence of opioids, benzodiazepines, antidepressants, or neuroleptics on toxicology. PwP were twice as likely to use a firearm for suicide ($OR = 2.15, p = 0.02$). While this higher gun use remained significant after adjustment for sex ($OR = 2.02, p = 0.04$), it was not significant after adjusting for age and race.

Conclusion: PwP demonstrate a disproportionate use of firearms for suicide compared to the general population, even adjusting for sex. This may be explained by demographic differences such as their increased age. Alcohol is also less likely to be associated with suicides in PwP. Physicians treating PwP at risk of suicide should be vigilant about their access to firearms, encouraging safe storage or removal in times of crisis.

James Whitbread, MS 2

Mentor(s): Ahmet Kilic, MD
Cardiac Surgery Division

VAD Status and Age Impacts Rate of Heart Transplantation for Waitlist Candidates

Authors: James Whitbread BS, Eric Etchill MD, Katherine Giuliano MD, Jennifer Lawton MD, Ahmet Kilic MD

Background: Ventricular assist devices (VADs) have been commonly employed as a bridge to transplantation (BTT) for heart failure, contributing to changes in the United Network for Organ Sharing (UNOS) Allocation Criteria. However, the full effects on post-implantation transplant eligibility and eventual transplantation are not well understood. We sought to compare the rates of transplantation stratified by the presence of a VAD and age.

Methods: Using the UNOS Database, we investigated the impact of age and VAD status on heart allocation rates among all transplant eligible patients from January 2005 to September 2018. Patients were divided based on the presence (+) or absence (-) of a VAD, and subdivided by age (<45, 45-65, and >65). Demographics were compared with a Fine-Gray multivariate competing risk analysis that yielded risk-adjusted sub-distribution hazards ratios (SHR).

Results: Among the 50,674 total waitlist candidates, the 18,874 (+)VAD patients had poorer health markers than (-)VAD patients, including higher rates diabetes, cerebrovascular disease, extracorporeal membrane oxygenation and intra-aortic balloon pump at entry, and higher mean BMI. Multivariate analysis between the 6 groups, with <45 (-)VAD as baseline reference, found statistically significant lower rates of transplantation for all (+)VAD groups compared to their age-matched (-)VAD counterparts. Post-hoc testing showed the 45-65 (+)VAD Group had the lowest rate of transplantation of any group (SHR = 0.62, $p < 0.0005$). Being in a (-)VAD group was protective, with transplantation rates increasing with age: 45-65 (-)VAD (SHR = 1.27, $p < 0.0005$) and >65 (-)VAD (SHR = 1.48, $p < 0.0005$).

Conclusion: There are statistically significant reduced rates of transplantation for (+)VAD patients, with the maximum reduced rate among the (+)VAD 45-65 cohort. The increasing prevalence of this demographic and the new de-prioritization of VADs in the post-October 2018 UNOS criteria have the potential to exacerbate this already present inequity.

Jennifer Franke, MS 2

Mentor(s): Michael Lim, MD
Department of Neurosurgery

Glycerol Rhizotomy for Tumor Associated Trigeminal Neuralgia: A Case Series

Authors: Jennifer Franke BS, Christina Jackson MD, Michael Lim MD

Background: Gross total resection (GTR) of the adjacent tumor is often the most effective option for pain control in tumor-associated trigeminal neuralgia (TATN). However, these tumors are often located near critical neuro-vascular structures or in difficult-to-access locations, and GTR may not always be feasible. One alternative is glycerol rhizotomy (GR). In the largest series to our knowledge, we evaluate the efficacy of GR in managing TATN.

Methods: We conducted a retrospective review of all patients who underwent GR for TATN at Johns Hopkins Hospital in 2008-2019. We evaluated baseline clinical and radiographic characteristics and clinical outcomes including pain improvement, pain recurrence, and complications. Neuralgic pain was measured based on the Barrow Neurological Institute (BNI) pain score of I-V and compared pre and postoperatively using paired t-tests.

Results: We identified 23 patients with GR for TATN. Five (21.7%) had previous surgical resection and 10 (43.5%) had prior radiation to the associated tumor. Twenty (87%) patients had an initial BNI score of IV or higher. The mean follow-up time was 21.7 months. Of 20 patients with follow-up, neuralgic pain improvement was achieved in 17 (85%). The mean preoperative BNI score was 4.1 (SD=0.89) and mean postoperative BNI score at best response was 2.55 (SD=1.20), constituting a statistically significant decrease ($p<0.001$). Seven (35%) achieved complete resolution of pain: no facial pain and not taking any pain medications. Pain later recurred in 8 (40%). Seven (35%) experienced new postoperative facial numbness and no patients experienced hemorrhage, infection, CSF leak, hearing deficit, or mortality related to the procedure.

Conclusion: We demonstrate that GR for TATN led to improvement in pain level in the majority of patients without significant complications. Therefore, it can be an effective and safe minimally invasive tool in the management of TATN in patients who may not be amenable to GTR.

Joon Ying Boon, MS 2

Mentor(s): Lydia Pecker, MD
Department of Hematology

Characterizing Drivers of Medical Resource Utilization Among Adolescents and Young Adults with Sickle Cell Disease

Authors: Joon Ying Boon PhD, Rachel O. Alade, Sophie Lanzkron MD, Lydia H. Pecker MD

Background: Sickle cell disease (SCD) is a common, monogenetic, hematologic disease associated with significant pediatric morbidity and early mortality. Adolescents and young adults (AYA) with SCD are known to be high utilizers of urgent and emergent care rather than outpatient care and many patients do not use disease-modifying treatment and require opioids for pain management. In this study, we stratified AYA SCD patients as high/low ED utilizers and characterized modifiable risk factors in SCD associated with high ED utilizations.

Methods: Subjects were identified using JHU's Datamart. Inclusion criteria consisted of a diagnosis of SCD, ages 16-19 in 2006 -2009, and having received care in the JHU healthcare system. Subjects were stratified into high use (mean ≥ 3 /year ED visits) and low use (< 3 visits/year). We collected data on (1) chronic transfusion (CT)/hydroxyurea (HU) therapy (2) opioid use including first opioid exposure and total pills prescribed and (3) outpatients appointments to hematology, primary care, and other specialists.

Results: Thirty high utilizers and 75 low utilizers were identified. Among the high utilizers, 33.33% had a history of CT, 27.59% were currently using CT, 40.74% HU and 33% received no disease-modifying therapy. Most (83%) had a history of i.v. opioid treatment; average age at first opioid exposure was 11.49. The average number of prescribed opioid pills at enrollment was 90 (+/-SD 152)/patient. The average number of appointments for pediatrics hematology=3.32, adult hematology=0.19, PCP=0.61 and specialists=1.25.

Conclusion: In this cohort, two-thirds of the high utilizers patients were on disease-modifying therapy (CT/HU) and average opioids prescribed were 90(+/-SD 152) pills/patient. This population also had a low average number of outpatient appointments. Ongoing data collection will facilitate comparison with low utilizing AYA with SCD. Better disease management with disease-modifying therapy, consistent outpatient appointments, and better pain management may help reduce ED utilizations and SCD morbidity and mortality.

Julie Kim, MS 3

Mentor(s): Jonathan Walsh, MD
Department of Otolaryngology

Frequency of Post-Tonsillectomy Hemorrhage Relative to Time of Day

Authors: Julie Kim, BS, Jonathan Walsh, MD, David E. Tunkel, MD, Emily F. Boss, MD, Andrew H. Lee, MD

Background: Postoperative hemorrhage is a serious complication of tonsillectomy, with secondary bleeding rates affecting up to 0.8%-3% of patients. Although these bleeds are anecdotally perceived as occurring more frequently at night, the occurrence of hemorrhage relative to the time of day has not been investigated. We measured the frequency of post-tonsillectomy hemorrhage onset relative to the time of day.

Methods: We reviewed electronic medical records of all patients who experienced post-procedural hemorrhage (ICD-9 998.11, ICD-10 J95.830 at two hospitals within a tertiary academic health system in a 10-year period). Patient demographics, time of bleed onset, ED arrival time, and management (OR vs. observation) were abstracted. Patients without a recorded bleeding time were excluded. Time of bleed onset was categorized as morning (6:01am-12pm), afternoon (12:01pm-6pm), evening (6:01pm-12am), or overnight (12:01am-6am). Chi-square goodness of fit test was used to assess the distribution of hemorrhage timing ($P \leq 0.05$).

Results: 7396 patients underwent tonsillectomy between 5/2008-5/2018, among whom 121 (2%) post-tonsillectomy hemorrhage patients were identified. Among the 104 patients with ED arrival times, 29 (28%) arrived in the morning, 15 (14%) arrived in the afternoon, 40 (38%) arrived in the evening, and 20 (19%) arrived overnight ($p=0.003$). 60 patients (mean age – 17.1 years, SD 16.6) had a recorded timing of bleed onset. Bleed onset occurred most commonly overnight (24, 40%), followed by evening (21, 35%), afternoon (11, 18%), and morning (4, 7%) ($p=0.0007$).

Conclusion: In this cohort, post-tonsillectomy hemorrhage occurred most frequently between midnight to 6am. Our findings confirm anecdotal experience and provide data in setting caregiver expectations.

Kaushik Parvathaneni, MS 2

Mentor(s): Morgan Grams, MD, PhD
Department of Internal Medicine

Association Between Mid-Life Physical Activity and Incident Kidney Disease: The Atherosclerosis Risk in Communities Study

Authors: Kaushik Parvathaneni, Aditya Surapaneni PhD, Shoshana H. Ballew PhD, Priya Palta PhD, Casey M. Rebholz PhD, Elizabeth Selvin PhD, Josef Coresh MD PhD, Morgan E. Grams MD PhD

Background: Physical activity is associated with lower risk of cardiovascular disease, diabetes, and hypertension, which have shared risk factor profiles with chronic kidney disease (CKD). However, there are conflicting findings regarding the relationship between physical activity and CKD.

Methods: We conducted a prospective cohort study of 14,537 participants aged 45 to 64 years old from the Atherosclerosis Risk in Communities Study. Baseline physical activity status was assessed by the modified Baecke Physical Activity Questionnaire at visit 1 (1987-1989) and categorized according to the 2018 Physical Activity Guidelines for Americans, which factors physical activity intensity, duration, and frequency to group participants as inactive, insufficiently active, active, and highly active. The primary outcome was incident CKD defined as estimated glomerular filtration rate (eGFR) <60 mL/min/1.73 m² at follow up and ≥25% decline in eGFR relative to baseline, CKD-related hospitalization or death, or end stage renal disease.

Results: At baseline, 37.8%, 24.2%, 22.7%, and 15.3% of participants were classified as inactive, insufficiently active, active, and highly active, respectively. During a median follow up of 24 years, 33.2% of participants developed CKD. After adjusting for age, sex, race, study center, education, smoking status, diet quality, diabetes, coronary heart disease, hypertension, antihypertensive medication, body mass index, and baseline eGFR, higher categories of physical activity were associated with lower risk of CKD compared to the inactive group (HR for insufficiently active, 0.95 [95% CI, 0.88-1.02]; active, 0.93 [95% CI, 0.86-1.01]; highly active, 0.89 [95% CI, 0.81-0.97]; P for trend = 0.007).

Conclusion: More than half of participants were physically inactive or insufficiently active at baseline. Participants classified as highly active had a lower risk of developing CKD compared to participants classified as inactive.

Larisa Breden, MS 2

Mentor(s): Bailey Miles, MD
School of Medicine

Farm to Clinic: Does Nutrition Education Impact Diet Modification?

Authors: Larisa Breden, BS; Harisa, Spahic, BS; Joseph, Carrese, MD, MPH, FACP; Gail, Geller, ScD, MHS; Kate, Rediger, CRNP; Laura, Harding-Fukushima, HBS; Bailey, Miles, MD.

Background: Maintaining a healthy diet is a key part of diabetes care. However, modifying one's diet can be difficult, especially for individuals experiencing food insecurity or living in a food desert. Previous efforts to improve diet within Baltimore have focused on providing healthy foods but have not addressed other barriers to diet change. As part of a larger project addressing diet management for diabetes, we developed and evaluated a series of group classes aimed at improving patient motivation and confidence regarding diet change.

Methods: Patients with uncontrolled diabetes (hemoglobin A1C >8%) were recruited from East Baltimore Medical Center (n=23) and randomized 2:1 to the intervention group (n=15) or control group (n=8). The 6-week intervention included nutrition education and cooking classes. Participants were surveyed and interviewed throughout the course and relevant health outcomes data were collected (weight, hemoglobin A1C, etc.). A focus group was conducted after intervention completion.

Results: Motivation for diet change increased among participants who attended the course (4%) and decreased among controls (-23%). Similarly, participant confidence increased in the intervention group (3%) and remained unchanged in the control group. Participants felt both education and motivation were significant drivers for diet change. Additionally, trends in weight showed larger decreases in the intervention group (8.3 kg vs 1kg). Participants reported high satisfaction with the program and found the education as well as the relationships formed within the group to be valuable.

Conclusion: Providing nutrition education and cooking classes might improve diabetes-related outcomes. Trends reflected an increase in motivation and confidence for diet change and a decrease in participant weight, which is likely due to a combination of factors, including education and group support. This study was limited by a small sample size, a single iteration of the course and low participation. Future research could examine the ideal intervention duration and how to optimize participation.

Malcolm Matheson, MS 2

Mentor(s): Fernando Goes, MD
Department of Psychiatry

Biomarkers of Ketamine's Antidepressant Effect: A Systematic Review of Neuroimaging Studies

Authors: Malcolm Matheson BS, Sharaya Matheson BS, Frederick Barrett PhD, Fernando Goes MD

Background: Depression is the leading cause of disability worldwide. Ketamine, an NMDA receptor antagonist, exerts a rapid antidepressant effect among individuals with depression. However, the mechanism of this effect is not well established. Because only a subgroup of individuals experience antidepressant response to Ketamine, characterizing baseline neurophysiological profiles of those who respond to treatment may inform on Ketamine's antidepressant mechanism. The objective of this systemic review is to summarize current neuroimaging literature on Ketamine and compile a list of candidate biomarkers for antidepressant response.

Methods: This review was conducted in accordance with PRISMA guidelines. We developed a three-concept literature search based on (1) Major Depressive Disorder or Bipolar Disorder, (2) Ketamine administration, and (3) neuroimaging methodology. The search was conducted in June 2019 within the following databases: Medline, Embase, PsycINFO, The Cochrane Library, and Web of Science. Studies were excluded if they included non-human animal models or were secondary analyses of non-antidepressant outcomes. We extracted all major pre-treatment variables which correlated with subsequent antidepressant response to Ketamine.

Results: The initial search yielded 1588 studies. 464 duplicates were removed, 1124 studies underwent title/abstract review, 112 studies underwent full-text review, and 37 studies ultimately met criteria for inclusion. There were 418 unique participants across all studies. 13 studies reported statistically significant pre-treatment correlates of antidepressant response to Ketamine. 11 of these studies reported region-specific findings, 8 of which (72%) implicated limbic system dysfunction.

Conclusion: Ketamine may primarily exert its antidepressant effects among subjects of a unique neurophysiological signature within the limbic system. Our findings provide convergent evidence of previously hypothesized neurophysiological subtypes of depression. Subtyping patients by neuroimaging rather than survey-based criteria may allow clinicians to identify those most likely to respond to Ketamine treatment.

Margo Peyton, MS 2

Mentor(s): Randall Packard, PhD

Segregated in Life and Death: Autopsy and the Racial Science of Tuberculosis at Johns Hopkins

Authors: Margo Peyton BA, Graham Mooney PhD, Randall Packard PhD

Background: In his 1944 landmark publication, *The Pathogenesis of Tuberculosis*, Arnold Rich, chair of Johns Hopkins Pathology (1947-1958), argued that blacks were more susceptible than whites to tuberculosis due to their weak immune systems. Rich based this conclusion on his performance of autopsies, a method characteristic of early 20th-century tuberculosis investigators who also promoted theories of racial difference. By the 1930s, however, large government-sponsored surveys questioned this theory, concluding that socioeconomic factors determined susceptibility. This paper explores how Rich's research methods and the role of race in Baltimore and at Hopkins shaped his theory of racial susceptibility.

Methods: My research relies on autopsy reports, as well as Rich's correspondence and diary entries in the Arnold Rich Collection, at the Chesney Medical Archives. Interviews with pathologists contextualize Rich's autopsy work.

Results: Preferential selection of autopsy cases permitted Rich to uphold his theory of black susceptibility to tuberculosis at a time when large epidemiological studies supported alternative environmental explanations. His research, though, is inseparable from the long-standing disparities in tuberculosis mortality in Baltimore that had racialized the disease. Rich was also not alone at Hopkins in studying how genetics dictated susceptibility to disease—eugenics in all but name. What complicates Rich, however, is that he endured anti-Semitism as the first Jewish department head at the School of Medicine and even condemned racial discrimination. Nonetheless, he advanced an argument of inherent racial difference that deepened racial divisions to the molecular level.

Conclusion: Although methodologically outdated at the time of publication, *Pathogenesis* is relevant to modern medicine as it still informs our understanding of the disease and is still cited as foundational evidence for the existence of racial differences in immunity. Understanding how Rich reached his conclusions and the social conditions that shaped them is therefore essential to the critical assessment of tuberculosis research today.

Mary Chen, MS 2

Mentor(s): Marco Grados, MD, MPH
Department of Psychiatry

The Effectiveness of a Breathing Biofeedback Device on Pediatric Anxiety

Authors: Mary Chen BS, Masoud Salehi, MD, Hasti Hadizadeh, MD, Marco Grados, MD, MPH

Background: Panic disorder is a debilitating anxiety disorder associated with changes in ventilation and respiratory distress. Prior studies in adults have shown benefits of breathing biofeedback on the reduction of panic symptoms. In children, anxiety disorders often precede panic disorder diagnoses. The aim of the study was to test the efficacy of the “Freespira” breathing biofeedback device on reducing anxiety symptoms in children ages 9-17.

Methods: Seventy-two children were randomized into active (n=37) and control (n=35) arms of the study. The mean age was 12.8 years and 37.5% of participants were male. Active participants received 4 weeks of Freespira, consisting of twice-daily 17-minute breathing sessions which progressively paced participants to breathe more slowly and increase end-tidal CO₂ in real-time. Anxiety severity was measured by parent and child self-report (SCARED) while panic symptoms were measured by the Panic Disorder Severity Scale (PDSS). T-tests were conducted on pre- and post-intervention for active and control participants at the 8-week outcome time point.

Results: Only study participants with complete data and at least 50% adherence were analyzed for each outcome measure. There was no significant difference in the mean % reduction of scores between the two groups (p=0.4205 SCARED Parent, p=0.7657 SCARED Child, p=0.3455 PDSSA). Breathing retraining elicited a 19% reduction in SCARED Parent (p=0.0069), 16% reduction in SCARED Child (p=0.0103), and 41% reduction in PDSS (p=0.0096). However, controls showed similar decreases: 13% (p=0.0006), 13% (p=0.0775), and 34% (p=0.0145), respectively. Interestingly, when examining age groups, anxiety was rated by parents as improving significantly in children under age 13 (27% reduction) compared to older children (8% reduction) (p=0.0246), with no difference in treatment adherence between the two groups.

Conclusion: Use of the Freespira breathing device does not improve self-reported anxiety or panic ratings in youth compared to controls. However, younger children appear to benefit the most from the intervention.

Michael Bray, MS 2

Mentor(s): Paul Nestadt, MD
Department of Psychiatry

Educational Achievement And Youth Homicide Mortality: A City-Wide, Neighborhood-Based Analysis

Authors: Michael J. C. Bray MS, Mary E Boulos MS, Kevin MacKrell BS, Galen Shi BS, Paul S. Nestadt, MD

Background: Educational achievement, particularly among youth, may mitigate risk of exposure to violence and negative related health outcomes such as crime and gang activity. Few studies to date have examined relationships between education and youth homicide with equivocal results. The authors hypothesized association between educational achievement in grades 3 and 8 and neighborhood rates of youth homicide mortality.

Methods: Neighborhood-based, city-wide analysis was conducted of cross-sectional data regarding N = 55 neighborhoods in Baltimore, MD, extracted from Baltimore 2017 Neighborhood Health Profiles.

Results: Neighborhoods within the highest tertile regarding youth homicide mortality differed from those in the lowest with fewer males (45% vs. 48%, $p = 0.002$), greater unemployment (17% vs. 8%, $p < 0.001$), familial poverty (35% vs. 16%, $p < 0.001$), residents identifying as black (88% vs. 25%, $p < 0.001$), and higher educational achievement in grades 3 and 8 (51% vs. 70% and 52% vs. 71% respectively, $p < 0.001$). In multivariate regression, higher educational achievement in third grade was associated with reduced neighborhood youth homicide mortality rates, controlling for demographic and socioeconomic factors ($\beta = -0.51$, $p = 0.03$). Mediation analysis revealed effects of familial poverty and educational achievement in eighth grade were fully mediated through educational achievement in third grade ($p < 0.05$).

Conclusion: Higher educational achievement predicts reduced homicide mortality among Baltimore youth and appears to mediate effects of familial poverty on homicide mortality as well. This converges with literature highlighting the importance of education as a mediator of social capital and violence. The novel findings that educational achievement in third grade is associated with neighborhood youth homicide rates and mediates effects of familial poverty bears substantial policy implications regarding violence prevention. Future interventions may target inequalities in educational achievement to mitigate homicide risk among youth in communities facing disparities in violent crime.

Michelle Recto, MS 4

Mentor(s): W. Christopher Golden, MD & Amit Pahwa, MD
Department of Pediatrics

Implementation of an Expanded Clinical Reasoning Curriculum in the Pediatrics Core Clerkship

Authors: Michelle Recto BA, Allison Haley BS, Olivia Widger MD, W. Christopher Golden MD, Amit Pahwa MD

Background: With a shift toward increased clinical experiences early in medical school, clerkship directors must verify that their curricula adequately teach medical students the skills needed to become competent physicians, including clinical reasoning (CR). Individual CR sessions have been a mainstay of clerkship education in pediatrics. However, to our knowledge, longitudinal CR experiences in pediatric clerkships have not been established or evaluated.

Methods: Clerkship students in the pediatrics core clerkship at a single institution participated in an expanded clinical reasoning curriculum during alternating quarters. Students in the traditional curriculum (control group) participated in one case-based discussion of a pediatric chief complaint. Students in the expanded curriculum (innovation group) participated in four case-based discussions at strategically timed points during an eight-week clerkship. Both curricula were led by pediatric medical educators. Exam performance (midterm and final NBME subject examination), clinical evaluations by residents and attendings (on a 5-point Likert scale), and self-evaluations by the students were compared between groups using two-tailed, unpaired two-sample Student's T-tests.

Results: Results between the groups demonstrated no significant difference in midterm exam performance ($p = 0.900$) or NBME subject examination performance ($p = 0.284$). However, students in the innovation group achieved significantly higher average clinical performance evaluations in all four domains measured: basic science knowledge (4.42 vs. 4.04; $p = 0.003$), clinical judgment (4.48 vs. 3.91; $p < 0.001$), clinical knowledge (4.44 vs. 3.98; $p < 0.001$), and problem solving (4.40 vs. 4.02; $p = 0.011$).

Conclusion: Pediatric clerkship students exposed to an expanded clinical reasoning curriculum received significantly higher clinical performance scores on the wards relative to their peers. Using multiple faculty-directed CR sessions during a pediatric clerkship may allow students to refine their critical thinking and differential diagnosis development in caring for pediatric patients.

Nivedha Kannapadi, MS 2

Mentor(s): Sung-Min Cho, MD
Division of Neurocritical Care

Risk Factors for LVAD-Associated Stroke and Other Adverse Outcomes

Authors: Nivedha Kannapadi BA, Sung-Min Cho MD

Background: While it is known that LVAD use increases stroke risk, current studies lack comprehensive data about how specific risks may contribute to stroke and other adverse LVAD outcomes.

Methods: The study design is a retrospective chart analysis of 24 LVAD patients who underwent a brain autopsy with gross and microscopic examinations. Patients who had their LVAD explanted more than 7 days before death or had their LVAD implanted less than 7 days before death were excluded from the study. Demographic data, past medical history, past surgical history, LVAD details, and outcomes post-LVAD implantation were collected.

Results: During LVAD use, 12 patients (50%) had clinical signs of brain injury. 3 (13%) had hypoxic-ischemic brain injury (HIBI), 6 (25%) had chronic ischemia, 6 (25%) had hemorrhagic stroke, and 4 (17%) had ischemic stroke. Other adverse outcomes include DVT (33%), encephalopathy (17%), seizure (21%), sepsis (67%), pump pocket infection (8%), driveline infection (46%), pump infection (4%), pump thrombosis (13%), GI bleeding (29%), significant bleeding (38%), and pulmonary embolism (21%).

On brain autopsy, 16 patients (67%) had brain injury, and 7 (30%) had stroke related deaths. 5 had HIBI (21%), 1 (4%) had chronic infarct, 8 (33%) had hemorrhage, and 10 (42%) had ischemic infarct. The discrepancy between the autopsy and clinical findings was significant in the cases of HIBI and hemorrhagic stroke ($p < 0.001$).

The risk factors for brain injury include increased BMI, COPD, CKD, and previous history of myocardial infarction, while protective factors include history of PCI and history of CABG ($p < 0.05$).

Conclusion: 50% and 67% of LVAD patients had clinical and gross autopsy findings of brain injury, respectively. Several risk factors and protective factors were identified for LVAD adverse outcomes, including brain injury. Limitations include small sample size and exclusion of living LVAD patients.

Pavan Shah, MS 2

Mentor(s): Michael Lim, MD
Department of Neurosurgery

Mutation Status as a Prognostic Marker for Survival Post-Resection of Non-Small-Cell Lung Cancer Brain Metastases

Authors: Pavan Shah BS, Jennifer Franke BS, Ravi Medikonda BA, Christopher Jackson MD, Michael Lim MD

Background: Non-small-cell lung cancer (NSCLC) has the highest incidence of brain metastases (BM) among all cancers. Prognostic markers are needed for survival post-neurosurgical resection of intracranial disease. Given the importance of mutation subtyping in determining systemic therapy and overall prognosis for NSCLC, we examined the prognostic value of mutation status for survival post-neurosurgical resection of NSCLC BM.

Methods: We retrospectively analyzed all cases of NSCLC BM with available molecular testing data from Jan-2008 to Feb-2019 resected by a single surgeon at a single academic center. Patients were classified by mutation (EGFR, KRAS, ALK) or as wild type (WT). Demographics, clinical features, and treatments were also analyzed. Graded Prognostic Assessment (GPA) score was calculated based on previous literature. Association between predictor variables and post-neurosurgical survival was determined using Cox regression.

Results: Of the patients included (n=84), 40% were male, 76% were smokers, average age at the time of surgery was 63 ± 11 years, and mean KPS was 85 ± 14 . 23%, 26%, and 4% of patients had EGFR, KRAS, and ALK mutations, respectively. On univariate analysis, mutation status was not a significant indicator of survival. On multivariate analysis, EGFR mutant patients trended toward better survival ($p=0.0683$, [HR 0.493, 0.2301-1.0547]). The subgroup of EGFR mutant patients who received tyrosine kinase inhibitor (TKI) therapy had significantly prolonged survival ($p=0.0496$, [HR 0.425, 0.1808-0.9985]) compared to WT patients. Postoperative stereotactic radiosurgery ($p=0.034$, [HR 0.451, 0.2164-0.9416]) and resected tumor diameter <3 cm ($p=0.0195$, [HR 0.437, 0.2184-0.8755]) were significantly associated with prolonged survival, while a GPA ≤ 1.0 ($p=0.0158$, [HR 2.951, 1.2252-7.1057]) was significantly associated with worse survival.

Conclusion: Our results suggest EGFR mutant patients who receive TKI therapy may have better survival than WT patients post-resection of BM. These results may inform counseling and decision-making regarding surgical resection of NSCLC BM.

Priyanka Kumar, MS 2

Mentor(s): Noori Kim, MD
Department of Dermatology

Age-Based Gaps between Awareness of Photoaging and Photoprotective Practices among Skin of Color Adults: Opportunities for Intervention

Authors: Priyanka Kumar BA, Noori Kim MD

Background: Photoaging is a dermatologic condition caused by chronic ultraviolet (UV) radiation. Sequelae of photoaging, including dyschromia, rank among the top dermatological conditions among African Americans adults. In this population demographic, the awareness of photoaging and utilization of photoprotective behaviors are poorly understood.

Methods: We performed a cross sectional study between 6/1/19-10/31/19 among individuals aged 18 and 70 years old who self-identified as Black/African-American with a reported Fitzpatrick type IV-VI. A 40-question survey assessing awareness of photoaging and photoprotective practices using 5-point Likert scale answers was distributed to the broader Johns Hopkins University community via email listservs. Chi-squared and Kruskal-Wallis testing was performed binned by age group(n): 18-30 (47), 31-50 (50), 51-70 (25).

Results: 82.1% subjects (16.1% male, 100% African American with median age of 34 (IQR 27-46)) completed the survey. There were no age-based differences in identifying causes of premature skin aging (e.g. smoking ($\chi^2(4) = 5.691$, $p = 0.2235$)) or signs of photoaging (e.g. discoloration ($\chi^2(4) = 1.902$, $p = 0.7538$)). There were significant age-based differences in the utilization of sun protective practices, including applying sunscreen in the morning ($\chi^2(2) = 14.901$, $p = 0.0006$) and wearing sun-protective clothing ($\chi^2(2) = 10.828$, $p = 0.0045$). Individuals aged 18-30 years old were more often using sunscreen while those 51-70 years old were more often using sun protective clothing. Though 40% of all respondents wanted more information relating to sun protection and skin aging, less than 5% had discussed these topics with a physician.

Conclusion: While skin of color adults can identify causes and signs of photoaging independent of age, there are age-based differences in photoprotective practices. With the increasing diversity in skin composition, and aging population, it is critical to deliver patient-centered care to minimize the cutaneous effects of chronic UV exposure among skin of color adults.

Rohan Verma, MS 2

Mentor(s): Marc Halushka MD
Department of Pathology

Proteogenomic single cell analysis of skeletal muscle myocytes

Authors: Katherine M. Fomchenko¹, Rohan X. Verma¹, Suraj Kannan, Brian L. Lin, Xiaoping Yang, Tim O. Nieuwenhuis, Arun H. Patil, Karen Fox-Talbot, Chulan Kwon, David A. Kass, Avi Z. Rosenberg, Marc K. Halushka

¹ These authors contributed equally to this project

Background: Skeletal muscle myocytes have evolved into slow and fast-twitch types. These types are functionally distinct as the result of differential gene and protein expression. Recent advances in proteomics and sequencing have led to an improved understanding of tissue-level protein expression. While previous efforts such as the human protein atlas have presented maps of the human tissue proteome, there remain significant gaps in our understanding of the complexity of gene and protein variation between myofibers.

Methods: We performed deep, whole cell, single cell RNA-seq on intact and fragments of skeletal myocytes from the mouse flexor digitorum brevis muscle. We compared the genomic expression data of 171 of these cells with two human proteomic datasets. The first was a spatial proteomics survey of mosaic patterns of protein expression utilizing the Human Protein Atlas (HPA) and HPASubC, a suite of image analysis tools. The second was a mass-spectrometry (MS) derived proteomic dataset of single human muscle fibers. Immunohistochemistry and RNA-ISH were used to understand variable mosaicism.

Results: scRNA-seq identified three distinct clusters of myocytes (a slow/fast 2A cluster and two fast 2X clusters). Utilizing 1,605 mosaic patterned proteins from visual proteomics, and 596 differentially expressed proteins by MS methods, we demonstrate the arbitrariness of the fast 2X division. Only 38 genes/proteins were mosaic across all three studies, of which 13 are newly described as variable between fast/slow twitch myofibers. An additional 400 genes/proteins were identified by two methods. Immunohistochemistry and RNA-ISH generally validated discrepancies between methods presumably due to species-related differences.

Conclusion: In this first integrated proteogenomic analysis of mature skeletal muscle myocytes we validate the main fiber types and greatly expand the known repertoire of twitch-type specific genes/proteins. We also demonstrate the importance of integrating genomic and proteomic datasets.

Samantha Ip, MS 2

Mentor(s): Fasika Woreta, MD, MPH
Wilmer Eye Institute

Non-Accidental Trauma in Pediatric Patients: Evidence-Based Screening Criteria for Ophthalmologic Examination

Authors: Samantha S. Ip BSE, Sidra Zafar MD, T. Y. Alvin Liu MD, Divya Srikumaran MD, Michael X. Repka MD, MBA, Mitchell A. Goldstein MD, Fasika A. Woreta MD, MPH

Background: Ophthalmologic examination is included in the work-up for pediatric non-accidental trauma (NAT) to evaluate for retinal hemorrhage. However, dilated fundus examination is not without its costs, which include inhibiting pupillary response checks and causing discomfort. Past studies suggest that some patients are unlikely to have retinal findings and may not need ophthalmologic examination; however, these studies have not systematically evaluated which characteristics would be most useful for screening patients. The purpose of this study is to develop screening criteria for when ophthalmologic examination should be performed in NAT evaluation.

Methods: Retrospective cohort study of patient encounters at a pediatric emergency department within a tertiary-referral center from August 2014 to July 2018 that involved NAT evaluation and ophthalmologic examination. Data collected include demographics, presenting symptoms, imaging findings, and ophthalmologic examination findings. The main outcome measure was presence of retinal hemorrhage.

Results: 192 NAT evaluations were included in the analysis, representing 190 unique individuals of mean (SD) age 8.4 (9.5) months at presentation. 15 children (8%) had retinal hemorrhage. Subdural hemorrhage was associated with presence of retinal hemorrhage (odds ratio 54, 95% CI 7.7-2334, $p < 0.001$) with sensitivity 0.933 and specificity 0.797. 14 out of 50 patients (28%) with subdural hemorrhage had retinal hemorrhage, compared to only 1 out of 142 patients (0.7%) without subdural hemorrhage.

Conclusion: When subdural hemorrhage is present, ophthalmologic examination should be performed as part of pediatric NAT work-up. When subdural hemorrhage is absent, probability of retinal hemorrhage is low, and clinicians may consider forgoing dilated examination.

Shirley Wang, MS 2

Mentor(s): Kimberly Levinson, MD
Department of Gynecology & Obstetrics

Barriers to Receipt of Intended Treatment for HIV-Positive Women with Cervical Cancer

Authors: Shirley Wang BS, Anna Beavis MD, Amancio Romero-Sackey BS, Anna Nickles Fader MD, Kimberly Levinson MD

Background: Internationally, HIV-positive women diagnosed with cervical cancer are less likely to complete cancer treatment as intended and experience poorer outcomes compared to HIV-negative women. Similar evidence among this population in the US is limited. We aim to describe limitations in completing intended cervical cancer treatment among HIV-positive and negative women at an urban hospital in the US.

Methods: This is a retrospective cohort study of women with HIV and cervical cancer between 1995 and 2017. Two HIV-negative patients were matched to each HIV-positive patient by FIGO stage, intended treatment, and age. Failure to complete intended treatment and reasons for incompleteness were compared between HIV-positive and negative women. Associations with incomplete treatment and survival were evaluated with Poisson and Cox regression analyses.

Results: Twenty-seven HIV-positive women were identified with a median age of 45.4 years. Ten HIV-positive women (37%) and 21 of 54 HIV-negative controls (38.9%) had incomplete treatment. Nine of 10 HIV-positive women (90%) and 19 of 21 HIV-negative (90.5%) women who failed to receive intended treatment were recommended to receive RT or chemoRT as part of their treatment ($p=0.393$).

Reasons for incomplete treatment did not differ by HIV status; social reasons were common in both groups (40% HIV-positive vs. 52% HIV-negative, $p=1.00$). Completion of intended treatment was not associated with HIV status ($OR=0.91$, $p=0.756$) but was associated with having RT or chemoRT as part of intended treatment for both HIV-positive and negative women ($OR=25.5$, $p=0.007$). Survival was not associated with HIV status ($OR=1.47$, $p=0.358$).

Conclusion: Rates of incomplete treatment for cervical cancer are high for both HIV-positive and negative women and associated with having RT or chemoRT as part of intended treatment. Further studies should focus on identifying opportunities to improve treatment completion among patients for whom social factors were the primary reason for incompleteness, regardless of HIV status.

Srujan Kopparapu, MS 2

Mentor(s): Debraj Mukherjee, MD
Department of Neurosurgery

Predictors of Postoperative Visual Improvement Following Surgical Intervention for Craniopharyngiomas

Authors: Srujan Kopparapu BS BA, Adham Khalafallah MD, Andrew Carey MD, Debraj Mukherjee MD MPH

Background: Due to involvement of the optic apparatus, craniopharyngiomas frequently present with visual deterioration. Although visual improvement is a primary goal of surgical intervention, prediction models are needed.

Methods: A retrospective review was conducted of all patients undergoing at least one craniopharyngioma surgery at the Johns Hopkins Hospital or Bayview Medical Center between 2014-2019. Preoperative, intraoperative, and postoperative variables were collected. Visual acuity and visual fields (VF) were standardized into visual impairment scores (VIS), as defined by the German Ophthalmological Society. VIS range from 0-100, with 0 normal vision and 100 complete bilateral vision loss. Visual improvement/deterioration were defined as a postsurgical decrease/increase of 5 or more VIS points, respectively. Visual improvement and postoperative VIS change were the primary outcomes for binary logistic and linear regressions.

Results: Preoperative and postoperative ophthalmological assessments were available for 41 patients, corresponding to 61 total operations. Ages ranged from 4-73 years and 42 (69%) operations were on male patients. Vision improved after 28 (46%) operations, remained stable after 27 (44%), and deteriorated after 6 (10%).

On bivariate analysis, significant ophthalmologic predictors of visual improvement were worsened preoperative VIS (OR=1.058, $p<0.001$), color vision (OR=0.023, $p=0.003$), VF mean deviation (OR=0.903, $p=0.032$), and vision deficits longer than 1 month (OR=6.050, $p=0.010$). Preoperative radiological involvement of the optic nerves (OR=3.694, $p=0.016$) and either the anterior/middle cerebral arteries (OR=4.140, $p=0.009$) led to improved VIS. Gross total resection (GTR) was also significant (OR=4.368, $p=0.026$).

On multivariate analysis, preoperative VIS remained significant (OR=1.058, $p=0.018$). Simple linear regression ($R^2=0.398$, $p<0.001$) suggests prediction of postoperative VIS improvement as $(-6.532)+(0.577)*(\text{preoperative VIS})$.

Conclusion: Patients with reduced vision, certain radiological optic/vascular involvement, and GTR had visual improvement following craniopharyngioma surgery. Such characteristics may guide patient-surgeon decision-making. Further implementation of the VIS as an ophthalmological tool to standardize visual function may facilitate investigation of other cranial malignancies.

Trevor Glenn, MS 2

Mentor(s): Kristen Riekert, PhD
Johns Hopkins Adherence Research Center

Engagement and Affective Communication During Pediatric Nephrology Clinic Visits: Associations with Medication Adherence

Authors: Trevor Glenn BA, Kristin A. Riekert PhD, Debra Roter PhD, Cozumel S. Pruetten MD, Tammy M. Brady MD, Susan R. Mendley MD, Shamir Tuchman MD, Barbara A. Fivush MD, Cyd K. Eaton PhD

Background: Up to 61% of adolescents/young adults (AYAs) with chronic kidney disease (CKD) are nonadherent to antihypertensive medications. Effective communication among AYAs with CKD, caregivers, and pediatric nephrologists, including higher engagement and positive rather than negative affective communication, may relate to higher adherence. However, there has been little empirical study of these associations and typically without rigorous adherence measures. This study aims to evaluate whether engagement and affective communication displayed by AYAs with CKD, caregivers, and pediatric nephrologists during outpatient clinic visit (CV) discussions relate to objective post-CV antihypertensive adherence.

Methods: AYAs (n=60, M age=15.40 years, SD=2.66, 40% female, 43% African American) and their caregivers (n=60, 73% female) attended audio-recorded CVs with their pediatric nephrologists (n=12, 75% female). CVs were coded with the Roter Interactional Analysis System Global Affective scale to assess participants' engagement (interactivity, interest), negative affect (anger, anxiety), and positive affect (warmth, sympathy). AYAs' daily antihypertensive adherence was monitored electronically during a 2-week period ≤ 7 months before and ≤ 7 months after CVs. A single linear regression model evaluated associations of AYA, caregiver, and provider engagement and negative and positive affect with post-CV adherence (controlled for AYAs' pre-CV adherence, gender, age, and race and clustered by provider).

Results: AYAs took 84% of doses (SD=20%) pre-CV and 82% of doses (SD=24%) post-CV. On average, CVs were 31.77 minutes long (SD=14.79). Higher levels of AYA engagement ($\beta=.03$, $p=.01$) and lower levels of provider negative affect ($\beta=-.15$, $p=.04$) were significantly associated with higher post-CV adherence even after controlling for pre-CV adherence. There were no other significant associations with post-CV adherence.

Conclusion: Promoting AYA engagement in CVs via patient-centered communication strategies and reducing provider negative affective communication during CVs (such as by discussing disease management challenges in a nonjudgmental manner) may enhance post-CV adherence and promote long-term health outcomes in AYAs with CKD.

Vasu Munjapara, MS 2

Mentor(s): Renee Boss, MD
Division of Neonatology

Exploring Parental Decision-Making Regarding Long-term Ventilation for Children With and Without Severe Neurological Impairment

Authors: Vasu Munjapara BA, Jori Bogetz MD, Benjamin Wilfond MD, Carrie Henderson MD, Jessica C. Raisanen MSPH, Kelly J. Shipman MS CCRP, Nicholas A. Jabre MD MS, Renee Boss MD

Background: Decisions around long-term ventilation (LTV) in children should consider the child's illness trajectory. Data suggest that children with severe neurologic impairment (SNI) are at increased risk of LTV being lifelong once placed (permanent) and have increased mortality compared to those without SNI due to their underlying medical complexity. This study sought to evaluate whether parents of children with SNI perceive clinician counseling regarding LTV differently than parents of children without SNI.

Methods: We interviewed parents from three academic centers who were faced with a decision about LTV for their child within the last 5 years. Interviews were audio recorded and transcribed. Content analysis was performed within and across groups of parents according to their child's SNI status.

Results: A total of 37 parents were interviewed; 24 with children with SNI and 13 with children without SNI. Among children with SNI, 46% had LTV and 83% were alive. Among children without SNI, 69% had LTV and 85% were alive. Parents of children with SNI perceived less certainty from clinicians regarding LTV permanence than parents of children without SNI. Despite this, mortality related to LTV was discussed with both groups and honesty about risk of death was appreciated by all parents. In contrast to parents of children without SNI, parents of children with SNI more often recalled detailed descriptions or examples provided by clinicians detailing how their child might die. This often caused distress and felt insensitive to parents.

Conclusion: Parents of children with SNI perceived less clarity from clinicians regarding LTV permanence compared to parents of children without SNI. Parents of children with SNI often experienced insensitive counseling about risk of death. More research and education are needed to improve clinician counseling of parents regarding LTV that meaningfully reflects the child's illness trajectory and provides honest information in a sensitive manner.

Vismaya Bachu, MS 1

Mentor(s): Joseph Brzezinski

University of Colorado Anschutz Medical Campus, Ophthalmology Department

Intronic Element of Pde6c Acts as an Early Cone-Specific Enhancer in the Murine Retina

Authors: Vismaya Bachu BS, Ko Uoon Park BS, Joseph Brzezinski PhD

Background: One potential strategy to overcome blinding diseases is to directly replace damaged cone photoreceptors in the retina of the eye. Yet, this approach is contingent upon a thorough understanding of gene regulatory networks underlying the process by which stem cells differentiate into cones. Based on preliminary investigations, we observed that the Pde6c gene is upregulated early in murine cone genesis.

Methods: We used DNase hypersensitivity and ATAC-sequencing datasets to identify multiple candidate enhancers for the Pde6c gene and then tested these for activity using organotypic retinal explant cultures at the peak of embryonic cone development.

Results: Only a 569bp intronic element of Pde6c showed expression in differentiating cone photoreceptors which was further dissected to indicate that only 100bp were required for expression specifically within cones. Systematic mutagenesis of this shortened sequence revealed two concise 20bp and 50bp regions that proved essential for expression. Using JASPAR transcription factor binding site predictions, we then identified several candidate regulators of Pde6c expression which are currently being tested by chromatin immunoprecipitation and loss-of-function experimentation.

Conclusion: The shortened enhancer sequence is allowing for the breeding of a founder mouse line which is currently being screened at developmental checkpoints to further elucidate the element's role in visual development. Moving forward, our goal is to test how factors that regulate Pde6c control cone fate specification, helping us find methods to re-program stem cells into cone photoreceptors.

Vorada Sakulsaengprapha, MS 2

Mentor(s): Simon C. Mathews, MD

Department of Medicine, Division of Gastroenterology and Hepatology

Analysis of Variation in Pre-Procedural Fasting Duration for Common Inpatient Gastrointestinal Procedures

Authors: Vorada Sakulsaengprapha BS, Michael Daniel MD, Jiarui Cai MS, Diego A. Martinez PhD, Simon C. Mathews MD

Background: Gastrointestinal procedures generally require pre-procedural fasting to optimize sedation safety. While the American Society of Anesthesiologists recommends no intake of clear liquids and solid food 2-4 and 6-8 hours respectively prior to endoscopic procedures, the actual nil per os (NPO) duration for these procedures in practice is unknown. Our objective was to analyze NPO duration for patients undergoing these procedures and to determine its association with clinical and administrative variables.

Methods: Inpatient data from 2016-2018 for esophagogastroduodenoscopies (EGD), colonoscopies, and endoscopic retrograde cholangiopancreatographies (ERCP) was extracted from electronic medical records and administrative data at a single-center tertiary academic medical center. We abstracted demographics, clinical characteristics, NPO duration, and hospital statistics for analysis. The data was then analyzed using Kruskal-Wallis, Wilcoxon, and Pearson tests, depending on the outcome type and data distribution.

Results: 1325 EGDs, 753 colonoscopies, and 550 ERCPs were included. The median NPO time for all procedures was 12.6 hours (IQR 9.6-16.1). The median NPO times were 12.6, 11.9, and 13.1 hours for EGD, colonoscopy, and ERCP respectively. NPO duration was greater for Hispanic than non-Hispanic patients (median 13.9 vs. 12.4, p-value = 0.018). NPO duration was also associated with increased age ($r = 0.041$, p-value = 0.027) and inversely related to hospital occupancy ($r = -0.08$, p-value < 0.0001). There were no statistically significant associations with provider type, hospital location or service, length of stay, and total number of comorbidities.

Conclusion: NPO times for common inpatient GI procedures generally exceeded 12 hours, suggesting there is an opportunity to adopt changes to decrease NPO duration for low-risk patients while maintaining adherence to guidelines and best practice.

Waverley He, MS 2

Mentor(s): Justin Sacks, MD, MBA
Department of Plastic and Reconstructive Surgery

Comparing Clinical Outcomes for TRAM, DIEP, and Latissimus Dorsi Flap Breast Reconstructions: A Systematic Review and Meta-Analysis

Authors: Waverley Y. He BA, Leen El Eter BS, Pooja Yesantharao MS, Razvan Azamfirei MS, Haley Owens, Justin M. Sacks MD, MBA

Background: Autologous breast reconstruction techniques following mastectomy include transverse rectus abdominis (TRAM) flap, deep inferior epigastric perforator (DIEP) flap, and latissimus dorsi (LD) flap. Understanding clinical outcomes of these flap types warrants comparison via a systematic review and meta-analysis.

Methods: A literature search was conducted in June 2019 using PubMed, EMBASE, Cochrane, Web of Science, and Scopus. Articles were screened by two independent reviewers. Comparative studies published after 2000 with clinical outcomes of patients undergoing TRAM, DIEP, or LD flap reconstructions were included. Data on population and surgical characteristics, and complications were extracted. Meta-analyses comparing TRAM to DIEP flaps, TRAM to LD flaps, and pedicled (pTRAM) to free TRAM (fTRAM) flaps were pooled using random effects modeling. Risk of bias was assessed using ROBINS-I for non-randomized studies.

Results: 5040 articles were identified. Abstract screening yielded 1292 studies. Of these, 21 studies were included. Random effects modeling demonstrated that TRAM flaps were less likely than LD flaps to result in seroma (OR 0.05, $p=0.001$), but more likely to result in fat necrosis (OR 3.39, $p=0.003$), and total flap loss (OR 2.47, $p<0.001$). TRAM flaps were less likely than DIEP flaps to result in delayed wound healing (OR 0.253, $p<0.001$), but more likely to result in abdominal bulge/hernia (OR 3.554, $p<0.001$) and flap necrosis (OR 3.057, $p<0.001$). Compared to fTRAM flaps, pTRAM flaps resulted in higher rates of abdominal bulge/hernia (OR 1.702, $p=0.008$), fat necrosis (OR 1.883, $p<0.001$), and partial flap loss (OR 1.801, $p=0.006$).

Conclusion: Compared to LD and DIEP, TRAM flaps have lower rates of short-term complications but higher rates of long-term complications such as fat/flap necrosis and abdominal bulge/hernia. fTRAM flaps lead to fewer complications than pTRAM flaps. These results will enable women and their surgeons to make an informed decision about the flap type most appropriate for them.

Yesha Shah, MS 2

Mentor(s): Pradeep Ramulu, MD, PhD
Wilmer Eye Institute

Ability to Predict Visual Field Damage in Glaucoma Using Patient Reported Symptoms

Authors: Yesha Shah BS, Michael Cheng, Aleksandra Mihailovic ScM, Pradeep Ramulu MD, PhD

Background: Currently, glaucoma severity is evaluated through testing, i.e. optic nerve findings, Optical Coherence Tomography (OCT), or Visual Field (VF). A useful adjunct is discussing patient symptoms, although the ability of symptom-related questions to predict severity is unknown. Here, we evaluate which patient-reported symptoms best capture glaucoma severity, using VF damage as the gold standard.

Methods: Patients in two groups (diagnosed glaucoma with VF mean deviation [MD] worse than -5 dB in both eyes and suspected glaucoma with VF MD better than -4 dB in both eyes) graded the presence and severity of 30 visual symptoms. Univariate and multiple linear regression models evaluated the amount of variance (adjusted R²) in VF MD explained by patient-reported symptoms or, for comparison purposes, OCT total retinal nerve fiber layer (RNFL) thickness. Multiple models controlled for age, sex, race, and education.

Results: In total, 177 patients were recruited (81 with glaucoma and 96 with suspected glaucoma). Mean age was 65 years and 58% were female. In univariate analysis, severity of two symptoms, better vision in one eye and peripheral loss, explained 33% and 34% of variance in VF damage respectively. The frequency of the following five symptoms: objects looking different sizes with each eye, missing patches, cloudiness, weekly vision variance, and glare explained 33%, 32%, 26%, 19%, and 6% of the variance in VF damage respectively. A multiple linear regression model including the above seven symptoms explained 52% of the variance in VF damage, while a multiple linear regression model including RNFL thickness explained only 37% of the variance in VF damage.

Conclusion: Patient-reported symptoms explained a significant amount of variance in VF damage, outperforming RNFL thickness, a common glaucoma tool. Patient communication with specific terms may be useful in staging glaucoma and can complement testing, especially in patients where traditional testing is difficult.

Zaw Phyo, MS 2

Mentor(s): Won Jin Ho, MD
Department of Oncology

Site-specific profiling of TCR signaling

Authors: Zaw Phyo MS*, Rohan Verma BS*, Won Jin Ho MD, Elizabeth M. Jaffee MD

*These authors contributed equally to this work

Background: While immune checkpoint inhibitors (ICIs) have improved clinical outcomes in cancer treatment by targeting inhibitory receptors and reinvigorating exhausted T cells, no biomarker to date reliably determines the extent of T cell exhaustion. Since robust T cell receptor (TCR) signaling is critical for effective antitumor immunity, we hypothesized that interrogating the phospho-signaling states within the T cells along with their functional states will enhance our understanding of T cell exhaustion and yield potential biomarkers.

Methods: We developed a validated mass cytometry panel of 24 markers to quantify phosphorylation states of 8 intracellular kinases involved in the TCR signaling within multiple CD8+ T cell subtypes. To identify potential differences between the local and peripheral immunological responses, we profiled CD8+ T cells derived from four sites (tumor, tumor draining lymph node, spleen and peripheral blood) in mice bearing MC38-induced flank tumors. We performed a clustering analysis of the dataset in aggregate using FlowSOM and visualized the results with UMAP, a dimensionality reduction algorithm, to compare the phospho-profiles of CD8+ T cell subtypes in all four sites.

Results: Bulk analysis of CD8+ T cells demonstrates site-specific concordance between phosphoproteins and T cell functional markers with the highest expression in tumor followed by tumor draining lymph node, spleen and peripheral blood. Based on the results from the clustering analysis, site-specific breakdown of CD8+ T cells revealed high prevalence of effector and memory T cells in tumors compared to other sites where naïve T lymphocytes predominated. Despite these variations in CD8+ T cell immunophenotypic distribution, TCR signaling profiles correlated strongly with specific T cell subtypes across all sites.

Conclusion: These data demonstrate that subtype-specific TCR signaling is preserved systemically and that phospho-immune subtyping of CD8+ T cells in the peripheral blood may be used to identify T cell exhaustion states found in the tumor microenvironment.

POSTER ABSTRACTS: BASIC SCIENCE

Listed alphabetically by author first name

Catherine Yip, MS 2

Mentor(s): Brian Ladle, MD
Department of Pediatric Oncology

The Application of Epigenetic Modulation to the Immunogenicity of Pediatric Sarcomas

Authors: Catherine Yip, BS, Brian Ladle MD

Background: Sarcomas are among the most devastating pediatric cancers, with 5-year survival rates stagnant around 60-70% and significantly worse outlooks in metastatic or relapsed disease. These tumors are relatively resistant to standard chemotherapies as they are not driven by a single, targetable mutation. The standard triad of chemotherapy, radiation, and surgery often leaves cured patients with high risks of morbidity and mortality due to the toxicity of the treatments themselves. Recent advances in immunotherapies have also been ineffective as pediatric sarcomas carry low mutational burdens and low basal neoantigen expression. This project thus focuses on manipulating the epigenetic landscape of osteosarcomas and rhabdomyosarcomas in hopes of sensitizing them to existing treatments.

Methods: In this study, we used cell viability assays to establish the toxicity of the following epigenetic modulating drugs, a lysine specific demethylase 1 (LSD1) inhibitor and a dual histone deacetylase 6 (HDAC6) and LSD1 inhibitor, on models of osteosarcoma and rhabdomyosarcoma. Using QPCR, we evaluated their effects on the gene expression of 6 major cancer testis antigens. Western blotting was used to assess the subsequent changes in protein expression and dose-dependent effects of the drugs themselves.

Results: Cell viability assays reveal that dual HDAC6/LSD1 inhibition is lethal to cells at submicromolar doses due to the action of HDAC inhibition. LSD1 inhibition alone was found to have cytostatic rather than cytotoxic effects on tumor cell growth. There were minimal changes in genetic expression of cancer testis antigens with either HDAC or LSD1 inhibition. Dual HDAC6/LSD1 inhibition resulted in a dose-dependent increase in acetylated alpha-tubulin after 24 hours of drug exposure.

Conclusion: This data demonstrates that epigenetic modulation may be a viable approach to an alternate treatment paradigm for pediatric sarcomas. Future directions include in vivo studies as well as exploring the specific genes responsible for changes in cell signaling and behavior.

Harshath Gupta, MS 2

Mentor(s): Srinivasan Yegnasubramanian, MD PhD
Department of Oncology

Investigating Complex Chromosomal Rearrangements in Prostate Cancer with Synthetic Long Read Assembly

Authors: Harshath Gupta BA, Tam Pham BA, Sarah Wheelan PhD, Michael Haffner MD PhD, William Nelson MD PhD, Srinivasan Yegnasubramanian MD PhD

Background: 40% of structural alterations in prostate cancer show complex genomic rearrangements. These rearrangements, involving multiple genomic regions, may drive prostate cancer evolution and are critical to understand for risk stratification and targeted therapies. Our lab found that Topoisomerase II beta (TOP2B) creates DNA double-stranded breaks following activation of the androgen receptor transcriptional program. These breaks arise near rearrangement breakpoints observed in human prostate cancers. However, the precise mechanisms and structure of these rearrangements remain unknown. We aim to assemble complex rearrangements across large genomic regions to define their precise structure and correlate them to the sites of recombination observed with androgen induced TOP2B breaks.

Methods: We used a long-range, linked-read sequencing platform that enables assembly of a continuous region from a large genomic region (>1 Mbp), unlike standard short read sequencing. We applied this to 7 prostate cancer cell lines. This technique permits haplotype-resolved identification of genetic variants. This allows precise mapping of complex alterations and determination of whether a single chromosome underwent multiple structural rearrangement events.

Results: Among the 7 cell lines, there were 48-1,632 (average=697) large structural variant calls. Further analyses are in progress in which we will (1) map the positions of rearrangement breakpoints in relation to androgen receptor-target genes, TOP2B binding sites, and histone markers to allow visualization of how these complex rearrangements arose. (2) To examine haplotype information, we will profile structural variants and single nucleotide polymorphisms on each allele and determine their net protein function in the cells.

Conclusion: Preliminary analyses indicate that complex rearrangement architecture can be captured in common prostate cancer cell lines. This knowledge will benefit the development of biomarkers for risk stratification or strategies to reverse or prevent accumulation of additional rearrangements. Understanding these fundamental processes provides benefit because complex genomic rearrangements are the hallmark of a subset of cancers from other tissues.

Jack Korleski, MS 2

Mentor(s): John Laterra, MD, PhD
Department of Neurology

Verifying genes regulated by PRC2 in Glioblastoma multiforme stem cells

Authors: Jack Korleski BA, Hernando Lopez-Bertoni PhD, John Laterra MD PhD

Background: Cancer stem cells (CSCs) are a potential therapeutic target in glioblastoma multiforme (GBM); however, their biology is not well understood. Previous unpublished data shows that epigenetic changes in histone 3 lysine 27 trimethylation (H3K27me3) help GBM cells maintain a stem-cell like phenotype. These data suggest that the CSCs overexpress PRC2, an H3K27 trimethylator. Overexpression of PRC2 is suggested to decrease the expression of 15 potential tumor suppressor genes. This project hypothesizes that these 15 genes are repressed by H3K27me3 via a PRC2 dependent mechanism.

Methods: We tested the hypothesis with qRT-PCR (to measure gene expression) and ChIP-PCR (to measure H3K27me3 binding) experiments using an in vitro stem cell model for GBM.

Results: Of the original 15 genes, 6 had decreased mRNA expression in the CSCs vs controls. These genes had recovered expression upon chemical inhibition of PRC2. ChIP-PCR experiments showed that these six genes are enriched for H3K27me3 in the promoter region. Of these six genes, five are previously reported to have tumor suppressor activity in a variety of cancers.

Conclusion: Thus, the collective data suggest that PRC2 overexpression leads to repression of at least six putative tumor suppressor genes via H3K27 trimethylation.

Josh Gray, MS 2

Mentor(s): Aaron Milstone, MD

Department of Pediatrics, Division of Infectious Disease

Whole-Genome Sequencing of Staph aureus for Nosocomial Outbreak Analysis

Authors: Josh Gray, Annie Voskertchian, Tracy Howard, Patricia Simner, Aaron Milstone

Background: Accurate detection of phylogenetic relationships between *Staphylococcus aureus* strains is essential to inform strategies to prevent the spread of MRSA in the neonatal intensive care unit. The current gold standard laboratory method, pulsed-field gel electrophoresis (PFGE), distinguishes organism relatedness by comparing how DNA segments digested by sequence-specific enzymes migrate through an agarose gel. PFGE's low resolution is unable to distinguish closely related organisms, as occurs in rapid clonal outgrowth. Historically cost-prohibitive, bacterial whole-genome sequencing (WGS) was anticipated to abate the limitations of PFGE but currently suffers from methodological challenges preventing widespread implementation in microbiology laboratories. Our objective was to compare methods for analyzing WGS data to inform outbreak investigation.

Methods: By using sequence data from parent-neonate *S. aureus* samples that were presumed transmission events based on the clinical epidemiology and confirmed by PFGE, we developed a WGS analytic method to infer *S. aureus* phylogenetic relationships from 'concatenated core alleles' (CCA). For each strain, the CCA sequence is the concatenation of the bacterial alleles of the conserved 'core' genes common to all *S. aureus* strains. We compared the accuracy of PFGE to CCA.

Results: We identified 76 parent-neonate pairs, where at least one parent was colonized with *S. aureus*, their neonate acquired colonization with *S. aureus*, and there were available *S. aureus* isolates available for sequencing. Among these parent-neonate pairs, 37 (49%) had a neonate who acquired a *S. aureus* strain that was determined to be the same as their parent's strain by PFGE, indicating a putative parent-to-child transmission. The remaining 39 neonates had strain that were determined to be different from their parent's strain by PFGE.

Conclusion: CCA is an appropriately sensitive method that is feasible to perform. To aid CCA adoption in the clinical setting, we developed a software package, *pacca*, to run the full analysis from the raw sequencing reads.

Mary Rostom, MS 2

Mentor(s): Luis Garza, MD PhD
Department of Dermatology

Potential of Subcutaneous Cell Implantation for Treatment of Lysosomal Storage Diseases

Authors: Mary Rostom BA, Luis Garza MD PhD

Abstract: Lysosomal storage diseases are genetic disorders in which patients lack the enzymes necessary for the breakdown of cellular waste or large molecules. For example, Fabry disease occurs due to insufficient amounts of galactosidase alpha causing an inability to breakdown glycogen and ultimately cell death. The mainstay of therapy for lysosomal storage diseases is intravenous enzyme replacement therapy. Unfortunately, this is associated with many poor outcomes in patients due to hypersensitivity reactions and poor tissue delivery. As there are a wide range of mutations that may cause each lysosomal storage disease it is important that a therapy will be well tolerated, have sufficient tissue delivery as well as be generalizable. The goal of this literature review is to examine if utilizing subcutaneously implanted autologous skin fibroblasts would be a viable option to achieve these goals of therapy. Ideally, CRISPR edited fibroblasts could be implanted both subcutaneously and in target organs to achieve equal or higher enzyme levels than current therapy. We present a systematic literature review hoping to identify benefits, viability and obstacles of undertaking a project like this. Despite the barriers that must be overcome to ensure stable subcutaneous engraftment and expression of cells that encode lysosomal storage enzymes, there is much potential in this as a treatment for LSD, as it bypasses immunogenicity, adverse infusion reactions and economic barriers associated with enzyme replacement therapy. Success of this therapy could mean large extensions of life span and high increase in quality of life of patients with lysosomal storage diseases, specifically Fabry disease.

Melissa Staley, MS 2

Mentor(s): Irving Reti, MD
Department of Psychiatry and Behavioral Sciences

How does Electroconvulsive Therapy suppress Self-Injurious Behavior associated with Intellectual and Developmental Disabilities: Focus on Mechanism

Authors: Melissa Staley BS, Cindy Jiang BS, Alec Stepanian BA, Sanmit Adhikari BS, Jeeva Jagabandhu BS, Andrew Chang BS, Alena Savonenko MD/PHD, Jay Baraban MD/PHD, Irving Reti MD

Background: Electroconvulsive therapy (ECT) significantly reduces self-injurious behavior (SIB) seen in a small subset of patients with intellectual disability disorder (IDD). Successful treatment, however, requires frequent sessions, exposing patients repeatedly to anesthesia and inducing debilitating memory loss. The mechanism by which ECT causes this reduction in self injury is poorly understood, yet, may help identify targetable pathways and therapies with fewer side effects. GABAergic pathways, in particular, may play a role reducing self injury in this patient population as the GABA agonist class of drugs, benzodiazepines, are sometimes effective in suppressing SIB in IDD patients. Additionally, numerous lines of evidence suggest that ECT enhances GABAergic tone, including increasing cortical GABA concentration.

Methods: In this study, we looked at striatal GABA levels in two mouse models that exhibit excessive self-grooming, one in which electroconvulsive stimulation (ECS) reduces repetitive grooming behavior (Viaat-MECP2) and another that demonstrates no response (Shank KO). We hypothesize that differential GABA levels between the mouse strains may explain their disparate responses to ECS. Striatal GABA and glutamate levels were measured via microdialysis and quantified via high performance liquid chromatography (HPLC) 1.5 hours before through 1 hour after sham or ECS treatment.

Results: In Viaat-MECP2 animals, we found that GABA levels dramatically increased in the striatum 30 minutes following ECS compared to wild type animals and those of Shank KO animals. Additionally, no significant change in glutamate levels was observed in either mouse strain regardless of treatment group.

Conclusion: This suggests that increased striatal GABA may play a role in the response of Viaat-MECP2 animals to ECS and, potentially, in the therapeutic effect of ECS in reducing self-injurious behavior.

Nancy Zhou, MS 2

Mentor(s): Daniel Sun, MD

Department of Otolaryngology-Head and Neck Surgery

In Vitro Biocompatibility of Engineered Magnetic Nanoparticles in Mouse Organ of Corti Explant Cultures

Authors: Nancy J. Zhou BA, Mukund M. Goyal MS, Philippe Vincent PhD, Charles C. Della Santina MD PhD, Elisabeth Glowatzki PhD, Chao Wang PhD, Daniel Q. Sun MD

Background: Comprised of an iron oxide nanocore surrounded by biocompatible coating, magnetic nanoparticles (MNPs) are emerging as promising drug delivery vehicles for the inner ear with the potential of overcoming passive diffusion-related barriers for intratympanically-administered therapeutics. Coating thickness is an important design parameter, affecting particle transport properties as well as drug loading and elution. Further, coating thickness may play a role in biocompatibility by shielding the highly oxidative and potentially cytotoxic iron oxide nanocores from delicate inner ear sensory structures. The relationship between coating thickness and cytotoxicity has not been investigated in detail.

Methods: Polyethylene glycol-coated MNPs (PEG-MNPs) were synthesized with 12- and 3000-molecule PEG chains (PEG12 and PEG3000, respectively). The organ of Corti mid-turn was microdissected from neonatal C57BL/6J mouse pups and cultured in growth media with PEG12 MNPs (0.1 or 0.5mg/ml), PEG3000 MNPs (0.1 or 0.5mg/ml), or neomycin and kainic acid for 72 hours, all with and without an external magnetic field gradient (0.3T at surface). NF200 and MyoVI antibodies were used for neurite and hair cell labeling, respectively. Images were acquired via confocal microscopy and inner hair cell (IHC), outer hair cell (OHC), and spiral ganglion neurite (SGN) counts were individually quantified and normalized.

Results: Synthesized PEG12 and PEG3000 MNPs consisted of 7nm Fe₃O₄ nanocores. IHC, OHC, and SGNs counts were similar to saline control for both PEG12 and PEG3000 MNPs across the range of concentrations tested, while neomycin/kainic acid resulted in significant depletion of these counts. In addition, an applied magnet orthogonal to each tissue during incubation did not lead to a difference in IHC, OHC, or SGN survival.

Conclusion: Results suggest that PEG-MNPs demonstrate histologic biocompatibility in mouse organotypic cultures across a broad range of coating thickness and concentrations, further informing the rational design of MNPs for labyrinthine drug delivery applications.

POSTER ABSTRACTS: CLINICAL SCIENCE

Listed alphabetically by author first name

Abhishek Gami, MS 2

Mentor(s): Judy Huang, MD
Department of Neurosurgery

Decision-making in unruptured intracranial aneurysms: correlation of the Unruptured Intracranial Aneurysm Treatment Score and PHASES score with referral center practice

Authors: Abhishek Gami BS, James Feghali MD, Justin M. Caplan MD, Rafael J Tamargo MD, Cameron G. McDougall MD, Judy Huang, MD

Background: The UIATS and PHASES are tools that guide the decision to treat aneurysms. This study assesses whether the decisions proposed by these tools correlate with real-world practice.

Methods: Patients with unruptured aneurysms in 2018 were studied. UIATS and PHASES scores were calculated and type of management was recorded. The sensitivity, specificity, and percent misclassification of the UIATS recommendation were evaluated. A ROC analysis measuring the ability of the UIATS and PHASES to discriminate correctly between real-world “treatment” and “observation” was conducted. Correlation coefficients between UIATS variables and surgeon decisions were calculated. Variables on univariable analysis were used to develop a model predicting real-world decisions based on the Akaike information criterion.

Results: Of 198 patients with 271 aneurysms, 42% were treated. 77% of patients were female. Concerning UIATS recommendations per aneurysm, 16% were labeled for treatment, 51% for conservative follow-up, and 34% had no recommendation. When compared to real world decision-making, the sensitivity of the UIATS was 56%, the specificity was 97%, and the percent misclassification was 19%. ROC for UIATS revealed an AUC of .77 ($p<.001$). The mean PHASES score of aneurysms treated by surgeons was significantly higher than that of non-treated aneurysms ($p=0.02$), while the model containing the PHASES yielded an AUC of 0.58 ($p=0.03$). The optimal model predicting surgeon decisions with the lowest AIC consisted of age, hypertension, clinical symptoms, reduced quality of life, aneurysm maximum diameter/irregularity, large size, and cavernous ICA location. The AUC for the final model was 0.942 ($p<0.001$). Over a mean follow-up of 9.3 months, zero untreated aneurysms had ruptured.

Conclusion: The high positive predictive value of the UIATS may indicate its clinical use in ruling in patients for treatment. The high odds of treatment for patients with greater aneurysm size, lower age, and aneurysm irregularity may indicate these factors are of importance in guiding treatment decision.

Adaobi Ugochukwu, MS 2

Mentor(s): Lisa Christopher-Stine, MD, MPH
Johns Hopkins Myositis Center

Medical Cannabis, Cannabinoids, and Myositis: Understanding Patient and Physician Attitudes, Beliefs, and Knowledge

Authors: Adaobi Ugochukwu BS, Dermot Maher MD, Christopher Mecoli MD, Lisa Christopher-Stine MD, MPH

Background: Despite the increased number of states that have legalized medical cannabis use and the need for alternatives to opioids for pain management, it is unclear how much cannabinoid-containing products are used in rheumatic disease clinics for symptoms such as chronic pain.

Methods: Surveys were designed to understand the attitudes, beliefs, and knowledge of myositis patients and providers on the use of medical cannabis and cannabinoids for the treatment of chronic pain and associated myositis symptoms. The surveys were created using existing literature and an expert panel. Both surveys of patients and providers included questions on demographics, clinical and personal experiences, potential concerns, and a knowledge self-assessment with an additional section in the physician survey for comparison of physicians' beliefs regarding the efficacy of medical cannabis for certain indications with currently available data. Cognitive debriefing sessions conducted with patients at the Johns Hopkins Myositis Center used the think-aloud process to transcribe and analyze their cognitive processes and verbalizations.

Results: Matrices were implemented using feedback from Johns Hopkins physicians. Questions deemed to be redundant by consensus were removed. The validated PROMIS-29 health-related quality-of-life measures were suggested to provide an understanding of the correlations that could underlie the results of the patient survey.

Revision of the patient survey using patient feedback focused on improving comprehension and formatting. In defining the different types of cannabinoid-containing products, emphasis was placed on how they are obtained to maintain consistency in patient interpretation.

Items numbered 150 and 306 for the physician and patient surveys, respectively.

Conclusion: Length, language ambiguities, and the potential for duplicate queries were minimized in the construction of the final survey items. The surveys will be distributed anonymously to physicians through the database of the International Myositis Assessment and Clinical Studies Group (IMACS) and to patients through the database of the Myositis Center and the Myositis Association.

Ainsley Taylor, MS 2

Mentor(s): Casey Humbyrd, MD
Department of Orthopaedic Surgery

Open Payments: Evaluating sex-based disparities of physician-industry payments within the 2016 American Academy of Orthopaedic Surgeons (AAOS) committee leadership

Authors: Ainsley Taylor BS, Casey Humbyrd MD

Background: The 2010 Physician Payments Sunshine Act created the Open Payments (OP) system, a national disclosure program that mandates payment reports from industry to physician. ProPublica Dollars for Docs (PPDD) is a public website that offers organized data from OP. The American Academy of Orthopaedic Surgeons (AAOS) requires members to self-report industry relationships. We wanted to evaluate disclosure discrepancies between AAOS and PPDD for the 2016 year. In addition, we investigated associations between physician-industry relationships and physician sex within the AAOS committee leadership for sex-based disparities.

Methods: We identified American Board of Orthopaedic Surgery (ABOS) physicians in committee positions at the 2017 AAOS Annual Meeting. These physicians' 2016 AAOS disclosures were compared to the 2016 PPDD disclosures. We identified three analogous disclosure categories (royalties, paid consulting, and paid presenter/speaker) between AAOS and PPDD, whereby mismatch in any of these three categories was assessed in terms of physician-industry relationship honesty. AAOS leadership was then grouped by sex and compared in terms of (1) years of ABOS certification, (2) number of industry relationships, and (3) physician-industry payments.

Results: Of the 319 individuals involved in AAOS committee leadership, 305 (96%) were ABOS certified orthopedic surgeons. Of these 305 physicians, 285 (93%) were men and 20 (7%) were women, with an average ABOS certification of 17.4 years for men and 17.0 years for women. The average payment from industry was \$6,345/woman and \$102,134/man (Figure 1). Women had an average of 3.16 industry relationships, while men had 3.75. Results pending for mismatch question.

Conclusion: There is a significant sex-based difference in payments to orthopedic surgeons from industry in 2016. Despite women having similar years of ABOS certification as men, they had fewer industry relationships and less total payments. Further work should investigate 2017 data for payment trends from 2016.

Amancio Romero-Sackey, MS 2

Mentor(s): Anna Beavis, MD
Department of Gynecologic Oncology

Multidisciplinary Team Integration Improves Treatment Completion and Reduces Racial Disparity in Cervical Cancer

Authors: Amancio Romero-Sackey BS, Kimberly L. Levinson MD, MPH, Anne Rositch PhD, MsPH, Shirley Wang BA, Akila Viswanathan MD, MPH, Amanda Nickles Fader MD, Rebecca L. Stone MD, MS, Stephanie L. Wethington MD, MSc, Anna L. Beavis, MD, MPH.

Background: To evaluate the effect of the integration of gynecologic oncology and radiation oncology into a multidisciplinary team on the rate of treatment completion, survival, and racial healthcare disparities for women diagnosed with cervical cancer.

Methods: Retrospective cohort study comparing women treated for invasive cervical cancer at an urban academic hospital from 1/1/11-12/17. Clinical and pathologic factors and treatment characteristics were compared using Fischer's exact test and Wilcoxon rank sum tests. Treatment completion and survival were analyzed using Fischer's exact test and the Cox proportional hazard model respectively and compared between the pre-integration and post-integration periods and by race.

Results: Of 115 women enrolled, 70% were treated before and 30% after team integration. The median age of the pre-integration group was significantly higher (47.0 vs. 39.7, $p=0.048$). The pre and post-integration groups did not differ in race, BMI, insurance status, smoking status, median income of zip code, stage, or histology. Treatment completion increased from 59% to 80% after integration of care ($p = 0.034$). Additionally, treatment completion was significantly lower among black women pre-integration (32% vs 77%, $p<0.001$), but this disparity was no longer present after integration (67% vs 85%, $p=0.34$). Notably, there was not a significant difference in treatment completion among the subgroup of black women after integration (32% vs 67%, $p=0.12$). On log-rank test, treatment completion, but not integrated care itself, was associated with a higher overall survival with a hazard ratio of 0.21 (0.09-0.49 95%CI). Treatment completion did not significantly affect progression-free survival (0.50 HR, 0.17-1.44 95%CI).

Conclusion: Integrated team care improved full treatment completion and reduced the racial disparity in treatment completion. Further study of care integration is warranted to elucidate the mechanism behind its impact on patient survival. This work has the potential to improve healthcare structure in gynecology oncology.

Andrew Supron, MS 2

Mentor(s): Phillip Pierorazio, MD
Department of Urology

Primary Robotic Retroperitoneal Lymph Node Dissection Following Orchiectomy for Testicular Germ Cell Tumors: A Single-Surgeon Experience

Authors: Andrew Supron BA BS, Joseph Cheaib MD MPH, Zeyad Schwen MD, Michael Biles MD, Mohamad Allaf MD, Phillip Pierorazio MD

Background: Nerve-sparing retroperitoneal lymph node dissection (RPLND) is a recommended therapy for men with stage I, IIA, and IIB non-seminomatous germ cell tumors of the testis. Recently, robotic RPLND (R-RPLND) has emerged as a promising approach, causing potentially less morbidity. However, limited data exist regarding its safety and efficacy. The objective of this study is to report the peri- and post-operative outcomes among our cohort of R-RPLND patients.

Methods: We performed a retrospective analysis of all primary R-RPLND cases performed by a single surgeon from August 2013 to 2019. Data on patient demographics, operative techniques, perioperative outcomes, and tumor characteristics were obtained; descriptive statistics were computed.

Results: Twenty-eight men who underwent primary R-RPLND were identified. The median age at R-RPLND was 30 (interquartile range (IQR): 26-37) years, and the majority of patients (N=21, 75%) had clinical stage I disease. Of note, two cases involving clinical stage II disease were converted electively from robotic to open. R-RPLND patients experienced no intraoperative complications and required no red blood cell transfusions. Follow-up time post-R-RPLND was 8 (IQR: 4-29) months. Median node count was 31 (IQR: 19-43). Sixteen (57%) patients had node-positive disease; among these, pN1=6 (38%), pN2=8 (50%), and pN3=2 (12%). Four of 28 (14%) patients received adjuvant chemotherapy post-R-RPLND, one (4%) patient developed recurrence at 10 months post-RPLND, and no patients required additional oncologic surgery. Chylous ascites was observed post-operatively in 3 (11%) patients. Median hospital stay post-surgery was 2 (IQR: 2-2.5) days. Ejaculation was retained in 12 (67%) of 18 patients who provided feedback.

Conclusion: With relatively short-term data, primary R-RPLND is a safe and efficacious procedure for carefully selected men with stage I and II NSGCTs. Long-term data and increased case numbers are needed to evaluate oncologic efficacy and the high rate of chylous ascites in comparison to open surgery.

Anthony Salerno, MS 2

Mentor(s): Pali Shah, MD
Pulmonary and Critical Care Medicine

Bronchoscopic transbronchial biopsies for assessment of lung allograft rejection: factors that impact specimen adequacy

Authors: Anthony Salerno M.Sc, Christopher Mallow MD MHS, Jonathan Orens MD, Pali Shah MD

Background: Transbronchial biopsy (TBBX) is the primary means to make a diagnosis of acute cellular rejection (ACR), in lung transplant recipients (LTR). Although consensus guidelines recommend at least five alveolated samples for histologic adequacy, procedures for obtaining histologic adequacy have not been well characterized. This study was designed to determine what factors impact the successful recovery of histologically adequate specimens for ACR grading.

Methods: Retrospective chart review of bronchoscopies performed on a surveillance schedule on 83 LTRs from JHH who underwent bronchoscopy between 12/15 and 2/19. The data was used to identify operator variables associated obtaining histologic adequacy. We examined procedure-based variables and complications (bleeding, pneumothorax, and hospital admission) in the assessment of 407 TBBX samples. Chi-squared tests, t-tests, Poisson, and Binomial regressions were used to determine significant associations with adequacy, number of alveolated samples, and complication rates.

Results: Of 407 biopsies, 161 (39.6%) did not have histologic adequacy. Although the median pass count was similar in bronchoscopies with and without histologic adequacy (9.60 vs 9.25, $p=0.111$), the number of total fragments recovered was significantly higher in bronchoscopies with histologic adequacy (6.61 vs 4.04 $p<0.01$). Neither proceduralist subspecialty, nor use of fluoroscopic guidance altered the yield of adequacy. Multivariate regression supported that total fragments was independently associated with of adequacy (AOR = 2.560 per fragment, 95% CI 2.219 – 3.154, $p<0.01$). Analysis of complications demonstrated no correlation in pneumothorax with pass count or fragments; pass count inversely correlated with bleeding (OR = 0.626, $p = 0.006$), possibly a reflection of early case termination upon bleeding.

Conclusion: Bronchoscopists may underestimate the number of total fragments obtained despite high pass counts during TBBX procedures. Centers that notice a high frequency of inadequate samples may benefit from consideration of additional passes if fragment count is lower than the expected medians above.

Anna Gong, MS 2

Mentor(s): Clifford R Weiss, MD
Department of Interventional Radiology

Effect of IV Bevacizumab Therapy on Visceral Arteriovenous Malformations in Patients with Hereditary Hemorrhagic Telangiectasia

Authors: Anna J Gong BA, Alex J Solomon MD, Muhammad A Latif MD, Clifford R Weiss MD

Background: Hereditary Hemorrhagic Telangiectasia (HHT) is a congenital, systemic disorder characterized by aberrant vessel formation. Clinical manifestations include hemorrhage secondary to telangiectasias and visceral arteriovenous malformations (AVMs). While bevacizumab, an anti-VEGF monoclonal antibody, can be used to treat severe epistaxis due to telangiectasias, there is limited data on its effect on visceral AVMs. We sought to assess the effect of bevacizumab on the imaging characteristics of visceral AVMs in patients with HHT.

Methods: A retrospective, electronic record review at a single, large academic center identified all patients with HHT. Patients with confirmed HHT diagnosis, visceral AVMs and pre- and post-bevacizumab imaging were included. Volumetric software within Picture Archiving and Communication System (PACS) was used to calculate AVM volume pre-and post- therapy. One-sample t-tests were used for statistical analysis.

Results: 565 patients with documented HHT were identified. 5 patients with a total of 21 visceral AVMs (4 Pancreatic, 5 Pulmonary and 12 Liver) met inclusion criteria. The most common reasons for exclusion were lack of bevacizumab therapy and/or inadequate imaging. The mean AVM volume pre-treatment was 90 mm³, 255 mm³ and 178 mm³ for pancreatic, pulmonary and liver AVMs, respectively. The mean AVM volume post-treatment was 23 mm³, 274 mm³ and 175 mm³ for pancreatic, pulmonary and liver AVMs, respectively. The mean percent change from pre- to post- bevacizumab was -78% \pm 11.9% (p = 0.007), 6% \pm 13.6% (p = 0.66), and -38% \pm 15.4% (p = 0.03) for pancreatic, pulmonary and hepatic AVMs respectively. One hepatic AVM, too large for volumetric analysis, saw a -8.33% change in diameter at the largest cross-section.

Conclusion: This preliminary data suggests that bevacizumab therapy produces a significant decrease in pancreatic and hepatic AVMs. Further study is needed to clarify this effect and its clinical implications.

Annie Cho, MS 2

Mentor(s): Nicholas Mahoney, MD and Joey Lopez, MD

Department of Ophthalmology and Department of Plastic and Reconstructive Surgery

Predicting orbitorrhea using optic nerve stretch in anterior skull base fractures

Authors: Annie Cho BA, Selim Gebran MD, Joseph Lopez MD, Nicholas Mahoney MD

Background: In patients who sustain a periorbital laceration, obliteration of the dura does not allow for formation of a discrete fluid cyst, and as such, visual findings such as optic nerve stretch and proptosis cannot be attributed to an intraorbital entity. This project examines the association between optic nerve stretch and orbitorrhea in trauma patients and aims to determine the role of optic nerve straightening as a predictor of dural violation and CSF leakage.

Methods: A retrospective study of trauma cases with and without anterior skull base fractures were identified in two centers from 2014 to 2017. Sagittal and axial Optic Nerve Tortuosity Index (ONTI) and Optic Nerve Angle (ONA) were measured using Multiplanar Reconstruction. Other study variables included age, sex, race, method of injury, and anatomic fracture location.

Results: This study consisted of 74 patients among two cohorts: (1) 37 cases with concomitant frontal sinus and orbital fractures and (2) 37 cases with isolated frontal sinus or orbital fractures. Within the combined fracture cohort, 13 cases presented with involvement of the anterior skull base and orbital roof, and 24 cases presented with involvement of the anterior table and orbit. Within the isolated fracture cohort, cases presented with zygomaticomaxillary complex, frontal sinus, or lateral orbital wall fractures. Among the combined fracture cohort, cases with involvement of the anterior skull base and orbital roof presented with an average axial ONTI of 0.57% and ONA of 1760; cases with involvement of the anterior table and orbit presented with an average axial ONTI of 2.3% and ONA of 1640. Among the isolated fracture cohort, cases presented with an average axial ONTI of 1.8% and ONA of 1620.

Conclusion: Combined skull and orbital fractures pose challenges for the clinicians treating these patients. Measurements of ONTI and ONA and its clinical implications warrant further investigation.

Breanne McCarthy, MS 4

Mentor(s): Chantel Cross, MD
Gynecology and Obstetrics - Reproductive Endocrinology

AKAP13 Interacts With the Vitamin D Receptor to Alter Vitamin D-Dependent Gene Activation in Uterine Fibroid Cells

Authors: Chantel Cross MD, Paul Driggers MD, Breanne McCarthy BS, James Segars MD

Background: Uterine leiomyomata (fibroids) are associated with vitamin D deficiency and treatment with vitamin D (1,25-dihydroxyvitamin D₃) reduces fibroid growth. Fibroids are characterized by an excessive, stiff extracellular matrix (ECM). Previous work has shown that A-kinase Anchoring Protein 13 (AKAP13) is overexpressed in fibroids and promotes pro-fibrotic responses. AKAP13 also interacts with nuclear receptors, but it is not known whether AKAP13 might interact with the vitamin D receptor (VDR) to affect vitamin D signaling in fibroids. This work sought to determine if AKAP13 interacts with the VDR to alter vitamin D-dependent signaling in fibroid cells.

Methods: Laboratory studies were conducted using human immortalized fibroid cells treated with 1,25-hydroxyvitamin D₃ (1,25(OH)₂D₃). Transfection experiments, quantitative real-time PCR (qPCR), GST-binding, small interfering RNA (siRNA) knockdown, and luciferase assays were performed. mRNA levels of AKAP13, fibromodulin, and versican were measured via qPCR. Vitamin D-dependent gene activation was assessed via luciferase reporter activity.

Results: 1,25(OH)₂D₃ resulted in a significant reduction in mRNA levels for AKAP13, versican, and fibromodulin. siRNA silencing of AKAP13 decreased both fibromodulin and versican mRNA levels. GST-binding assays revealed that AKAP13 bound to the VDR through its nuclear receptor interacting domain. Cotransfection of AKAP13 and VDR significantly reduced vitamin D-dependent gene activation. RhoA pathway inhibition partially relieved AKAP13's repression of vitamin D-dependent gene activation.

Conclusion: These data suggest that interaction of AKAP13 with the vitamin D receptor via the RhoA signaling pathway repressed vitamin D-dependent gene activation. This study thus offers a potential mechanistic understanding of the opposing effects of AKAP13 and vitamin D on fibroid growth and ECM proliferation, and may explain how vitamin D might reduce fibroid cell growth.

Caroline Qin, MS 2

Mentor(s): Steven Frank, MD

Department of Anesthesiology and Critical Care Medicine

Medication, Supply, and Blood Product Cost Awareness Among Anesthesia Providers

Authors: Caroline X. Qin BS, Brian C. Cho MD, Lekha V. Yesantharao, Kevin R. Merkel BA, Edward Lau PharmD, Michael A. Phelps MD, Tymoteusz J. Kajstura BS, Michael C. Grant MD, Steven M. Frank MD

Background: As the cost of health care in the United States continues to grow, there is an increasing emphasis on providers to practice high-value health care, which means increased quality at a decreased cost. Being cost conscious of the therapies they prescribe would help providers make informed decisions about the treatments they choose for their patients while practicing responsible resource stewardship. The objective of this study is to determine if anesthesia providers can accurately estimate what commonly used medications, supplies, and blood products cost to the hospital.

Methods: An anonymous survey was distributed in-person and electronically to providers in the Department of Anesthesiology/Critical Care Medicine at the Johns Hopkins Hospital from April-June 2019. The survey assessed provider knowledge of the cost of commonly used perioperative therapies using their estimate of the average wholesale price (AWP) of items from 12 categories (opioids, non-opioid analgesia, vasopressors, hypertension medications, antibiotics, neuromuscular blockers, reversals, anesthetics, supplies, kits, blood, and blood-related). Estimates were considered to indicate a moderate lack of knowledge if the median cost differed from the AWP by more than 25% and a severe lack of knowledge if by more than 50%.

Results: 107 surveys [CRNAs: 25(48%), Residents: 36(44%), Fellows/Attendings: 46(15%)] were returned. For all providers, the majority surveyed demonstrated a severe lack of knowledge for item costs. Accurate cost estimation was low, and similar among provider groups (CRNAs: 27%, Residents: 23%, Fellows/Attendings: 20%) ($P=0.34$). Rates of under and overestimation varied widely between items. Providers were most likely to accurately estimate the cost of neuromuscular blockers and blood products, underestimate vasopressors and blood-related products, and overestimate non-opioid analgesia and antibiotics.

Conclusion: All anesthesia providers generally have a poor understanding of cost for medications, supplies, and blood products. Given this lack of knowledge, provider education of cost may be beneficial for promoting high-value healthcare.

David Botros, MS 2

Mentor(s): Debraj Mukherjee, MD, MPH
Department of Neurosurgery

Assessing the Efficacy of Repeat Resection for Glioblastoma

Authors: David Botros BS, Adham Khalafallah MD, Debraj Mukherjee MD MPH

Background: Despite varying treatment regimens for recurrent glioblastoma (rGBM), median overall survival remains ~14 months. Controversy remains regarding the potential added survival benefit of repeat resection for GBM.

Methods: We retrospectively reviewed records of 191 adult patients with histologically-confirmed GBM treated at a tertiary care academic medical center. Covariates investigated included age, race, Stupp protocol completion, IDH-1 status, Karnofsky performance status (KPS) and extent of tumor resection (EOR) at first and repeat surgeries. Using Kaplan-Meier method, we plotted overall survival (OS) stratified by total number of surgeries. X²-testing was used for bivariate analyses. Multivariate maximum likelihood estimates analysis for OS was performed adjusting patient age, KPS, and EOR.

Results: One hundred and ninety one patients (119 male, median age: 60.5 years) met inclusion criteria. At time of last follow-up, 128 and 63 patients underwent 1 or 2+ total surgeries, respectively. Within the entire cohort, median OS was 12.4 months, while progression-free survival (PFS) was 9.4 months. Median OS/PFS for the 1 and 2+ total surgery groups was 8.3/8.3 and 16.9/10.4 months, respectively. In bivariate analysis, groups were equivalent except for a higher KPS in the 2+ surgery group ($p = 0.0023$).

Multivariate analysis demonstrated a hazard ratio (HR) for death of 0.62 ($p = 0.022$) in those who received repeat resection and 1.88 ($p = 0.0137$) for patients who failed to complete Stupp Protocol. EOR and KPS were not found to influence survival ($p = 0.23$ and 0.73).

Conclusion: Repeat resection for rGBM remains controversial. In our series, patients who received multiple resections demonstrated a remarkable increase in OS. Patients who failed to complete standard treatment due to adverse reactions or recurrence demonstrated significantly worse OS than counterparts who completed the Stupp Protocol.

Elizabeth Liu, MS 2

Mentor(s): Rita R. Kalyani, MD MHS

Department of Medicine, Division of Endocrinology, Diabetes & Metabolism

Prevalence of aspirin use for prevention of cardiovascular disease in U.S. adults with and without diabetes: National Health and Nutrition Examination Survey (NHANES), 2011-2016

Authors: Elizabeth Y. Liu BA, Mohammed E. Al-Sofiani MBBS MSc, Hsin-Chieh Yeh PhD, Justin B. Echouffo-Tcheugui MD PhD, Joshua J. Joseph MD, Rita R. Kalyani MD MHS

Background: The net benefit of aspirin for primary prevention of cardiovascular disease (CVD) has been controversial both in people with and without diabetes. Prevalence of aspirin use in older U.S. adults, particularly, has not been previously investigated but has significant clinical implications. We evaluated the prevalence of preventive aspirin use in older adults with and without diabetes in a nationally representative sample.

Methods: We performed a cross-sectional analysis of 2011-2016 National Health and Nutrition Examination Survey data of adults ≥ 40 years old who completed the aspirin questionnaire ($n=11,157$). Diabetes was defined as self-reported history or insulin use. CVD status was categorized as: “History of CVD”, “CVD risk factors”, and “No CVD with no CVD risk factors”. CVD risk factors included obesity, hypertension, albuminuria, hyperlipidemia, or family history of CVD. Logistic regression with key covariate adjustment was used to determine the relationship between age and aspirin use in people with versus without diabetes.

Results: Approximately 54.5% of U.S. adults ≥ 40 years old with diabetes used aspirin versus 26.7% of those without diabetes. In fully-adjusted regression models accounting for race, sex, education, smoking, CVD category, BMI, and waist circumference, among people with diabetes, the odds of aspirin use among age groups relative to age 40-49 were: age 50-59 years, OR=1.980 (1.168–3.356); age 60-69 years, OR=2.475 (1.527–4.011); age 70-79 years, OR=2.655 (1.538–4.581); age ≥ 80 years, OR=2.738 (1.532–4.895). In people without diabetes, corresponding ORs were: 50-59 years, OR=3.368 (2.652–4.277); 60-69 years, OR=6.373 (4.865–8.347); 70-79 years, OR=7.612 (5.968–9.710); ≥ 80 years, OR=9.758 (7.146–13.326).

Conclusion: In the U.S., preventive aspirin use is common among older populations that may be at risk for harm, including those with and without diabetes. These findings suggest that physicians should be aware of their patients’ aspirin use, and given recent guidelines, appropriately counsel them regarding risks and benefits.

Emerson Lee, MS 2

Mentor(s): G. Nina Lu, MD

Department of Otolaryngology Facial Plastic and Reconstructive Surgery

Dysphagia in a geriatric, care-seeking population: a descriptive study

Authors: Emerson Lee, BA, Jeremy Applebaum, BS, Lee Akst, MD

Background: Older adults (age > 65) are disproportionately impacted by dysphagia and suffer increasing consequences with age. However, it is important to recognize that older adults are by no means uniform. There has been little work exploring diagnosis and severity of disorders in geriatric otolaryngology. In this study, we aimed to characterize differences in the presentation of dysphagia across older-age subgroups.

Methods: A retrospective chart review was conducted for patients who presented to the Johns Hopkins Voice Center between April 1, 2015 and March 30, 2017. New patients with a chief complaint of dysphagia and age >65 qualified for inclusion. Patients were assigned to age sub-groups of young-old (65-74 years), middle-old (75-84), and old-old (>85), and categorization of dysphagia was by both anatomic location and etiologic category of mechanical obstruction or motor dysfunction. Primary univariate measures were used to describe the overall population. Secondly, bivariate analysis explored differences in dysphagia etiology between gender and age categories. Multivariate analysis was used to model predictors of dysphagia categorization and predictors of dysphagia-impairment score.

Results: 111 patients met inclusion criteria. 56.8% of patients were categorized as young-old, 29.7% as middle-old, and 13.5% as old-old. The most prevalent etiologies of dysphagia were obstructive causes (68.5%), and the most common anatomic source of dysphagia was esophageal. Common diagnoses were gastroesophageal and laryngopharyngeal reflux disease (19.8%), esophageal diverticular disease (17.1%), radiation-induced change (6.3%), and cricopharyngeal spasm (5.4%). No statistically significant difference was found between etiology of dysphagia, anatomic source, or dysphagia-impairment by either age subgroup or gender.

Conclusion: The most common causes of dysphagia were obstructive and esophageal in nature, with the top causes comprising of reflux-related disease, diverticula, and post-irradiative changes. These etiologies result in significant quality-of-life burden, pointing to the need for further research in the evaluation and treatment of dysphagia in older age.

Erik Almazan, MS 2

Mentor(s): Shawn G. Kwatra, MD
Department of Dermatology

Association of diabetes, cigarette smoking, liver disease, and headache with granuloma annulare: a case-control study

Authors: Erik Almazan B.A., Micah Belzberg B.A., Caroline X. Qin B.S., Benjamin Kaffenberger M.D., Jihad Alhariri M.D., and Shawn G. Kwatra M.D.

Background: Granuloma annulare (GA) is an idiopathic inflammatory cutaneous disorder that is usually benign and self-limiting. The association between GA and systemic conditions such as type II diabetes, dyslipidemia, liver disease, HIV, and malignancy remains unclear due to conflicting studies.

Methods: A retrospective analysis was performed of 82 patients with biopsy-confirmed GA treated at the Johns Hopkins Hospital System (JHHS) between 2009 and 2019. The comparison group included 164 age, race, and sex-matched healthy controls presenting as outpatients for regularly-scheduled skin checks or benign, localized chief complaints. Groups were compared using Student's t-test, Pearson Chi-squared, or Fisher's exact tests where appropriate.

Results: The mean age of GA patients was 58 ± 16 years, most were women (73%) and were non-Hispanic white (85%). Compared to controls, patients with GA had higher incidences of type II diabetes (15% vs. 3%; $P=0.0007$), liver disease (6% vs. 1%; $P=0.0429$), and headache disorders (15% vs. 6%; $P=0.0270$). Additionally, GA patients were more likely to report a smoking history (48% vs. 33%; $P=0.0257$). Previously reported associations between GA and dyslipidemia, solid organ malignancy, and HIV were not observed.

Conclusion: This case-control analysis of GA clarifies previous studies by replicating an association between GA and type II diabetes. The association between GA and smoking history, as well as headache disorders, have not been previously reported in a case-control study. The association between GA and liver disease, which has previously been reported only in small sample case reports, suggests an area for future investigation.

Evelyn Leland, MS 2

Mentor(s): Shawn G. Kwatra, MD

Leukocytoclastic vasculitis with and without IgA deposition is associated with renal damage: a case-control study

Authors: Evelyn Leland BS, Shawn G. Kwatra MD

Background: Leukocytoclastic vasculitis (LCV) is a small vessel vasculitis presenting with palpable purpura. Direct immunofluorescence (DIF) is routinely performed on skin biopsy to identify IgA deposition, which is thought to contribute to greater frequency of renal comorbidity associated with Henoch-Schonlein Purpura (HSP). Knowledge of characteristics between LCV +/- IgA deposition is limited. This study characterized presentations of LCV +/- IgA.

Methods: Charts identified in the JHH pathologic database system with biopsy confirmed LCV between 2009-2018 were reviewed. Patients were stratified by presence of IgA by DIF on skin biopsy to compare demographics, past medical history, clinical features, and hospitalization characteristics. Univariate analyses were performed using χ^2 tests and t-tests in STATA.

Results: Of 162 biopsy confirmed LCV cases, 118 (72.8%) had DIF performed. HSP was diagnosed in 46 (39.0%) based on IgA deposition. Median age was 54 (IgA-) and 51 (IgA+). Cases were 40.5% (47, IgA-) and 37.0% (17, IgA+) male. HSP patients were more likely to be Hispanic (7.5% vs. 1.0%; $\chi^2=0.040$) with no identified cause of vasculitis (55.8% vs. 37.9%, $\chi^2=0.046$). LCV was associated with elevated CRP (average 8.66 vs. 3.41; $\chi^2=0.015$). Differences in comorbidities included pulmonary hypertension (IgA- 3.7%, IgA+ 14.0%; $\chi^2=0.024$) and peripheral vascular disease (IgA- 22.6%, IgA+ 7.0%; $\chi^2=0.024$). No difference in kidney involvement (hematuria, pyuria, or proteinuria) was observed (IgA- 60.7%, IgA+ 54.3%, $\chi^2=0.545$). There was no difference in prevalence of AKI or CKD at diagnosis (IgA- 28.4%, IgA+ 30.6%, $\chi^2=0.810$) or within 365 days (IgA- 31.5%, IgA+ 42.9%; $\chi^2=0.230$).

Conclusion: Patients with LCV +/- IgA deposition are both at heightened risk of renal disease, suggesting all LCV cases should be followed for potential renal injury. Future studies should evaluate differences in pathogenesis and natural history and investigate the impact of skin biopsy and DIF in the management of patients presenting with palpable purpura.

Feras Shamoun, MS 3

Mentor(s): Nho V Tran
Mayo Department of Plastic Surgery

The Evolving Trends in the Impact Factor of Plastic Surgery Journals: A 22-Year Analysis

Authors: Feras Shamoun BSc, Malke Asaad MD, Nho V. Tran MD

Background: The journal impact factor (IF) is one of the most widely adopted metrics to assess journal value. We aimed to investigate the trends in the IF and ranking of plastic surgery journals (PSJs) over a 22-year period

Methods: The Journal Citation Report 2018 was used to identify all journals within the field of plastic surgery from 1997 to 2018. We analyzed the IF of PSJs and that of the category 'Surgery'. Statistical analysis using the T-test was performed to compare groups.

Results: A total of 34 PSJs were identified. The mean IF increased from 0.584 (median 0.533) in 1997 to 1.58 (median 1.399) in 2018; $p < 0.0001$. Over the same time, the median IF of the journals in the category 'Surgery' increased from 0.914 to 1.883. The mean journal IF percentile of PSJs within 'Surgery' remained stable, ($p = 0.999$). A strong positive correlation was identified between the IF of PSJs and both the 5-year IF ($r = 0.943$, $p < 0.0001$) and the immediacy index ($r = 0.736$, $p < 0.0001$). The percentage of self-citations across the study period was fairly stable at a mean of 19.2%. A weak positive correlation was found between the IF and the percentage of self-citations ($r = 0.171$, $p < 0.0001$).

Conclusion: The mean journal IF in PSJs has been trending upwards over the last 22 years. Ranking of PSJs IF within the category 'Surgery' has remained unchanged. The self-citation rate has been fairly stable and correlated weakly with the IF. A strong positive correlation exists between the IF and both the immediacy index and the 5-year IF.

Galen Shi, MS 2

Mentor(s): Shawn G. Kwatra, MD
Department of Dermatology

Erythema Multiforme: Characteristics, Associations, and Treatment in a Series of Johns Hopkins Hospital Patients

Authors: Galen Shi BA, Shawn G. Kwatra MD

Background: Erythema Multiforme (EM) is an acute, immune-mediated, self-limited syndrome with distinctive skin lesions.¹ EM is subcategorized as major, minor, or recurrent with a multifactorial etiology including infections and medications.² The exact incidence of EM is unknown, but is estimated between 0.01%-1%³, occurring in young adults between the ages of 20 and 40. ^{4,5} We aimed to describe clinical characteristics, associations, and treatments for EM patients at our center.

Methods: A retrospective cohort study of patients seen at JHH with a pathology-confirmed diagnosis of EM from 2009 to 2019. Variables collected included demographic characteristics, co-morbid conditions, concomitant medications, number and type of treatments, and documented underlying cause.

Results: A total of 21 patients were included, of whom 12 (57%) were female and 9 (43%) were male with a mean (SD) age at time of diagnosis of 55.2 years (+/-21.8). 57% of patients were white/Caucasian and 38% were black/African American. 6 patients (29%) were hospitalized with a mean length of stay (SD) of 5.6 days (+/-4.9). According to clinical guidelines, cases were categorized into major (57%) and EM minor (43%), of which 29% were recurrent EM. 11 (52%) cases were precipitated by viral infection (most common cause HSV (55%)), 9 (43%) were precipitated by drugs (most common cause Bactrim (56%)) and 1 case was of paraneoplastic etiology. 14 (67%) patients presented with classic targetoid lesions and 12 (57%) patients presented with mucous membrane involvement. 16 patients (76%) were treated with either topical or systemic steroids, 7 patients (33%) were treated with Valtrex/acyclovir.

Conclusion: Pathology confirmed EM is rare. In this cohort diagnosed at Hopkins over a 10-year period, the study found an older age of diagnosis, fewer cases caused by infection, and greater cases caused by drugs than previously reported literature.

Gilberto Lobaton, MS 2

Mentor(s): Amit Jain, MD
Department of Orthopaedic Surgery

Workforce and Compensation Trends in Maryland Hospitals after Introduction of Global Budget Revenue

Authors: Gilberto O. Lobaton BS, Majd Marrache MD, Olivia Petrusky BS, and Amit Jain, MD

Background: In 2014, Maryland implemented a Global Budget Revenue (GBR) hospital payment system, whereby all hospitals receive a flat annual amount for all hospital-based services versus volume-based fee for service. In this study, we examine the effects of the GBR on trends in workforce salary. Secondary objectives included assessing male vs female prevalence in executive positions and differences in average salary.

Methods: We examined 48 Maryland hospital's IRS 990 forms for 2012, 2013 (pre-GBR), and 2015, 2016 (post-GBR). Data collected included revenue, employee count and salary, and executive positions' count, salary, and sex. Executive positions included President and/or Chief Executive Officer (P/CEO), Chief Financial Officer (CFO), Chief Medical Officer (CMO), Chief of Nursing (CON), and Chief Operating Officer (COO). All monetary values were inflation-adjusted to the 2016 dollar.

Results: Comparing pre and post-GBR, there were no significant differences in total employee compensation, total executive compensation, nor P/CEO, CFO, CON, CMO, and COO salary as a percentage of hospital revenue. There was a significant decrease in average compensation per hospital employee (0.0357% vs 0.0327%, $p=0.001$), with no significant difference in average compensation per hospital executive. Prevalence of female executives was lower in P/CEO (15.6% vs 84.4%), CFO (27.7% vs 72.3%), CMO (14% vs 86%), and COO (30.6% vs 69.4%). CON showed a higher prevalence of females (90.3% vs 9.7%). Male COO's and CON's had significantly higher salaries vs females (0.20% vs 0.14%, $p=0.039$ and 0.31% vs 0.16%, $p=0.049$). There were no significant differences between male vs female salary for P/CEO, CFO, and CMO.

Conclusion: GBR implementation showed non-significant differences in several parameters related to employee and executive salary, except for a decrease in average employee compensation as a percentage of revenue. Prevalence of female vs male executives was lower in all positions except CON, and male salary was significantly higher for COO's and CON's.

Glory Mgboji, MS 2

Mentor(s): Mindy Christianson, MD

Department of OB/GYN, Reproductive Endocrinology and Infertility

Predictive Factors for Fertility Preservation in Pediatric Patients with Planned Gonadotoxic Treatment

Authors: Glory Mgboji BS, Christina C. Mitchell MD, Mindy S Christianson MD

Background: Many childhood diseases, including cancer, are highly curable. However, current treatments put female patients at risk for permanent infertility due to egg supply depletion. Primary fertility preservation options for young females include ovarian tissue cryopreservation (OTC) and oocyte vitrification (OV). Our objective was to characterize pediatric fertility preservation patients and identify predictive factors for fertility preservation treatment. We hypothesized that factors preventing patients from opting for fertility preservation may include cancer type, prior therapies, race, and socioeconomic status.

Methods: We performed a retrospective analysis of female pediatric patients seen for fertility preservation consultation at an academic fertility center between 2005 and 2019. Patient data was characterized and fertility preservation rates were determined among several subgroups.

Results: In the study period, 106 females ages 3-21 were seen for consultation with a mean age of 16.5. Of these, 12.7% were premenarchal. Top diagnoses included the following malignancies: hematologic (41.5%), sarcomas (16.0%), inherited anemia (9.4%), and neurologic (8.5%). 64.2% of all patients pursued fertility preservation with treatments including OV (35.8%) and OTC (23.6%). Mean age of those undergoing OV was 17.7 with top diagnoses including hematological malignancies, ovarian cancer and inherited anemias. Mean age of patients undergoing OTC was 13.2 with top diagnoses including hematological malignancies, sarcomas, and ovarian cancer. 41.5% of patients had prior chemotherapy, and had lower rates of fertility preservation (45.5%) compared to patients who did not receive prior chemotherapy (77.4%). Additionally, patients who sought fertility preservation consultation within one year after their diagnosis had higher fertility preservation rates (69.7%) compared to patients who presented after one year (55.0%).

Conclusion: Prior gonadotoxic therapy and longer elapsed time from diagnosis are potentially negative predictive factors for fertility preservation therapies in female pediatric patients. Future studies with larger patient sample sizes will be needed to confirm the implications of these data.

Grace Ma, MS 3

Mentor(s): Emily Johnson, MD
Department of Neurology

New Onset Epilepsy during Pregnancy

Authors: Grace Ma BS, Emily Johnson MD

Background: Epilepsy is a disease of recurrent, spontaneous seizures. In women, seizure frequency and severity may be affected by changes in serum hormone levels. Women with epilepsy may therefore have an increase in seizures during pregnancy. More rarely, pregnant women can develop new-onset epilepsy. In this study, we investigated the frequency of new-onset seizures in pregnant women at Johns Hopkins, and of seizure recurrence after pregnancy.

Methods: We searched the medical records of women seen at Johns Hopkins from 2011-2016 for concomitant diagnoses of “pregnancy” and “seizure” or “epilepsy,” without “eclampsia.” We reviewed the records to identify women without prior seizure history who had events concerning for seizure during pregnancy. We obtained follow up information on those who had true epileptic seizures during pregnancy via chart review or telephone call, to determine if they had seizures after delivery.

Results: Over this five-year period, 41,869 women received care at Johns Hopkins during pregnancy. 211 had a diagnosis of seizure or epilepsy during pregnancy, and 84 had at least one event concerning for seizure during their pregnancies. Of these, 11 had a first-time event concerning for seizure during pregnancy. Five had first-time epileptic seizures confirmed by EEG. All women delivered at term with no major complications. Four of these women continued to have seizures after pregnancy and are treated with antiseizure medications, while one has not had further seizures.

Conclusion: New onset seizures during pregnancy are rare. Most women with first-time seizures during pregnancy also had seizures after pregnancy, thus representing a first presentation of epilepsy rather than seizures provoked solely by the hormone changes of pregnancy. Taking into account potential teratogenicity, women who develop epileptic seizures during pregnancy benefit from initiation of appropriate anti-epileptic treatment due to the risks of uncontrolled epilepsy for mother and fetus.

Ha Vi Nguyen, MS 4

Mentor(s): Anne Burke, MD
Department of Gynecology and Obstetrics

The Clinical Importance of Postpartum Contraception Upon Hospital Discharge

Authors: Ha Vi Nguyen BS, Yangshu Pan MD, Anne Burke MD, MPH

Background: The immediate postpartum period is critical for contraceptive provision due to rapid fertility return but only half of women attend the postpartum visit. Our objective was to examine whether immediate postpartum contraception influenced the likelihood of postpartum follow-up or subsequent pregnancies within 3-years of delivery.

Methods: We conducted a retrospective chart review of hospital deliveries from April–July 2015 and reviewed follow-up data through 2018. The primary outcome was immediate postpartum contraception (provided before discharge). Secondary outcomes were postpartum visit attendance, follow-up after postpartum visit, and subsequent pregnancies within 3 years. Chi-square analysis was used for between-group comparisons.

Results: Among 307 patients, the largest percentage (n=76, 24.8%) received contraceptive implants. Only 44.3% (n=133) of women returned for the postpartum visit; there were no differences by contraceptive method. There were 171 (55.7%) women without follow-up past the postpartum period. Patients who received LARC or permanent contraception immediately postpartum were less likely to follow up after the postpartum visit (n=52, 38.2%) compared to less effective methods (n=84, 61.8%; $p=0.03$). Of 55 women with subsequent pregnancies, 13 (23.6%) had been discharged with LARC, and 42 (76.4%) with less effective methods or no method ($p<0.001$).

Conclusion: Less than half of patients returned for postpartum care. Women discharged with LARC or permanent methods were less likely to have follow-up after the postpartum visit, or have subsequent pregnancies within a 3-year time frame compared to women discharged with less effective or no contraception. Results highlight the importance of offering contraception in the immediate postpartum period.

Heba Mahjoub, MS 2

Mentor(s): Vered Stearns, MD
Department of Oncology - Breast Cancer

Analysis of tumor characteristics and circulating tumor DNA (ctDNA) in women with early stage hormone receptor (HR)-positive breast cancer

Authors: Heba Mahjoub BS, Jennifer Lehman BS, Alessandro Leal MD PhD, Elaine Walsh MD PhD, Victor Velculescu MD PhD, and Vered Stearns MD

Background: In 2019, breast cancer is the leading tumor type diagnosed in women in the US and the second leading cause of cancer-related death. Patients with HR-positive/HER2-negative early stage breast cancer without nodal involvement are candidate for the Oncotype Dx (ODX) assay to guide adjuvant systemic therapy recommendations. This assay uses a gene-expression panel to predict a 10-year risk of distant recurrence. We hypothesized that low ODX scores will less likely be associated with the presence of ctDNA.

Methods: We conducted a retrospective chart review study in patients who previously enrolled in the Johns Hopkins Breast Cancer Program Longitudinal Repository. We included women who were diagnosed with HR-positive/HER2-negative, node-negative tumors between 4/29/09-12/11/18 and for whom blood samples were available before and after the definitive breast surgery. We performed multivariable regression analyses to compare patient/tumor characteristics and presence/absence of ctDNA. These characteristics include age, race, stage, future recurrence, ER/PR status, HER2 status, ethnicity, histology, surgery type, tumor size, grade, ki-67 proliferation index, and ODX score. We used Next Generation Sequencing to analyze 58 genes that could show ctDNA mutation, including TP53, PIK3CA, and EBB4.

Results: Among 43 patients, the average age was 56.5 +/- 10.2 years. 41 (95%) were white women, while 2 (5%) were black women. We were not able to identify statistically significant differences between low, intermediate, and high ODX when compared with age ($p=0.88$), race ($p=0.16$), ethnicity ($p=0.45$), stage ($p=1.00$), surgery type ($p=0.53$), histology ($p=0.14$), side ($p=0.38$), size ($p=0.87$), grade ($p=0.82$), receptor status ($p=0.013$), future recurrence ($p=0.16$), and ki-67 ($p=0.095$). ctDNA analysis is pending.

Conclusion: Patients with different patient and tumor characteristics were not statistically more likely to have a certain ODX score. We will compare ODX and patient and tumor characteristics with presence or absence of ctDNA. Our results can help guide adjuvant systemic therapy decisions.

Matthew Tan, MS 2

Mentor(s): Allan Gottschalk, MD
Department of Anesthesia and Critical Care

Accuracy of propofol doses in the electronic medical record (EMR) system

Authors: Tan, Matthew; Al-Grain, Haithem; Norgaard, Katherine; Shin, Eunji; Hsu, Aaron; Kearns, Niki; Faraday, Nauder; Abernathy, Jake; Parish, Michelle; Dalesio, Nick; Gottschalk, Allan; Lester, Laeben

Background: Anesthesiology is transitioning from paper documentation to electronic medical records (EMR) to streamline patient care. One hypothesized benefit of EMR is the opportunity to retrospectively find trends within perioperative data. Although EMR is perceived as more accurate than paper documentation, quantitative validation of EMR accuracy is lacking. In this study, we compare the EMR propofol dose against the records of an independent observer.

Methods: 4 independent observers were randomly assigned to 110 endoscopy procedures. Each procedure involved sedation with propofol, administered by a CRNA and a supervising attending. The observers were research assistants trained and familiar with propofol and sedation. They recorded the infusion rate, bolus dose, and time of administration of propofol throughout the entire procedure.

Results: Complete data sets were collected from observer and EMR data for 109 procedures. Bland-Altman plot of percent error in propofol dosing ($100 \times (\text{EMR} - \text{observed}) / ((\text{EMR} + \text{observed}) / 2)$) versus the average of propofol dose observations $((\text{EMR} + \text{observed}) / 2)$ was used to analyze the data. The bias and slope of the corresponding regression line were not significantly different from zero (bias = -4%, $p = 0.39$; slope = 0.003, $p = 0.77$). About 20% of the subjects had errors in total propofol dose of greater than 20%. Within the 109 procedures, 100 patients received both propofol bolus and infusions, while 9 received only boluses. Within the bolus plus infusion group, 50% had errors in total propofol dose greater than 10%, compared to 30% of the bolus only group.

Conclusion: There is discordance between propofol doses recorded by an independent observer and that within the EMR, but there is no significant bias that favor omission or commission. With increased interest in retrospective studies, it is important to consider the extent of error within sedative dose data in the EMR in the analysis and interpretation of the results.

Meghana Jami, MS 2

Mentor(s): Adam Levin, MD
Department of Orthopaedic Surgery

Treatment and Prognosis of Patients with Skip Metastasis and Extremity-Only Osteosarcoma: A Case Series

Authors: Meghana Jami BS, Adam S. Levin MD, Carol D. Morris MD

Background: Skip metastases in osteosarcoma is a rare event, estimated to occur in approximately 2% of cases. It is defined as a focus of disease within the same bone that is both radiographically and histologically separate from the primary tumor. Patients with skip metastases are classified as Stage III according to the AJCC Staging System. Due to the rarity of this clinical scenario, little is known about the prognosis and management of this subset of patients. We sought to characterize patients with skip metastasis and osteosarcoma in order to better understand treatment and prognostic trends.

Methods: A Cancer Registry Database of orthopedic oncology patients from 1991-2017 at the Johns Hopkins Hospital was retrospectively reviewed. Inclusion criteria for the study included having osteosarcoma localized to the extremity and skip metastasis present at the time of diagnosis. Following identifying skip metastasis cases, clinical, imaging, and pathologic data were analyzed to identify trends in type of surgery, margins of resection, chemotherapy treatment protocol, and disease-specific survival.

Results: Out of the 328 patients reviewed, 125 were diagnosed with extremity-only osteosarcoma. Nine patients within this subgroup presented with skip metastasis (7.2%). Seven cases were located in the femur, and two in the tibia. The majority of patients (6/9) presented with distant metastases at the time of diagnosis— of which, five had lung metastases. All patients were treated with standard MAP (methotrexate, doxorubicin, and cisplatin) chemotherapy. All patients underwent limb salvage surgical resection with negative margins. Six had died of disease, and three are alive with no evidence of disease. The mean follow up time was 54.4 months.

Conclusion: The incidence of skip metastases in our cohort was 7.2%. Skip metastases in osteosarcoma carries a poor prognosis. Innovative treatment strategies are needed to improve outcomes in patients with Stage III disease.

Michelle Colbert, MS 2

Mentor(s): Justin Bailey
Department of Infectious Disease

Broadly-neutralizing antibodies with the same antigenic specificity show preference for single polymorphisms within the AR3 epitope

Authors: Michelle Colbert, Nathan Board, Justin Bailey MD PhD

Background: A vaccine for hepatitis C virus (HCV) is urgently needed due to high cost of treatment and possibility of reinfection after cure. Development of broadly neutralizing antibodies (bNAbs) during acute infection is associated with HCV clearance, as they target conserved viral epitopes. Identifying these epitopes could elucidate the specificity and function of bNAbs that should be induced by a vaccine. The AR3-antigenic site of hepatitis C envelope glycoprotein E2 is a target of several bNAbs characterized to date. HCV resistance to these bNAbs may reduce the efficacy of a vaccine and must be considered when engineering a vaccine antigen. In this study, we use a novel computational method, Subject-adjusted Neutralizing Antibody Prediction of Resistance polymorphisms (SNAPR) to identify viral resistance polymorphisms against five bNAbs that target the AR3 epitope: HEPC3, HEPC74, HEPC74 RUA, HEPC153, and HEPC153 RUA. These antibodies have broadly-neutralizing activity against a diverse panel of genotype 1 and 2 HCV strains; compared to their mature counterparts, RUA antibodies have no somatic hypermutations.

Methods: Using site-directed mutagenesis, the resistance polymorphisms identified through SNAPR were individually introduced into a wild-type viral strain to create 13 mutant clones and were expressed as soluble E2 (sE2) proteins for use in ELISA. Binding to each mutant sE2 was quantified and compared to wild-type to determine the effect of the polymorphisms on bNAb binding.

Results: We discovered that some sE2 mutants enhance binding compared to wild-type, and those same mutants minimally affect binding of other bNAbs. For example, 5/13 mutants enhanced HEPC74 binding and the same 5 mutants did not significantly enhance binding to HEPC153. In addition, 3/13 mutants had enhanced binding to the germline bNAbs.

Conclusion: In conclusion this data suggests that it is possible to engineer a vaccine E2 antigen that would enhance the binding of these potent front-layer specific bNAbs.

Mitchell Huang, MS 4

Mentor(s): Kevin Koo
Department of Urology

Evidence-Based Analysis of Online Consumer Information about Prostate Artery Embolization for Benign Prostatic Hyperplasia

Authors: Mitchell M. Huang BA, Jared S. Winoker MD, Brian R. Matlaga MD, Mohamad E. Allaf MD, Kevin Koo MD

Background: Prostate artery embolization (PAE) is an investigational treatment for benign prostatic hyperplasia (BPH). Guidelines from the American Urological Association (AUA), European Association of Urology, and National Institute for Health and Care Excellence have conflicting interpretations of the evidence on PAE. Due to increased patient demand for minimally-invasive BPH treatments, this study evaluated the information about PAE that patients may encounter online.

Methods: We queried Google with different forms of “BPH” to determine how frequently PAE is encountered in BPH searches. We performed 10 additional queries of “PAE” alone and with terms related to safety and efficacy, analyzing the first 20 search results from each query for descriptions of PAE and guideline-recommended practice.

Results: Of 57 unique sites encountered in BPH treatment-related queries, 15 (27%) discussed PAE as a treatment option. Based on additional PAE-specific queries, we found 50 unique sites from a range of sources, the majority of which were academic institutions (32%) and academic journal articles (32%). 20 (40%) sites were hospitals offering PAE to patients; 16 (80%) were academic institutions, and only 3 (15%) offered PAE in clinical trials as recommended by AUA guidelines. Discussion of benefits and risks of PAE were biased toward benefits; 88% of search results cited benefits of PAE, and only 58% mentioned risks. 1 in 4 sites provided inaccurate or non-evidence-based claims, such as overstatement of PAE’s efficacy (14%), characterizing transurethral resection of the prostate as “risky” or “invasive” (12%) and arguing that PAE should be offered to more or all patients (12%), which was inconsistent with all 3 guidelines we analyzed.

Conclusion: One-quarter of PAE-specific sites that patients are likely to encounter contain potentially misleading claims. Contrary to AUA guidelines, 85% of institutions offering PAE do so outside of clinical trials. Urologists should carefully counsel patients interested in PAE about evidence-based benefits and risks.

Nanki Hura, MS 3

Mentor(s): Nicholas Rowan, MD
Department of Otolaryngology - Head and Neck Surgery

Atypical Presentation of Silent Sinus Syndrome: A Case Report and Literature Review

Authors: Nanki Hura, B.S., Omar G. Ahmed, M.D., Nicholas R. Rowan, M.D.

Introduction: Silent sinus syndrome (SSS) is a condition characterized by ophthalmologic features, such as spontaneous enophthalmos and hypoglobus with ipsilateral maxillary sinus atelectasis and an otherwise asymptomatic presentation. SSS has been documented secondary to a number of external causes, including trauma or surgery, but has less commonly been described in the setting of a potential mass in the deep masticator space.

Case Presentation: A 56-year-old woman with a history of chronic headaches with normal prior sinonasal imaging presented with increasing right-sided facial pain and headaches that radiated to her occiput, subjective visual changes, sharp ear pain, and longstanding subjective diminished sense of smell. Physical exam was normal, while nasal endoscopy demonstrated lateral bowing of the medial maxillary wall on the right. Magnetic resonance imaging demonstrated a homogenous 2x2x2.4 cm T1- and T2-weighted, hyperintense mass lesion in the deep masticator space splaying the right medial and lateral pterygoid muscles concerning for a possible lipomatous lesion. Computed tomography revealed an atelectatic and opacified maxillary sinus with inward bowing of the posterior maxillary wall and increased orbital volume on that side. Endoscopic maxillary antrostomy was performed with biopsy of the retromaxillary space lesion and with near immediate resolution of the patient's symptoms. Histologic examination of the mass demonstrated mature adipose tissue with few aggregates of benign small vessels.

Discussion: This is an unusual presentation of SSS, with an accompanying enlargement of the retromaxillary fat pad. We herein review our clinical experience with SSS and provide a literature review of the presentation, management and perioperative considerations for SSS.

Prachi Aggarwal, MS 2

Mentor(s): Shawn Kwatra, MD
Department of Dermatology

The natural history of prurigo nodularis: an online, global questionnaire-based study

Authors: Prachi Aggarwal BA, Shawn Kwatra, MD

Background: Prurigo nodularis (PN) is characterized by intensely pruritic nodules on the extremities and trunk. No FDA approved therapies currently exist for PN and many patients are recalcitrant to therapy. Despite the significant morbidity of disease, limited epidemiologic studies describe the natural history of PN and its impact on quality of life. Our objective was to characterize demographic characteristics, severity of symptoms, and quality of life of patients with PN.

Methods: An anonymous, online Qualtrics survey was developed and delivered to 4,353 patients via four Facebook PN support groups between August and September 2019. The survey assessed symptoms associated with PN, but also utilized established quality of life (QoL) measures including the Dermatology Life Quality Index (DLQI), the 5-D pruritus scale and the Pittsburgh Sleep Quality Index (PSQI) to assess patient QoL.

Results: We received a total of 171 completed surveys for a response rate of 5.3%; 57% of the respondents were from the U.S. and 22.8% from the U.K. The mean (SD) age of respondents was 52.3 (13.2) years with the majority being female (92%) and Caucasian (77.2%). 67.1% of patients described having itch in both nodules and the intervening skin. In these patients, 69.8% of itch was concentrated in the nodules. For associated sensations, 62% felt prickling, 56.7% felt pain, 53.8% felt stinging and 52.6% felt burning. A total of 18.7% of patients had the atopic triad. PN patients had a mean (SD) DLQI of 16.4 (7.6), 5D pruritus score of 16.8 (4.1) and a PSQI of 11.6 (4.6). Compared to the mean scores of atopic dermatitis and psoriasis, these scores are significantly lower and suggest that PN patients have a significantly decreased quality of life compared to other chronic itch conditions.

Conclusion: PN is associated with severe symptoms including pain, stinging, prickling, and burning sensations. Itch is largely localized to nodules.

Ravi Medikonda, MS 4

Mentor(s): Michael Lim, MD
Department of Neurosurgery

The Effects of Postoperative Neurological Deficits on Survival in Patients with Single Brain Metastasis

Authors: Ravi Medikonda BA, Christopher Jackson, MD, Michael Lim, MD

Background: The prognosis for brain metastasis is poor, and the current standard of care for single brain metastasis includes surgical resection. In the glioblastoma literature, development of neurological deficits after surgical resection has been associated with worsened outcomes. However, the effects of post-operative neurological deficits on survival in patients with single brain metastasis has not been investigated to date, and is therefore the purpose of this current study.

Methods: A single-institution retrospective cohort study was performed on all patients with single brain metastasis undergoing surgical resection by a single neurosurgeon.

Results: 126 patients met the inclusion criteria for this study. 66% of patients presented with a pre-operative deficit, and 3.9% of patients developed a new permanent post-operative deficit. Median overall survival in patients with a new post-operative deficit was 3.1 months whereas median overall survival in patients without a post-operative deficit was 8.0 months. Furthermore, in the cohort of patients without a pre-operative deficit, development of a new post-operative deficit was associated with the lowest median overall survival of 1.6 months.

Conclusion: This study suggests that a new neurological deficit after surgical resection of a single brain metastasis is associated with worsened outcomes. This finding has potential implications for patient selection and counseling. Furthermore, these data provide further rationale for continuing to refine less invasive surgical techniques in the resection of brain metastases, particularly for lesions that are deep-seated or in eloquent locations.

Rohan Bajaj, MS 4

Mentor(s): Allen Eghrari, MD
Department of Ophthalmology

A Quantitative Method of Grading Fuchs' Dystrophy Using Images Taken at the Slit Lamp

Authors: Rohan Bajaj BS, Tejus Pradeep BS, Allen Eghrari MD

Background: Fuchs' Dystrophy is an ocular condition in which the innermost layer of the cornea degenerates. Objective tests such as specular-microscopy, pachymetry, and retro-illumination are used to grade disease severity and guide management. However, each test has its limitations: the former two have varied baseline values amongst individuals, and the latter requires dilation and an experienced ophthalmic photographer. Here, we test a method which we hypothesize will help determine the grade of Fuchs' Dystrophy using a cellphone camera.

Methods: Images were taken at the slit lamp with an iPhone 4S and analyzed using ImageJ. Half the slit beam in images was fractioned into four equally-sized sections, and the number of guttae were recorded within each. The ratio of guttae in the peripheral section to those in the center section was correlated to the clinical severity (on a scale of 0.5 to 5) through Spearman's Correlation Coefficient. A Wilcoxon rank sum test was used to compare cases of mild disease (clinical severity of 0.5-2) to severe disease (clinical severity of 3-5).

Results: Images from 15 patients, of whom 9 (60%) were female, were analyzed. The cohort had an average age of 67.13 years and a mode Fuchs' clinical severity of +4. An increase in the peripheral/center guttae ratio was correlated to an increased Fuchs' clinical severity ($S=201.56$; $p=0.017$). Moreover, there was a significant difference in the peripheral/center guttae ratio between mild and severe cases ($W=33$; $p=0.031$).

Conclusion: The ratio of guttae between the peripheral and central cornea can help determine the severity of Fuchs' Dystrophy. Our technique is advantageous because it avoids eye dilation and allows for a standardized baseline of zero guttae which can be used to gauge disease progression. Moreover, it requires less skill and fewer resources, so it has the potential of improving management of patients with Fuchs' Dystrophy in low-resource settings.

Sharon Pang, MS 2

Mentor(s): Ferdinand Hui, MD
Department of Interventional Radiology

Health Outcomes in Older Adults Undergoing Endovascular Therapy for Acute Ischemic Stroke

Authors: Sharon Pang BA, Risheng Xu MD, Sasicha Manupipatpong BA, Paul Choi BA, Sophie Roh BA, Rafael Llinas MD, Ferdinand Hui MD

Background: One of the most clinically significant procedures for stroke patients is endovascular therapy (ET). There have been many conflicting studies on the benefits and consequences of ET for older ischemic stroke patients. This study aims to compare the safety and efficacy of ET in older and younger stroke adults.

Methods: We conducted a retrospective review of 232 patients who underwent ET for acute ischemic stroke at Johns Hopkins Hospital and Bayview Hospital from January 2014 to January 2019. Demographic, procedural, and outcome variables, including mortality, functional independence measured with 90-day modified Rankin scale (mRS), and neurological impairment measured with NIH Stroke Scale (NIHSS) were compared between patients less than 80 years old (n=162) and 80+ years old (n=70).

Results: The average age of the younger group was 60.7 (SD 14.35), while the average age of the older group was 86.8 (SD 5.05). On initial presentation, older patients presented with higher NIHSS (17.1, SD 5.8) than the younger patients (15.3, SD 6.9, $p=.02$). In-hospital mortality due to neurological deterioration or procedural complications was higher in the older patients (45.7%) compared to the younger patients (23.5%, $p<.001$). Additionally, at a three-month follow-up, older patients had significantly lower rates of functional independence, defined as a mRS score of 0-2 (48.7% vs. 28.1%, $p=.039$). However, there were no age group-related impairment based on NIHSS at 3 months ($p=.73$).

Conclusion: While our findings suggest that ET is associated with higher rates of mortality and lower rates of functional independence in the older patients, there were no apparent differences in neurological impairment at 3 months between the two groups. These findings raise concern about the risk-benefit ratio in treating older adults with ET and point to a need for more nuanced evaluation of possible subgroups of elderly patients to better understand who would most benefit.

Xinyi Chen, MS 2

Mentor(s): Fasika Woreta, MD, MPH
Department of Ophthalmology

Factors Influencing Post-Graduate Career Decisions of Ophthalmology Residents

Authors: Xinyi Chen BS, Sidra Zafar MD, Divya Srikumaran MD, Michael V. Boland MD PhD, Thomas V. Johnson MD PhD, Laura Green MD, Saras Ramanathan MD, Jeff Pettey MD, Steven J. Gedde MD, Fasika A. Woreta MD MPH

Background: After residency, ophthalmology residents either pursue subspecialty training or start practicing comprehensive ophthalmology. A 2011 study by Adelman et al. reported a consistently growing demand for subspecialist ophthalmologists. Other recent studies have noted current and future shortages in certain subspecialties such as glaucoma, pediatric ophthalmology and neuro-ophthalmology. The purpose of this study is to identify factors that influence ophthalmology residents' decisions to pursue fellowship training or to practice comprehensive ophthalmology after residency.

Methods: An anonymous survey was sent to ophthalmology residents in the U.S. from the graduating Class of 2018 and Class of 2019. The main outcome measure was the decision on whether to seek fellowship training or to practice comprehensive ophthalmology. Information on demographics, residency program characteristics and factors influencing career choices were collected.

Results: The overall response rate was 16.4% (153/931). Among the 153 respondents, 117 (76.5%) matched into subspecialty training. Residents pursuing fellowships had more first-author publications (4.4 vs. 1.2, $P < 0.001$), were more likely to plan to practice in an academic setting (47.0% vs. 8.3%, $P < 0.001$) and in an urban location (48.7% vs. 25.0%, $P < 0.001$). In a multivariable analysis, factors predictive of fellowship training included a desire to acquire special skills (OR=3.01; 95% CI, 1.34–6.77), working with new technology (OR=2.67; 95% CI, 1.14–6.24) and mentorship (OR=2.30; 95% CI, 1.02–5.17). Factors that predicted a career in comprehensive ophthalmology were being married (OR=0.11; 95% CI, 0.02–0.74), lifestyle considerations (OR=0.19; 95% CI, 0.07–0.56), educational debt (OR=0.31; 95% CI, 0.15–0.68) and a decreased interest in an academic career (OR=0.38; 95% CI, 0.17–0.86). Gender, prestige or perceived favorable job market were not significant factors.

Conclusion: Various factors including mentorship, lifestyle considerations, educational debt and interest in an academic career influenced the post-graduate career choices.

Yangshu Linda Pan, Student in Residence

Mentor(s): Anne Burke
Department of Gynecology & Obstetrics

Antenatal and Postpartum Contraceptive Concordance: How Often do Patients Receive Their Requested Method?

Authors: Yangshu Pan MD, Ha Vi Nguyen BS, Anne Burke MD, MPH

Background: A patient's antepartum contraceptive plan is not always concordant with the method received postpartum. Our objective was to determine how often patients received their preferred method by their postpartum visit.

Methods: This was a retrospective chart review of deliveries at our hospital from April to July 2015. We determined concordance of antepartum contraceptive preference with method received by 8 weeks postpartum. We excluded those with undecided or undocumented antepartum preferences. The primary outcome was the percentage of patients with evidence of concordance, by method received postpartum. Secondary outcomes included attendance at postpartum visits and subsequent pregnancies.

Results: Of 262 patients, 77.9% (n=204) had concordance. Highest and lowest concordances by method were implant (93.2%) and injection (81.3%), respectively. Other methods include intrauterine device (67.6%), tubal ligation (67.7%), and oral contraceptives (61.3%). On bivariate analysis, Hispanic race (OR 2.10, 95% CI 1.08 - 3.97) and no insurance (OR 2.19, 95% CI 1.09 - 4.3) had higher odds of concordance, but associations were no longer significant on multivariate analysis. Method choice did not correlate significantly with concordance (78.4% for long acting reversible contraceptive/tubal, 76.7% for other methods; $P=.761$). There was also no significant association of either postpartum follow-up (46.6% vs 41.4%; $P=.484$) or subsequent pregnancies (17.2% vs 22.4%; $P=.361$) with concordance.

Conclusion: Implant had the highest concordance between antepartum plan and receipt of chosen contraceptive. Other factors that influence contraceptive concordance merit further investigation.

YoonJi Moon, MS 2

Mentor(s): Victor Urrutia, MD
Department of Neurology

Implementation of a Stroke Center in Latin America: benchmarks, demographics, and outcomes of acute ischemic stroke

Authors: YoonJi Moon BA, Victor Urrutia MD

Background: Stroke is the second leading cause of death and disability worldwide. Interventions of prove benefit include administration of tPA or thrombectomy, rehabilitation, secondary prevention, and management in a stroke unit. Stroke units are central components of modern stroke services in many high income countries, but their utility in low and middle income countries is unknown. The objective of this study was to compare stroke care among stroke units in Colombia, Panama, and JHH.

Methods: We conducted a cross-sectional study utilizing de-identified data from Safe Implementation of Treatments in Stroke Database (SITS-QR) for Fundación of Colombia and Pacífica Salud of Panama, and Get With The Guidelines database for JHH. We compared volume of stroke patients, demographics, performance, and clinical outcome among centers during the year 2018.

Results: 476 patients from JHH, 195 from Fundación, and 56 from Pacífica Salud were analyzed. Mean (SD) age was 63.6 (15.0) at JHH, 71.6 (15.0) at Fundación, and 63.1 (17.3) at Pacífica Salud ($p < 0.001$). TIA accounted for a larger percentage of stroke patients at Fundación (30.3%) and Pacífica Salud (48.2%) compared to JHH (3.78%) ($p < 0.001$). Pacífica Salud showed lower rates of secondary prevention (22.22% received anti-thrombotics, 55.6% lipid-lowering therapy) compared to JHH (90.2%, 89.2%) and Fundación (90.7%, 97.2%). Mean door-to-needle time (SD) was 70.1 minutes (36.0) at JHH compared to 53.3 (19.2) at Fundación ($p < 0.001$). A greater percentage of ischemic stroke patients were discharged to another healthcare facility for JHH (41.0%) compared to Pacífica Salud (5.6%) ($p = 0.13$).

Conclusion: In 2018, the stroke centers differed in mean age, distribution of stroke type, time to treatment, and discharge destination. These findings highlight that environmental, demographic, and cultural context matter when implementing and assessing the performance of stroke centers. Furthermore, the findings point to potential aspects of each stroke unit that could be emphasized for future implementation.

POSTER ABSTRACTS: ETHICS AND THE ART OF MEDICINE

Listed alphabetically by author first name

Nabila Ali, MS 2

Mentor(s): Mary Fissell, PhD
History of Medicine

The Most Magnificent Work of the Most Excellent Art: Anatomical Representation in the 18th Century in Cheselden's Osteographia

Authors: Nabila Ali BS, Mary Fissell PhD

Background: William Cheselden (1688-1752) is widely recognized as one of the most influential English anatomists and surgeons of the early modern period. His works include *Osteographia*, or *The Anatomy of the Bones* (1733), a lavishly-illustrated anatomy atlas intended to provide the most accurate representation of the human skeleton at the time. This publication received considerable praise for its beauty and evident skill, yet it was also criticized for its lack of practicality due to its focus on unusual, pathological specimens.

Methods: I examine Cheselden's works in relation to the surgical handbooks of his contemporaries, including those of Richard Wiseman and Daniel Turner, in order to gain insight into Cheselden's choices regarding artistic representation and anatomical illustration.

Results: Cheselden's *Osteographia* was unique among contemporary anatomical atlases for his choice to dedicate extensive illustrations to pathologic body parts. This decision, however, was informed by Cheselden's background as a surgeon. He selected pathological specimens to illustrate both common surgical conditions and extraordinary cases of interest to English surgeons because of their rarity. His illustrations of these pathological specimens built upon surgical expertise by demonstrating important visual characteristics of diseased or injured bones.

Conclusion: The anatomical choices in *Osteographia*—in particular, Cheselden's focus on pathological specimens—arises from his background as a surgeon and was shaped by the needs of surgical practice in early modern London. While his work has long been analyzed in the history of anatomy, it was also intended as work for surgeons and a claim for their theoretical sophistication.

POSTER ABSTRACTS: HISTORY OF MEDICINE

Listed alphabetically by author first name

Ashlyn McRae, Student in Residence

Mentor(s): Amit Pahwa, MD
Department of Medicine

Assessing Medical Students' and Residents' Attitudes Towards Student Note Writing and Use of Student Notes for Billing

Authors: Ashlyn McRae, BS; Regina Macatangay, MD; Rebecca Carter, MD; W. Christopher Golden, MD; and Amit Pahwa, MD.

Background: In 2018, the Center for Medicare & Medicaid Services changed their policy to allow attendings to verify medical student (MS) documentation in the electronic medical record (EMR) instead of re-documenting findings.¹ In preparation for this transition, we studied MS and resident attitudes towards student note writing and its use for billing.

Methods: Students at two medical schools and pediatric residents at one institution completed a survey at the end of their respective pediatric clerkships. Data was analyzed using standard univariate and bivariate analysis.

Results: Forty-four students responded (62%). Of this cohort, 90% felt writing notes contributed to their education, and 67% felt use of their notes for billing would improve their perceived self-value to the medical team. However, only 54% of respondents reported receiving any training on electronic medical record (EMR) note writing, most commonly via formal or informal instruction from residents (41%). Self-directed learning (17%) was the second most common means of students learning note writing.

Among the 63 residents (49%) who responded to the survey, 48% percent felt that third year MSs should be allowed to write “billable” notes and 90% felt fourth year MSs should be allowed to write such notes. Furthermore, 61% percent of residents felt billable MS notes would decrease their daily workload.

Conclusion: Use of MS notes for billing may increase student perceptions of their utility to the medical team. However, a formal note writing curriculum for core clerkship students may be needed to ensure the efficiency and timeliness of documentation. Further investigation is needed to determine why residents do not feel third year MSs should be allowed to write billable notes despite the potential benefit of decreased workload.

Harisa Spahic, MS 2

Mentor(s): Bailey Miles, MD
Department of Medicine

Farm to Clinic – Does Having a Choice Influence Program Adherence and Food Consumption?

Authors: Harisa Spahic BA, Larisa Breden BA, Joseph Carrese MD, Gail Geller MHS ScD, Bailey Miles MD

Background: Vegetable intake improves glycemic control, and community supported agriculture (CSA) programs may promote vegetable consumption in healthy food priority areas. As part of a larger project addressing diet management for diabetes, this study sought to determine whether choice of vegetables (vegetable bag (VG) composition self-selected by participants versus premade by research team) would affect utilization of the CSA program, vegetable consumption, and subsequent health outcomes.

Methods: Participants (N=15) were recruited from East Baltimore Medical Center. They completed a baseline survey prior to intervention. The intervention consisted of VB pick-up (participants chose self-selected or premade VBs) for 6 weeks. Surveys were administered at each VB pick-up/class, intervention completion, and 1 month after completion. Individual interviews were conducted throughout; focus groups were held after intervention completion. Patient demographics and pertinent health information were collected (e.g. HbA1c, BMI).

Results: Participant attendance was 47%, with higher weekly participation among those receiving premade VBs (79% versus 72%). The decision between self-selected versus premade VBs was based on (1) grocery shopping role at home and/or (2) decision fatigue. Participants who attended sessions reported increased vegetable consumption during the intervention. Participants reported no change in vegetable preferences based on previous eating habits and ideas, while program adherence and dietary change (i.e., eating more vegetables) was linked to motivation rather than barriers to healthy food access. Furthermore, there was a trend toward larger drops in HgA1c and diastolic blood pressure among participants who self-selected. Conversely, BMI increased among those who self-selected but dropped for those with premade VBs. The sample size was too small to determine if differences were statistically significant.

Conclusion: Adherence to CSA programs and subsequent dietary changes and healthy outcomes might be influenced by individuals exercising choice over vegetables they acquire. Qualitative data findings indicate successful program outcomes require recognition of participant motivation in addition to minimizing barriers.

John Bliamptis, MS 2

Mentor(s): Anne Barnhill, PhD
Berman Institute of Bioethics

Physician attitudes toward deceptive administration of placebos as therapeutics

Authors: John Bliamptis, Anne Barnhill PhD

Background: Research into the therapeutic effects of both undisclosed and disclosed placebos has called into question the ethics of their use in clinical practice. Previous qualitative research has shown that many patients find administration of undisclosed placebos deceptive, while surveys reveal that many physicians employ placebos of some kind in their practices. This study was designed to understand physicians' experiences and perspectives regarding the ethics of placebo use.

Methods: We conducted 4 focus groups of physicians, each one representing a different specialty (clinical bioethics, psychiatry, pain management, and primary care). Participants were asked to recount times they had engaged in or witnessed placebo use in practice. Pre-written clinical vignettes were used to facilitate discussion. Participants were informed of recent open-label placebo studies and gave their impressions. Audiotapes were transcribed verbatim; transcripts were analyzed inductively.

Results: Opinions on the ethics of placebos varied between participants and scenarios according to two main principles: deceptiveness and perceived costs and benefits for the patient. In discussions of deceptiveness, some participants were reluctant to prescribe a medication they perceived to have no benefit over a placebo without disclosing it as a placebo, but would not discourage a patient from taking a similar medication if the patient already felt it was helping. In discussions of costs and benefits, participants described symptom improvement as the main benefit. Costs included potential harm to the treatment relationship and financial burden. Participants anticipated the challenges of widespread clinical use of open-label placebos and expressed the need for training in their administration.

Conclusion: Physicians have mixed perceptions and engage in different practices regarding placebo use, reflecting differences between competing considerations. Many providers remain hesitant to administer open-label placebos, citing a need for formal training and comparison data against blinded placebos as areas for future work.

Lillian Hayes, MS 2

Mentor(s): Margaret Chisolm, MD
Department of Psychiatry and Behavioral Sciences

“One foot in front of the other”: A qualitative exploration of thru-hikers' experiences on the Pacific Crest Trail

Authors: Lillian Hayes BA, Margot Kelly-Hedrick MBE, Margaret Chisolm MD

Background: Each year, thousands of people attempt to “thru-hike” the Pacific Crest Trail (PCT), walking 2653 miles from Mexico to Canada through California, Oregon, and Washington. This feat of endurance involves tremendous physical and mental challenge which has rarely been studied. This project sought to explore thru-hikers' accounts of their motivations, challenges, coping mechanisms, and perceived changes in physical and mental well-being during and after their thru-hike.

Methods: We conducted individual, semi-structured interviews with 20 PCT thru-hikers. Eleven had completed the hike previously. They were recruited via social media and word of mouth, and interviewed via telephone. Nine were current hikers interviewed in person on the PCT in Northern California, Oregon, and Washington. Interviews lasted 15-90 minutes. Audiofiles were transcribed, coded, and analyzed using thematic content analysis.

Results: Participants were most commonly motivated to thru-hike as a means of accomplishing a lifelong goal, healing from a traumatic life event, and/or seeking beauty, adventure and escape. During and after their thru-hike, most participants reported extensive self-reflection, empowerment, gratitude for others' kindness, improved tolerance of discomfort, and some degree of goal-setting. Additionally, many participants developed coping mechanisms for the trail's physical and mental challenges of pain, loneliness, adverse weather, interpersonal conflict, and thoughts of quitting. Whether hikers maintained these mental changes in their post-trail life varied. Many hikers described post-trail dysphoria upon returning home.

Conclusion: Participants reported many different motivations to thru-hike, varying degrees of sustained personal change, and a wide spectrum of experiences on and off the trail. However, most participants expressed that thru-hiking was a meaningful and often transformative experience that fostered personal reflection and strengthened resilience. Future research could explore specific populations for which thru-hiking may help them achieve particular goals of healing or self-development, such as military veterans, cancer survivors, or people who have experienced other traumas.

Vignesh Sadras, MS 2

Mentor(s): Paula Teague, D.Min., M.B.A., B.C.C.
Department of Spiritual Care and Chaplaincy

Exploring patients' and spiritual care providers' perspectives on a spiritual care program and its influence on patients and their primary care.

Authors: Vignesh Sadras BS, Macy Early BA, Andrea Fitz BS, Joseph Carrese MD, MPH, Gail Geller ScD, MHS, Heather Agee MD, Paula Teague DMin, MBA, BCC

Background: Spirituality, however understood by patients, is relevant to health and the practice of patient-centered health care. Studies have explored the effect of addressing patients' spirituality in the palliative care setting but not in the primary care setting. This project sought to explore the perspectives of patients and providers regarding a spiritual care program in the primary care setting.

Methods: In-depth interviews lasting about 1 hour were conducted with 7 patients who had received spiritual care for the longest duration, and all 4 spiritual care providers (SCPs) involved in the program. Interview transcripts were read and coded using standard methods of content analysis.

Results: Patients reported that spiritual care in the primary care setting supports them as they cope with personal hardships, including loss of family members, behavior change, and chronic disease. They viewed their chaplain as a deeply trustworthy figure with whom they could share anything without being judged. Patients expressed that their chaplain unfailingly provided a hopeful lens through which they could view their situation. Patients explained that spiritual care goes hand in hand with their primary care; both support patients' well-being. A patient shared that this holistic approach to health care makes him feel better understood and cared for and facilitates overall healing.

SCPs shared that their role centered on meeting patients and staff where they are, emotionally and spiritually, serving as a nonjudgmental listener, and helping patients navigate their outlook on life. SCPs found this experience new and affirming.

Conclusion: Our study suggests that spiritual care and chaplains play an important role in primary care, and that integration of spiritual care in the primary care setting is beneficial. Future studies should examine a similar intervention in primary care settings with different and larger patient populations, and should explore the views of primary care physicians.

POSTER ABSTRACTS: PUBLIC HEALTH

Listed alphabetically by author first name

Alexander Blum, MS 2

Mentor(s): Chris Beyrer, MD

Bloomberg School of Public Health, Center for Public Health and Human Rights

Rohingya Refugee Family Perspectives on Birth Delivery Location

Authors: Alexander Blum ScB, Tessa Saturday MPH, Jennifer Leigh DrPH, MPH, Bhakti Hansoti MBCHB, MPH, Chris Beyrer MD

Background: Among the 1.2 million Rohingya living in the world's largest refugee camp in Cox's Bazar, Bangladesh, rates of shelter-based birth delivery are among the highest of all humanitarian settings globally. More than 70% of Rohingya neonates are delivered in families' shelters instead of health facilities. This phenomenon contributes to unacceptably high rates of maternal and neonatal mortality and morbidity.

Methods: A quantitative survey tool was designed de novo in collaboration with Community Partners International (CPI), health sector partners, and Rohingya community health workers (CHWs). A preliminary version underwent pilot testing in mid-late July 2019 and revisions were made accordingly. The finalized survey was coded into a tablet-based mobile health application called CommCare. Audio translations into Rohingya (language) were embedded directly into the survey. 16 Rohingya CHWs collected responses from 1,367 Rohingya refugees (665 female, 702 male — distinct households) over a 1-month period from mid-August through mid-September 2019.

Results: The majority of Rohingya women and men (70% and 80% respectively) are aware of existing health facilities in the refugee camp and believe that they are the best overall location to give birth. However, more than 80% of the same respondents indicated that their families ultimately delivered their most recently-born child in-shelter — not at a health facility.

This disparity between stated beliefs and actual outcomes is multifactorial. Our research found that the primary factors discouraging facility-based delivery include perceptions of poor communication (language barrier), inappropriate provider behavior, and substandard quality of care available at health facilities in the refugee camps.

Conclusion: These insights suggest that the health sector's awareness initiatives have successfully conveyed the existence of health facilities in the Rohingya refugee camps, and the dangers of shelter-based delivery. Targeted improvements to provide higher quality, more culturally competent care are essential to increasing utilization of health facilities by Rohingya women and their families.

Austin Peer, MS 2

Mentor(s): Mary Kathryn Grabowski, PhD
School of Medicine

HIV, STIs, and pregnancy among women of reproductive age in a Lake Victoria fishing community: a population-based study

Authors: Austin D Peer, Mary K Grabowski, Joseph Kagaayi, Robert Ssekubugu, Jade Jackson, Godfrey Kigozi, Sarah Kalibala, Ronald H Gray, Maria J Wawer, Josephine Mpagazi, Stephen Kiboneka, Steven J Reynolds, Aaron AR Tobian, Charlotte Gaydos, Thomas C Quinn on behalf of the Rakai Health Sciences Program

Background: Population-based data on sexually transmitted infections (STI) during pregnancy are limited in sub-Saharan Africa. The prevalence of HIV and four curable STIs (Chlamydia trachomatis (CT), Neisseria gonorrhoeae (NG), Trichomonas vaginalis (TV), and Treponema pallidum (syphilis)) were measured among women in a fishing community in Uganda.

Methods: We compared population-level prevalence of NG, CT, TV, and syphilis among sexually active women of childbearing age (15-49) who participated in the Rakai Community Cohort Study May-July 2019. CT and NG testing were conducted by nucleic acid amplification testing (Abbott RealTime CT/NG m2000). Point-of-care testing was performed for TV (OSOM Trichomonas) and syphilis (Anti-TP SDBioline syphilis 3.0), with confirmatory rapid plasma reagin (RPR) titers (Cypress Diagnostics). RPR titers \geq 1:8 were classified as active syphilis. All participants received treatment when indicated. Associations between STIs, pregnancy, and HIV status were assessed with multivariable modified Poisson regression and reported as age adjusted prevalence risk ratios (adjPRR) with 95% confidence intervals (CI).

Results: 432 women met inclusion criteria, with 11% (n=47) pregnant. Among pregnant women, HIV prevalence was 32% (n=15), NG 13% (n=6), CT 13% (n=6), and TV 26% (n=12). Syphilis reactivity was 17% (n=8), and 6.4% (n=3) had titers indicative of active infection. Among non-pregnant women (n=385), HIV prevalence was 49% (n=189), NG 9.6% (n=37), CT 10% (n=40), and TV 18% (n=68). Syphilis reactivity was 27% (n=108), and 9.6% (n=37) had active infection. The age-adjusted relative risks of active STI in pregnant versus non-pregnant and HIV-positive versus HIV-negative women were 1.31 (95%CI: 0.74-2.12) and 1.64 (95%CI: 1.12-2.40), respectively. Pregnant women with HIV were 62% more likely to have \geq 1 STIs compared to pregnant women without HIV (adjPRR=1.62; 95%CI: 1.11-2.39).

Conclusion: These data highlight the very high burden of STIs among women in Lake Victoria fishing communities, particularly among pregnant women. There is an urgent need for integrated STI screening and treatment in antenatal care and HIV treatment programs in this population.

Chelsea Moriarty, MS 2

Mentor(s): Bradley Herring, PhD
Bloomberg School of Public Health

The ACA's Medicaid Expansion on Access to Obesity Treatment

Authors: Chelsea Moriarty, BA, Bradley Herring, PhD

Background: The Affordable Care Act expanded Medicaid access and coverage; however, these changes varied state by state. This created a unique opportunity to analyze the differences in access and outcomes, specifically around obesity interventions. Obesity continues to be a rising medical challenge in the United States, adding to patient burden and healthcare cost through direct costs of obesity and indirect costs of co-morbidities.

Methods: Based on research from George Washington Department of Health Policy, I analyzed Medicaid's coverage of three obesity treatment interventions: nutritional counseling, pharmacotherapy, and bariatric surgery in 50 U.S. states from 2010-2017. Coverage was restricted to non-pregnant adults older than 21. A state received a 0 score if there was no reimbursement for an intervention, an 1 score for reimbursement for an intervention with prior approval, and a 2 score for reimbursement for an intervention without requiring prior approval.

Results: In 2010, only 23 states offered Medicaid reimbursement for nutritional counseling with a physician and/or dietician. By 2017, all 50 states offered Medicaid reimbursement for nutritional counseling, with 10 states providing reimbursement to registered dietitians. In 2010, 21 states offered Medicaid coverage for pharmaceuticals intended for weight loss; but that number decreased to 17 by 2017. In 2010, 43 states offered Medicaid coverage for bariatric surgery with/without prior authorization. In 2017, coverage for bariatric surgery expanded to 48 states, all requiring prior authorization. Mississippi and Montana were the only two states that did not offer bariatric surgery for any medical condition.

Conclusion: Across the U.S., states moved toward moderate Medicaid coverage for obesity treatment intervention. Obesity continues to be a difficult and expensive illness to treat. Medicaid coverage changes reflect the evidence-based research and physician-recommended treatment with nutritional counseling being the primary intervention and bariatric surgery reserved for high mortality risk patients with obesity related co-morbidities.

Danielle Amundsen, MS 2

Mentor(s): Anita Shet, MD
JHSPH Department of International Health

Taking Another Look: Diphtheria in India

Authors: Danielle Amundsen BS, Baldeep Dhaliwal MSPH, Anurag Agarwal MD, Anita Shet MD

Abstract: The global incidence of diphtheria cases declined after the WHO's Expanded Programme on Immunization in 1974 led to increases in vaccination. Overall, this led to a >90% reduction in reported cases from 1980-2000. From 2006-2013, worldwide annual incidence of diphtheria hovered between 4,300 to 5,700 cases. Since then, the rate of incidence has increased to 16,648 cases in 2018. Of note, 8,788 (52.8%) of these cases were reported in India. India has consistently had the greatest yearly incidence of diphtheria in the past 10 years. Here we report the case of an unvaccinated 10-year-old who presented to a government hospital in New Delhi with a fever, swollen neck and throat, and a gray membrane covering his tonsils. He was admitted and treated for suspected diphtheria. We examine India's vaccine schedule and coverage, including the Indian Ministry of Health & Family Welfare's recommendation to replace the tetanus toxin (TT) vaccine with the tetanus and adult diphtheria (Td) vaccine in 2018. Lastly, we compare the management of diphtheria in low-resource and high-resource settings. Although diphtheria is now rare in the United States, this case highlights the lingering presence of diphtheria worldwide and the vulnerabilities associated with lower rates of vaccination.

Hulaimatu Jalloh, MS 2

Mentor(s): Babar Shafiq, MD
Department of Orthopaedics

Assessing Post-Operative Infection in Patients with Pilon Fractures

Authors: Hulaimatu Jalloh BA, Diana Zhu MD, Babar Shafiq MD

Background: Pilon fractures make up 1% of all lower extremity fractures, but have a large impact on quality of life, leaving patients with long-term sequelae such as post-traumatic arthritis and unemployment. The aim of our study is to assess the pre and intra-operative factors that correlate with post-operative infection.

Methods: An IRB approved retrospective chart review was done of patients who had received an open reduction and internal fixation of a pilon fracture at Johns Hopkins Hospital between 2015 and 2019. Male and female patients over the age of 16 were included. Primary outcomes were post-operative infection as measured by intravenous or oral antibiotics administered or return to the OR for irrigation and debridement. Secondary outcomes were non-union and loss of reduction as measured by surgical revision and imaging. Some intra-operative factors such as operative time and number of hardware were also collected.

Results: 72 patients were enrolled in the study that met inclusion criteria. Of those, 56% (40/72) were male. Median age was 42 years (IQR: 31-54), and median BMI was 29 (IQR: 24-35). Preliminary results reveal 6 (8.3%) patients had post-operative infection, 4 (5.6%) returned to the OR for non-union, and 7 (9.7%) had removal of hardware. Operative time was found to significantly correlate with the number of tibial implants ($r=0.32$, $p=0.01$).

Conclusion: From preliminary data, it is evident that the number of implants can be used as a surrogate for operative time. With better understanding of these patients and intra-operative factors, our treatment of pilon fractures can improve in a clinical and operative setting.

Hursuong Vongsachang, MS 3

Mentor(s): Megan Collins, MD MPH

Wilmer Eye Institute, Dana Center for Preventive Ophthalmology

Are screening failure rates and consent rates in school-based vision programs correlated?

Authors: Hursuong Vongsachang BA, Ahmed Shakarchi MD, Megan E. Collins MD MPH

Background: Despite providing eye care access directly in schools, consent rates to receive eye exams after failed vision screenings in school-based vision programs are often low. Prior work suggests that various factors influence consent rate in school health programs, but there is limited literature on the association between screening failure rates and consent rates. We examined the relationship between disease burden (screening failure rates) and consent rates in school-based vision programs.

Methods: We calculated screening failure and consent rates of students enrolled in Baltimore City public schools participating in a school-based vision program between 2016-2019. We analyzed the association between screening failure and consent rate using mixed effects linear models that accounted for clustering of grades within schools. Multivariable models adjusted for school size (measured by enrollment numbers), school grade, and school year (2016-2017, 2017-2018, 2018-2019).

Results: The analysis included 1000 grades in 123 schools (41 schools/school year). In a univariable model, consent rate decreased by 2.2% (95% confidence interval (CI): 1.1, 3.3%) for each 10% increase in screening failure rate. After adjusting for grade, this association failed to maintain statistical significance. Adjusting for school size and/or school year did not affect significance. In a model adjusted for grade, school size, and school year, consent rate changed by -0.6% (CI: -1.7%, 0.4%) for each 10% increase in screening failure rate. In this fully adjusted model, while screening failure rate increased by 1% (CI: 0.7%, 1.2%) with each increasing grade, consent rate decreased by 2.5% (CI: 2.1%, 2.9%) with each increasing grade.

Conclusion: Screening failure rate does not influence consent rate. The association is confounded by school grade, where younger grades are less likely to fail screening but more likely to consent. More work is needed to identify factors that impact consent rates to ensure successful delivery of school-based vision care.

Insia Zufer, MS 2

Mentor(s): Barry Solomon, MD
Department of Pediatrics

Assessment of Social Determinants of Health in an Integrated Maternal Mental Health Clinic within an Urban Pediatric Primary Care Practice

Authors: Insia Zufer BA, Shannon Adams CHW, Tracy Carter BA, Barry Solomon MD

Background: Maternal mental health has increased direct and indirect costs for both mother and child. In urban underserved populations, social determinants of health are obstacles in addressing maternal mental health. Community health workers are able to assess and address these barriers by providing a variety of supports. By looking at CHW engagement data, we assessed the social determinants of health impacting the caregivers at a maternal mental health clinic embedded in an urban pediatric primary care setting.

Methods: We completed a systematic review of community health worker notes to determine the assessments completed and resources provided to mothers while they were patients at the clinic. The supports provided will be assessed to determine the social determinants of health impacting the population of caregivers seen at this maternal mental health clinic. CHW supports include food, baby formula, utilities, transportation, housing, medical assistance, and financial resources, in addition to providing reminders, accompaniment to appointments, home safety evaluations, and assistance obtaining personal identification documents.

Results: Out of the 38 participants currently evaluated, all 38 (100%) of mothers are enrolled with Priority Partners insurance. 3 (8%) caregivers identify as Black, and 35 (92%) identify as white. Out of 34 mothers with supplied data, they have on average 2.05 biological children and 1.83 children that live at home. Regarding points of referral, out of 34 mothers, 12 (35%) were referred from a mental health consultant, 12 (35%) from social work, 3 (9%) from a case manager, 5 (15%) from OB, and 2 (6%) from another source. Community health worker data is pending.

Conclusion: Social determinants of health such as lack of access to transportation, financial resources, and food were found in the mothers at the maternal mental health clinic, and were being addressed through community referrals by the community health worker.

Isabel Lake, MS 2

Mentor(s): Joseph Lopez, MD
Department of Plastic and Reconstructive Surgery

Non-Invasive Management of Pediatric Isolated, Condylar Fractures: Less is More?

Authors: Isabel V. Lake BS; Nima Khavanin MD; Bartłomiej Kachniarz MD MBA; Omar Najjar BS; Navid Pourtaheri MD PhD; Richard J. Redett MD; Paul N. Manson MD; Amir H. Dorafshar MBChB, Joseph Lopez MD MBA

Background: The purpose of this study was to examine injury patterns in pediatric mandibular condylar fractures and to propose and evaluate the validity of an institutional treatment algorithm for such fractures based on post-management complications.

Methods: A retrospective chart-review was conducted on pediatric patients who presented to our institution with isolated mandibular condylar fractures between 1990-2016. Patients were categorized by dentition, and information regarding demographics, injury characteristics, management, and complications was compiled.

Results: Forty-three patients with 50 mandibular condylar fractures were identified. Twelve (27.9%) patients had deciduous dentition, 15 (34.9%) had mixed dentition, and 16 (37.2%) had permanent dentition. The most common fracture pattern in all groups was diacapitular [$n = 30$ (60%)], however older groups showed higher rates of condylar base fractures and bilateral fractures ($p = 0.049$ and 0.009 , respectively). Thirty-one patients (72.1%) were treated with non-operative management, 10 (23.2%) with closed-treatment and MMF, and 2 (4.7%) with open-treatment and MMF; non-operative treatment was more common in younger patients ($p = 0.022$). Management for 10 (23.2%) patients was non-adherent to the treatment algorithm. Eight patients had complications (18.6%). Common complications included TMJ ankylosis [$n = 2$] and malocclusion [$n = 2$]. Though complications were seen in all management groups, they were more common in patients whose care was non-adherent to the algorithm ($p = 0.032$).

Conclusion: Non-operative management is preferred in deciduous children. Children in permanent/mixed dentition may undergo closed treatment and MMF if they have malocclusion/contralateral open bite, significant condylar dislocation, and ramus height loss $> 2\text{mm}$.

Jacob Roberts, MS 2

Mentor(s): Bhakti Hansoti
Department of Emergency Medicine

Determining the prevalence of tuberculosis (TB) in emergency departments in the Eastern Cape region of South Africa and the utility of an emergency department (ED)-based testing strategy.

Authors: Roberts JS, Hansoti B

Background: Within South Africa, emergency departments (ED) serve an important role in providing services to tuberculosis (TB) patients but face significant gaps in TB screening. We assess the utility of the World Health Organization (WHO) TB screening questionnaire, define identifying symptoms and co-morbidities present among TB-infected patients, and quantify the drug resistance and disease burden of TB patients in the ED.

Methods: Previously, TB screening was implemented in the Livingstone Hospital ED. A report form including components of the WHO TB screening questionnaire was utilized which included four TB symptom-related questions. A positive response to any question represented a positive screening. To corroborate screening results with confirmatory laboratory testing, all patients were searched by name and date of birth on the National Health Laboratory Service (NHLS) database. Laboratory results were accessed to determine if confirmatory lab testing followed the initial screening in the ED. Laboratory results were also used to assess chronic TB in this population. Positive tests for coinfections and immune function markers were also recorded.

Results: Of all patients screened for TB (N = 1144), 176 (15.4%) screened positive using the WHO screening questionnaire. Of these patients, ()% had positive confirmatory laboratory tests following the initial screening. Rifampicin resistance ()% and XDR-TB ()% were also quantified. Among patients who had a negative TB screen, ()% had positive lab results. For all patients screened, ()% had a history of positive laboratory testing, and ()% of these patients with prior history screened positive for active TB. Among patients who did not have a positive TB screening but who tested positive with laboratory testing, () were identified as the most common presenting symptoms which were not assessed using the questionnaire.

Conclusion: While WHO screening guidelines identify a large share of these patients, the exclusion of certain criteria results in the under-detection of TB.

Laura Pugh, MS 2

Mentor(s): Anne Rositch

Bloomberg School of Public Health, Department of Epidemiology

Multidisciplinary Treatment Planning for Breast Cancer in Tanzania: Time to ACT

Authors: Laura Pugh BS, Anne Rostich MD

Abstract: Breast cancer is the leading cause of cancer death among women in Tanzania. The Tanzania: Time to ACT project conducted a chart review of 600 charts at Bugando Medical Center which revealed that few breast cancer patients receive multidisciplinary treatment planning. The aim of the Multidisciplinary Treatment component was to improve interdisciplinary communication and increase the number of women with a comprehensive treatment plan. Tumor boards have been shown to improve patient care by increasing adherence to standard of care, changing treatment and management of cases, and increase communication between specialties.

Eight semi-structured in-depth interviews were conducted to obtain key stakeholder perspectives on creating a breast cancer specific multidisciplinary tumor board, including the need to meet regularly but efficiently, that at least one member from each relevant specialty must be present, and a list of key information that needed to be discussed and documented for each meeting. Overall, stakeholders felt that the tumor board would be difficult to coordinate, but that the benefits would be substantial, including better treatment ideas, better communication between specialties, and ultimately better patient outcomes. The research team then created a pre/mid/post survey for physicians to address whether the goals and concerns identified by stakeholders in the interviews are addressed. We developed new tools for the tumor board: a tracking form for the tumor board, and a clinical treatment plan form. We organized a stakeholder meeting to present the implementation plan to key stakeholders across the hospital and receive their feedback.

We hope the creation of a multidisciplinary tumor board will increase the confidence of physicians in treating breast cancer cases, ensure that women who would benefit from adjuvant chemotherapy or radiation are given that option, and improve communication between all specialties involved in the diagnosis and treatment of breast cancer at Bugando Medical Center.

Mohamed Mohamed, MS 2

Mentor(s): Anne Rositch PhD

Johns Hopkins Bloomberg School of Public Health, Department of Epidemiology

Development of a Standardized Breast Cancer Diagnostic Pathway for Bugando Medical Centre

Authors: Mohamed Mohamed BS, Laura Pugh, Lindsay Eberhart, Christina Chao MS, Anne Rositch PhD

Background: Breast cancer is the leading cancer in women worldwide and is an urgent public health concern in low-and-middle-income countries. Bugando Medical Centre (BMC) in Mwanza, Tanzania, serves a population of 13 million and is becoming one of Tanzania's leading cancer care hospitals but lacks a coordinated diagnostic pathway for women presenting with breast concerns. To increase comprehensive treatment planning and reduce loss to follow-up, a standardized breast diagnostic pathway (SBDP) was developed for BMC.

Methods: We interviewed hospital leadership and staff involved in caring for breast patients from departments of pathology, surgery, radiology and oncology. Data were collected on current diagnostic practices such as the ordering, methodology and reporting of pathology and imaging. In addition to logistical information, we also assessed perspectives of individuals across departments regarding benefits and challenges of current system.

Results of interviews were discussed with stakeholders and appropriate areas for intervention were identified. A SBDP was created based on collected data and feedback from stakeholders.

Results: Challenges emphasized in interviews included lack of standardization in ordering diagnostic tests, limited access to core biopsy and immunohistochemistry, poor quality of Ultrasound-guided Fine Needle Aspirate Cytology (FNA-C) samples, delayed diagnosis and loss to follow-up. A chart review comparing nondiagnostic sample rates of Ultrasound-guided FNA-C to conventional FNA-C showed significant difference (70% versus 20%).

Conclusion: From highlighted challenges, lack of standardization, FNA-C sample quality and delayed diagnosis were identified as areas for feasible intervention.

To address challenges with standardization, the creation of a new SBDP accompanied by training on the protocol and relevant national guidelines was proposed. To improve FNA-C sample quality, the new SBDP proposed all women with breast concerns first receive a conventional FNA-C before an Ultrasound-guided FNA-C is attempted. Finally, to address delayed diagnosis, the new SBDP proposed that women receive both FNA-C and breast ultrasound during same hospital visit.

Mya Abousy, MS 2

Mentor(s): Robin Yang, DDS MD
Department of Plastic and Reconstructive Surgery

Policies and Price Tags: the public's perception of face transplants and their funding

Authors: Mya Abousy BA, Hillary Jenny MD, Helen Xun BS, Nima Khavanin MD, Francis Creighton MD, Patrick Byrne MD, Damon Cooney MD, Richard Redett MD, Robin Yang DDS MD

Background: Face transplants are becoming rapidly available across the United States, with more than forty cases since 2005. However, the issue of financial coverage for the procedure is unresolved: face transplants can cost over one million dollars, and are usually not covered by insurance companies. This study is the first to evaluate the layperson's opinions on face transplants and the associated financial responsibilities.

Methods: 815 laypersons surveyed through Mechanical Turk were presented information explaining the face transplant procedure. Respondents rated their agreement with 11 statements on a Likert scale from 1 to 5. Topics included support and perception of face transplants and financial coverage. Respondent demographics were self-reported, and responses were analyzed using descriptive statistics, the Wilcoxon Signed-Rank test, Chi Square test, and the Kruskal-Wallis test.

Results: Respondents were supportive of face transplants in nearly all statements (10/11 items, $p < .0001$ for all). They would be willing to undergo face transplants; believed face transplants were as important as other organ transplants; believed faces should be included on the organ donation registry; supported insurance companies providing coverage for face transplants regardless of the cause of trauma; supported their tax dollars funding the procedure; and believed face transplants improved both physical appearance and quality of life. Although respondents generally supported their tax dollars funding the procedure, fewer supported this for self-inflicted trauma.

Conclusion: This study highlights the significant disconnect between the public's opinions on face transplant coverage and the lack of coverage in practice. Respondents support insurance coverage of face transplants and believe face transplants should be treated in a similar manner to other organ transplant procedures. Respondents' acceptance of including faces on organ donation registries could eliminate the issue of locating a donor, and increasing financial coverage of this procedure may broaden its accessibility to more individuals.

Nicholas Daneshvari, MS 2

Mentor(s): Michelle Johansen, MD
Department of Cerebrovascular Neurology

Could ischemic stroke infarct volume aid in determining stroke subtype?

Authors: Nicholas Daneshvari BA, Michelle C. Johansen MD

Background: Identification of stroke etiology facilitates proper treatment. The relationship between ischemic stroke infarct volume and stroke subtype remains unclear. We hypothesize that larger infarct volume is associated with cardioembolic stroke (CS) versus other subtypes, independent of vascular risk factors.

Methods: Inclusion criteria reflect those of a larger study: Johns Hopkins Hospital inpatient admission (2015-2019) for ischemic stroke with confirmatory brain MRI, and transthoracic echocardiogram. Infarct volumes were calculated using MRIcron© by a reviewer masked to participant characteristics. Ischemic stroke subtype was independently adjudicated by a cerebrovascular neurologist using TOAST classifications. Multivariable logistic regression was used to determine the association between infarct volume and each stroke subtype (OR=odds ratio). Multinomial logistic regression was used to compare the risk of CS versus other subtypes, per unit change in infarct volume (RRR=relative risk ratio). Step-wise adjustment accounted for potential confounders; Model 1: age, sex, black race; Model 2: Model 1+ BMI, LDL, hypertension, diabetes mellitus, smoking.

Results: The participants (n=150) were on average 61yo, male (58%), and black (57%). Per 10mL increase in infarct volume, there were higher odds of CS (OR 1.15, 95% CI 1.01–1.30) and large-artery strokes (OR 1.20, 95% CI 1.04–1.40) in the final adjustment model. Per 10mL increase in infarct volume, there was a 97% decreased odds of having a small-vessel stroke versus other subtypes (95% CI 0.003–0.31, model 2). Risk of CS versus large-artery stroke was nonsignificant per 10mL increase in infarct volume (RRR 1.03, 95% CI 0.89–1.19, base CS).

Conclusion: This single-center prospective cohort study demonstrated that larger infarcts had increased odds of both CS and large-artery strokes (no difference when directly compared), but decreased odds of small-vessel stroke. Work is ongoing to determine whether location and number of infarcts can help further distinguish between subtypes.

Rochelle Prokupets, MS 2

Mentor(s): Stefano Schena, MD
Division of Cardiac Surgery

The Effect of Re-exploration for Bleeding on Postoperative Outcomes for Cardiac Surgery

Authors: Rochelle Prokupets BA, Pooja Yesantharao BA, Tina Esfandiary BA, Diane Alejo, Joe Dinatale, Stefano Schena MD

Background: Cardiac surgery, not infrequently, is characterized by postoperative bleeding. Although mediastinal exploration remains a potentially lifesaving intervention, many surgeons are reluctant to return to the operative room (OR) due to the perceived risk of postoperative complications and increased mortality. Further, the optimal timing to undergo re-exploration remains unclear. We aim to assess outcomes of cardiac surgery patients who experience significant postoperative bleeding and require return to the operative room. Investigating the benefit of early re-exploration (<12 hours) as a factor leading to lower morbidity and mortality and identifying associations between intraoperative administration of blood products and reoperation for bleeding is needed.

Methods: Adult cardiac surgery patients (age ≥ 18 years) between January 2010 and June 2019 were identified using the Society of Thoracic Surgeons (STS) database. Patients undergoing ventricular assist devices (VAD) placement or heart transplant were excluded. A retrospective chart review of patients returning to the OR for bleeding was conducted. Chest tube output, timing of reoperation, intraoperative blood products and site of bleeding were collected. Analysis was performed using STATA.

Results: Of the 7,853 cardiac surgery patients, 278 patients (3.5%) returned to the OR for bleeding after index operation. Of those patients, 17% had the sternum left open after the index operation. Upon reoperation, most commonly reported findings were no active bleeding (29%), anastomosis bleed (11%), graft bleed (6.8%), and internal mammary artery bleed (4.7%). Patients were stratified according to extent of bleeding and by time (minutes) to reoperation for bleed.

Conclusion: Less than 4% of cardiac surgery patients returned to the OR for bleeding. The most common finding upon re-exploration was no active bleeding (29%). Further analysis is needed to determine if reoperation earlier (<12 hours) will have better outcomes compared to those who received later re-exploration or conservative management.

Rohanit Singh , MS 2

Mentor(s): Lawrence Appel, MD
Welch Center for Prevention

Systematic Review of Selected CKD Websites

Authors: Rohanit Singh BS, Gibran Kazi BA, Lawrence Appel MD

Background: Chronic kidney disease (CKD) is a disease that requires lifelong adjustments and education. A review by Smekal et. al highlighted a set of 10 CKD websites that addressed the greatest number of areas of CKD-related content. This paper assesses these 10 websites to provide suggestions for the most concrete, applicable information in the diet, physical activity, emotional support, financial information, general CKD information and medication adherence.

Methods: The 10 websites that were listed from Smekal et. al were evaluated by two evaluators. Each website was given a score for each category: a 0 for an unaddressed category, a (+) for an addressed category with little to no concrete advice for implementation, and a (++) for information that addressed the topic and provided information regarding lifestyle change advice and concrete plans for implementation.

Results: While many websites received a (++) for diet, the National Kidney Foundation and Fresenius Kidney Care were unique in offering dietary tracking and substitutes. Only the Kidney Foundation of Canada and NIDDK received a (++) for physical activity with pictures and instructions for specific exercises. The National Kidney Foundation and Kidney Care UK were the best for emotional support. The best American website for financial information was the NIDDK. All websites scored a (++) for general CKD information. DaVita, National Kidney Foundation and Fresenius Kidney Care all scored a (++) for medication.

Conclusion: Our results are aimed towards providing CKD patients with suggestions for websites that are best suited for applicable information for specific categories. While diet and CKD information are well covered by almost all websites, physical activity is truly comprehensively explained only in the NIDDK and Kidney Foundation of Canada websites. Information on emotional support, financial information, and medication is also mixed in quality with regards to applicable information for usage and compliance.

Sarah Frey, MS 2

Mentor(s): Adam Levin, MD
JHU SOM Department of Orthopaedic Surgery

Identification of Primary Site of Malignancy in Patients with Skeletal Metastases and Unknown Primary Malignancy in a Modern Cohort

Authors: Sarah Frey BS, Adam Levin MD

Background: The workup used to reveal the occult primary site of malignancy in patients who present with skeletal metastases and unknown primary malignancy was established by Rougraff et al. (1993) and includes history, physical examination, routine lab work, bone scan, CT CAP, and bone biopsy. The objective of this study is to quantify how often new radiological and laboratory tests such as PSA, PET/CT, and MRI are used to identify the primary malignancy in patients with skeletal metastases and unknown primary malignancy.

Methods: Patients who presented with skeletal metastases between February 2016 and December 2017 were identified from the SKCCC registry. Patients under the age of 18, with sarcoma, and with a history of previous malignancy were excluded.

Results: Between February 2016 and December 2017, 50 (14%) of 358 patients with skeletal metastases had unknown primary malignancy at presentation. The primary malignancy was lung carcinoma in 11 (22%) patients, prostate carcinoma in 10 (20%) patients, renal cell carcinoma in 8 (16%) patients, and was not identified in 3 patients (6%). The primary malignancy was identified with abdominal CT in 11 patients (22%), chest CT in 10 patients (20%), pelvic CT in 3 patients (6%), PET/CT in 2 patients (4%), MRI in 0 patients, elevated PSA in 8 patients (16%), and bone biopsy in 5 patients (10%).

Conclusion: Chest CT and abdominal CT were commonly used to identify the site of primary malignancy, while pelvic CT was less useful. Elevated PSA was useful in diagnosing prostate cancer and therefore should be used early in male patients. PET/CT and MRI were not commonly used to identify the site of primary malignancy because the primary malignancy was usually already identified with other less expensive imaging modalities; however, these tests may be useful when the primary site of malignancy is not identified with CT and bone scan.

Shanna Yue, MS 2

Mentor(s): Megan Tschudy, MD
Department of Pediatrics

Analyzing outcomes for a school-based directly observed therapy program for asthma.

Authors: Shanna Yue BA, Katherine A. Connor MD, MSPH, Katherine Bissett RN, Sara B. Johnson PhD, MPH, Megan Tschudy MD, MPH.

Background: Asthma is one of the most common diseases of childhood and disproportionately affects children from poor and minority backgrounds. School-based directly observed therapy (DOT) of asthma controller medication has been shown to improve asthma control, school attendance, and academic performance. We have launched a real-world implementation of a school-based asthma DOT program through the Rales Health Center located at two urban schools in Baltimore. This project looked at average adherence to DOT, absenteeism, and unscheduled albuterol doses for students in the program. We also analyzed the effect of adherence to daily controller medication on absence rate and unscheduled albuterol doses

Methods: The Rales Health Center serves 1,529 students K-8, most of whom reside in low-income communities. Thirty percent of students have asthma and 7% have persistent asthma. Our study population was 35 students enrolled in the program during the 2018-2019 school year. A linear regression was used to calculate how adherence rate of medication affects absence rate, and a negative binomial regression was used to examine the effect of adherence rate on number of unscheduled albuterol doses.

Results: Thirty percent of 107 eligible students were enrolled. Mean adherence to DOT was 80%, students were absent an average of 1.3 times/month and received an average of .46 unscheduled albuterol doses/month.

For every percent increase in adherence, absences decreased by .128 absences/month. A significant regression equation was found ($F(1,248) = 34.146$, $p < .000$), with an R^2 of 0.117 after adjusting for days enrolled in the program.

There was no significant effect of adherence rate on number of unscheduled albuterol doses, $\chi^2(1) = 3.389$, $p = 0.066$.

Conclusion: Based on these results, we predict that over a school year (10 months), for every percent increase in controller adherence, our program can expect to see a decrease of 1.28 absences/year.

Tina Esfandiary, MS 2

Mentor(s): Christopher Mecoli, MD
Division of Rheumatology

Assessing the Face Validity of Myositis Patient-Reported Outcome Measures

Authors: Tina Esfandiary BA, Clifton O. Bingham III MD, Lisa Christopher-Stine MD, Christopher Mecoli MD on behalf of the OMERACT MYOSITIS WORKING GROUP

Background: The idiopathic inflammatory myopathies (IIM) are a heterogeneous group of autoimmune diseases characterized by chronic skeletal muscle involvement leading to inflammation and muscle weakness and damage. Organs such as the skin, joints, lungs, and heart are often affected and contribute to patient morbidity and mortality. However, little is known about patients' characterization of symptoms and quality of life. The Outcome Measures in Rheumatology (OMERACT) Myositis Special Interest Group (SIG) previously identified four patient-reported items that are recommended for such measurements in clinical trials and cohort studies: fatigue, pain, physical activity and function, and muscle symptoms.

Methods: The Myositis SIG identified 2-3 questionnaires for each item, and then developed a survey to assess the content validity and feasibility of each questionnaire. For the domain "muscle symptoms", the SIG considered the possibility that this may be encapsulated by the other three domains (fatigue, pain, physical activity/function), and incorporated this question into the survey. Twenty patients from the Johns Hopkins Myositis Center were randomly selected to complete the survey while undergoing cognitive debriefing in person or by telephone.

Results: The majority of patients (>70%) felt that each of the questionnaires were clear, easy to read and understand and could be theoretically be used for assessment. They also thought the instruments were reflective of their experience. However, patients were divided on whether muscle symptoms should be its own item or if they thought it was encapsulated by the other three items.

Conclusion: We provided evidence in support of adequate content validity for several questionnaires for each item. Further research is needed to determine the status of muscle symptoms. Using data from a forthcoming online, international survey in combination with this cognitive debriefing report, the Myositis SIG hopes to select one questionnaire for each item and obtain serial measurements in longitudinal adult IIM cohorts.

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